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Hospital adoption of electronic health record functions to support age-friendly care: results from a national survey

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ABSTRACT

Objective: To measure US hospitals' adoption of electronic health record (EHR) functions that support care for older adults, focusing on structured documentation of the 4Ms (What Matters, Medication, Mentation, and Mobility) and electronic health information exchange/communication with patients, caregivers, and long-term care providers.

Materials and Methods: In an online survey of a national, random sample of 797 US acute-care hospitals in 2018–2019, 479 (60.1%) responded. We calculated nationally representative measures of the percentages of hospitals with EHRs that include structured documentation of the 4Ms and exchange/communications functions.

Results: Structured EHR documentation of the 4Ms was fully implemented in at least 1 unit in 64.0% of hospitals and across all units in 41.5% of hospitals. Of the 4Ms, structured documentation was the highest for medications (91.3% in at least 1 unit) and the lowest for mentation (70.3% in at least 1 unit). All exchange/communication functions had been implemented in at least 1 unit in 16.2% of facilities and across all units in 7.6% of hospitals. Less than half of the hospitals had an EHR portal for long-term care facilities to access hospital information (45.4% in at least 1 unit), sent information electronically to long-term care facilities (44.6%), and had training for adults/caregivers on the patient portal (32.1%).

Discussion: Despite significant national investment in EHRs, hospital EHRs do not yet include key documentation, exchange, and communication functions needed to support evidence-based care for the older adults who comprise the majority of the inpatient population. Additional policy efforts are likely needed to promote the expansion of EHR capabilities into these high-value domains.

Conclusions: US acute-care hospital EHRs are lacking key functions that support care for older adults.

Key words: medical records systems, computerized, health services for the aged, health care surveys

INTRODUCTION

There is a critical need to redesign our health-care system to better serve the needs of older adults. Prior research has identified specific ways in which health-care delivery could be improved to address these needs.[1–3] In response, 4 organizations came together in 2017 to develop a community of health system–embedded teams to learn together, with expert input, how to adopt the 4Ms Framework via the Age-Friendly Health Systems initiative.[4] The 4Ms Framework[5] is a set of evidence-based priorities designed to shift approaches to care for older adults by focusing on What Matters, Medication, Mentation, and Mobility. What Matters refers to the alignment of individuals' specific health outcome goals and care preferences with their care plans. Medication refers to reductions in unnecessary medication use and specific attention to the use of medications that could interfere with patient care goals, mobility, or mentation. Mentation refers to the commitment to preventing, identifying, treating, and managing dementia, depression, and delirium. Mobility refers to the goal of ensuring that adults move safely and can maintain or improve function.

While this framework has the potential to promote an Age-Friendly Health System,[6] the implementation relies on the ability to adapt the daily work of frontline clinicians. Given the impact of the electronic health record (EHR) on daily workflows, it is critical that the significant national investment in EHRs provides support for these new approaches to care delivery.[7,8] The implementation of each of the 4Ms functions is associated with a series of activities, which could include operationalizing these activities in the EHR. For example, EHRs could be adapted to incorporate functions that address the 4Ms by adding prompts and fields in the EHR for clinicians to enter structured documentation of care goals or to review medications known to impact mobility and mentation. However, efforts to leverage EHRs to improve age-friendly care processes may not be occurring because of competing priorities or a lack of awareness of the specific needs of older adults.[9–11] There are no national data on how often hospitals are making this investment, nor data on whether hospitals are investing in other types of information technology (IT) to support the unique needs of older adults across settings.

Objective

To address this gap, we collected the first national data on how hospital EHRs are supporting documentation of care for older adults using the 4Ms Framework. We focused on the hospital setting because the inpatient population is disproportionately older (those over 65 account for more than two-thirds of adult hospital admissions[12]) and sicker (almost two-thirds of Medicare beneficiaries with 6 or more chronic conditions were hospitalized and 16% had 3 or more hospitalizations per year[13]), which should enhance the benefits from adoption of the 4Ms Framework. Given that this population often transitions between settings, it is also critical to examine the connectivity between hospital EHRs and patients/caregivers, as well as post-acute care settings. We therefore also collected data on the adoption of IT capabilities related to electronic exchange and communication with patients, caregivers, and long-term care providers. Our results inform efforts to ensure that our health-care system and, in particular, our IT infrastructure, which influences how clinicians document care and make clinical decisions, are designed to meet the needs of older adults.

MATERIALS AND METHODS

Survey development

We developed, pilot tested, refined, and then administered a national hospital survey to capture the adoption of EHRs that support documentation of the 4Ms, along with other specific IT capabilities relevant to older adults (eg, an EHR portal to enable long-term care facilities to access hospital data). Survey development was informed by case studies conducted at 6 hospitals. For case studies, we interviewed senior administrative and clinical leaders to understand their EHR implementation process and those factors that shape the realization of an EHR's value. A content analysis of transcripts resulted in the identification of varied potential factors, including the adaptation of EHRs to meet the needs of older adults and the need to support information sharing during transitions to post-acute care. These concepts were translated into structured survey questions, which we then pilot tested with the Chief Information Officers at the 6 hospitals that participated in the case studies. The questions were refined iteratively based on feedback from each participant.

Survey content

The final instrument included 30 questions. We first asked respondents to report on their organizational approach to EHR implementation, asking questions about the implementation timeline, the scope of clinical units involved, the types of training available to clinicians, and involvement of the EHR vendor, as well as of hospital leadership. The second section, Human Capital, asked respondents to report on their staffing levels to support various roles and functions related to IT and quality. The final section, Organizational Approach to EHR Use, asked respondents to report on the quality of information documented in the EHR, the extent to which specific functions (including the 4Ms and the exchange/communication capabilities) were implemented, the standardization of certain practices, and the degree to which different IT systems are integrated.

For this paper, we focused on questions that asked about the extent to which the hospital had implemented structured EHR documentation that captured the 4Ms, using the following categories: "structured documentation of patient care goals," "structured documentation of medications," "structured documentation of challenges around mentation," and "structured documentation of mobility." We focused on structured documentation in order to achieve the right balance between setting a high bar for advanced functionality that few hospitals could meet and setting a bar for very basic functions (eg, any form of documentation of any of the 4Ms) that the majority of hospitals would already have in place. Structured documentation of medications is a function included in the Centers for Medicare & Medicaid Services Meaningful Use Program, so we expected a high level of adoption for that function, consistent with federally reported statistics; for the other 3Ms, our results offer a baseline measure of national adoption. Following other national hospital IT surveys,[11] the answer choices were: "fully implemented across all units," "fully implemented in at least 1 unit," "beginning to implement in at least 1 unit," "have resources to implement in the next year," "do not have resources but considering implementing," and "not in place and not considering implementing." We also included questions that asked whether the hospital had implemented the following additional EHR functions related to electronic exchange and communication: "dedicated field(s) in EHR to capture caregiver information," "specialized training for older adults and/or their caregivers on the patient portal," "provider portal that allows long-term care facilities to

view patient data in EHR," and "electronically sending to long-term care facilities patient data in EHR." Answer choices for these questions were the same as for the above questions. A copy of the instrument is included in the Supplementary Appendix.

Survey sample and administration

In partnership with the American Hospital Association, surveys were mailed to the CEOs of the facilities in a national, random sample of 797 acute-care hospitals. Hospital CEOs often delegated survey completion to the most knowledgeable person in the institution (frequently the Chief Information Officer, Chief Medical Officer, or Chief Quality Officer). After sending a paper copy of the survey to all respondents, we followed up with 3 phone calls and/or 3 emails (if we had an email address available) between June 2018 and August 2019. The survey could be completed online, by mail, by fax, or by telephone. Facilities that did not respond to initial outreach attempts were offered a $100 gift card if they completed the survey. The final response rate was 60.1%. Following our prior approach to adjusting for nonresponses and creating nationally representative results in national hospital survey data,[14–20] we calculated nonresponse weights using a propensity score model predicting response, with hospital characteristics as independent variables in the model. These characteristics included hospital size, teaching status, profit status, census region, critical access hospital status, and rurality. The survey was approved by the Institutional Review Board at the Harvard T.H. Chan School of Public Health, and written or oral consent (depending on the method of administration) was obtained prior to the survey completion.

Measures

Our focal measures capture hospital implementation of the 4Ms EHR functions and implementation of the exchange/communication EHR functions. For the former, we captured the proportion of facilities that reported implementation of each 4Ms function in at least 1 unit, as well as the proportion that had implemented all 4 functions in at least 1 unit and the proportion that had implemented all 4 functions across all units. For the latter, we replicated this approach, measuring implementation of each exchange/communication function in at least 1 unit, implementation of all in at least 1 unit, and implementation of all across all units. For all measures, we did not classify "beginning to implement in at least 1 unit" as implemented, but we report measures in which this response choice is considered "implemented" in the Supplementary Appendix.

We captured hospital characteristics to describe the sample and to assess whether the adoption of the 4Ms EHR functions and exchange/communication functions varied by hospital characteristics. We selected characteristics that have been shown in prior studies to be associated with more advanced EHR adoption[21]: hospital size (<100 beds, 100–399 beds, >400 beds), teaching status, profit status, census region, critical access hospital status (those with less than 25 beds which provide the majority of care in areas where access is limited), and rurality. We also examined the relationship to the level of EHR adoption, which we measured as the hospital's adoption of a comprehensive, basic, or less than basic EHR, based on an existing definition.[14]

Statistical analysis

We first compared the characteristics of hospitals that responded to the survey to those that did not. We then calculated descriptive statistics with nonresponse weights to create nationally generalizable

measures of implementation of the 4Ms EHR functions and of implementation of the exchange/communication functions. Finally, we assessed whether the adoption of all 4Ms in at least 1 unit and whether the adoption of all exchange/communication functions in at least 1 unit varied by our key hospital characteristics. We included *P* values from Chi-squared tests to assess whether any differences were statistically significant.

RESULTS

We received responses from 479 hospitals, or 60.1% of the hospitals surveyed. We observed modest differences between respondents and nonrespondents (Table 1). Hospitals that responded were more likely to be small or large (as compared to medium-sized), to be major teaching hospitals, to be not-for-profit or government owned, to be rural, to be in the Northeast or Midwest, not to be a member of a hospital system, and to have implemented at least a basic EHR.

Adoption of 4Ms EHR functions

Of US hospitals, 64.0% had structured EHR documentation of the 4Ms fully implemented in at least 1 unit, with structured documentation of medications implemented in at least 1 unit in 91.3% of hospitals, structured documentation of patient care goals implemented in at least 1 unit in 84.1%, structured documentation of mobility implemented in at least 1 unit in 80.8%, and structured documentation of mentation implemented in at least 1 unit in 70.3%. Of the US hospitals, 41.5% had structured documentation of the 4Ms fully implemented across all units (Figure 1).

In our bivariate results, none of the characteristics that we examined—including size, teaching status, profit status, system membership, urban/rural location, region, Medicare volume, Accountable Care Organization participation (which has strongly predicted EHR adoption in other studies), or EHR adoption level itself—were associated with adoption of the 4Ms (Table 2).

Adoption of electronic exchange and communication EHR functions

The implementation of electronic exchange and communication functions was less widespread. While 83.1% of hospitals had an EHR field with caregiver information, 45.4% of hospitals had an EHR portal for long-term care facilities to access hospital information, 44.6% sent information electronically to long-term care facilities, and 32.1% had specialized training for adults/caregivers on the patient portal (Figure 2). All exchange/communication functions had been implemented in at least 1 unit in 16.2% of facilities, with these functions implemented across all units in 7.6% of hospitals.

We observed statistically significant bivariate associations between 2 hospital characteristics and the implementation of these functions in at least 1 unit (Table 3). Hospitals that had implemented all of the 4Ms in at least 1 unit were more likely to be urban (85.6% urban versus 74.8% rural; *P* = .0214). Hospitals that had implemented the 4Ms were less likely to be members of hospital systems (26% system-affiliated in the implementation group versus 46.9% system-affiliated in the not-implemented group; *P* = .0014).

When we included hospitals that indicated "beginning to implement" in the implemented group, the adoption measures did not substantially increase. For 6 of the 8 functions, this change resulted in a less than 5 percentage point increase. For structured documentation of mobility, the increase was ~7 percentage points

Table 1. Hospital characteristics: respondents versus nonrespondents

	Responders, $n = 479$	Nonresponders, $n = 318$	P Value
Hospital size			.046
Small	52.2%	46.9%	
Medium	37.0%	45.3%	
Large	10.9%	7.9%	
Hospital teaching status			.037
Major teaching	6.1%	2.2%	
Minor teaching	23.2%	23.6%	
Nonteaching	70.8%	74.2%	
Profit status			<.001
Investor owned, for profit	9.4%	19.8%	
Nongovernment, not for profit	67.2%	65.4%	
Government, non-Federal	23.4%	14.8%	
Urban			.149
Rural	28.2%	23.6%	
Urban	71.8%	76.4%	
Census region			<.001
Northeast	17.7%	11.3%	
Midwest	32.2%	21.4%	
South	32.4%	45.6%	
West	17.7%	21.7%	
Member of hospital system			<.001
Yes	51.4%	71.4%	
No	48.6%	28.6%	
EHR Adoption from AHA IT Supplement			<.001
Comprehensive EHR	66.6%	51.9%	
Basic EHR	17.3%	11.0%	
Less than basic EHR	16.1%	37.1%	

Note: AHA: American Hospital Association; EHR: electronic health record; IT: information technology.
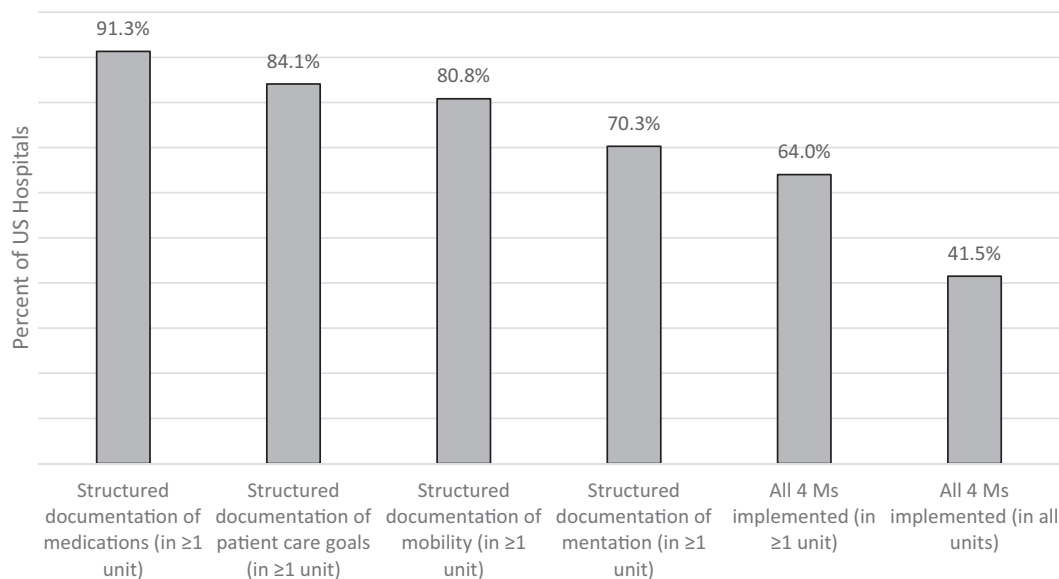
Figure 1. Hospital implementation of 4Ms EHR functions. 4Ms: What Matters, Medication, Mentation, and Mobility.

and for specialized portal training, the increase was ~10 percentage points (Supplementary Appendix).

DISCUSSION

Our results offer the first assessment of US hospitals' implementation of age-friendly EHR functions. Despite the substantial national investment in hospital EHR adoption, implementation has not focused on the specific capabilities of systems to support the care of older adults, who comprise the majority of the inpatient population. It is therefore unlikely that the use of EHRs is resulting in optimal gains in health outcomes for older adults. To address this, it is critical that policy- and practice-based efforts, particularly those focused on the care and outcomes for older adults, promote stronger incentives that reward hospitals for such investments.

Table 2. Hospital characteristics associated with implementation of 4Ms EHR functions

	4Ms fully implemented in at least 1 unit	4Ms not fully implemented in at least 1 unit	*P* Value
Hospital size			.0738
Small	42.8%	52.5%	
Medium	44.8%	41.8%	
Large	12.4%	5.7%	
Hospital teaching status			.383
Major teaching	5.8%	4.3%	
Minor teaching	25.9%	20.4%	
Nonteaching	68.2%	75.3%	
Profit status			.271
Investor owned, for profit	13.4%	18.2%	
Nongovernment, not for profit	66.0%	55.1%	
Government, non-Federal	20.6%	26.7%	
Urban			.0836
Rural	20.5%	28.8%	
Urban	79.5%	71.2%	
Census region			.839
Northeast	13.7%	14.6%	
Midwest	27.1%	28.3%	
South	37.9%	32.9%	
West	21.3%	24.2%	
Member of hospital system			.0823
Yes	60.1%	49.9%	
No	39.9%	50.1%	
EHR adoption			.802
Comprehensive EHR	70.3%	66.9%	
Basic EHR	15.2%	17.1%	
Less than basic EHR	14.6%	16.0%	
% Medicare admissions			.700
Top quartile	21.5%	17.2%	
2nd	24.3%	26.0%	
3rd	24.9%	29.6%	
Bottom quartile	29.2%	27.2%	
ACO participation			.818
Yes	22.2%	21.1%	
No	77.8%	78.9%	

Note: 4Ms: What Matters, Medication, Mentation, and Mobility; EHR: electronic health record; ACO: Accountable Care Organization.
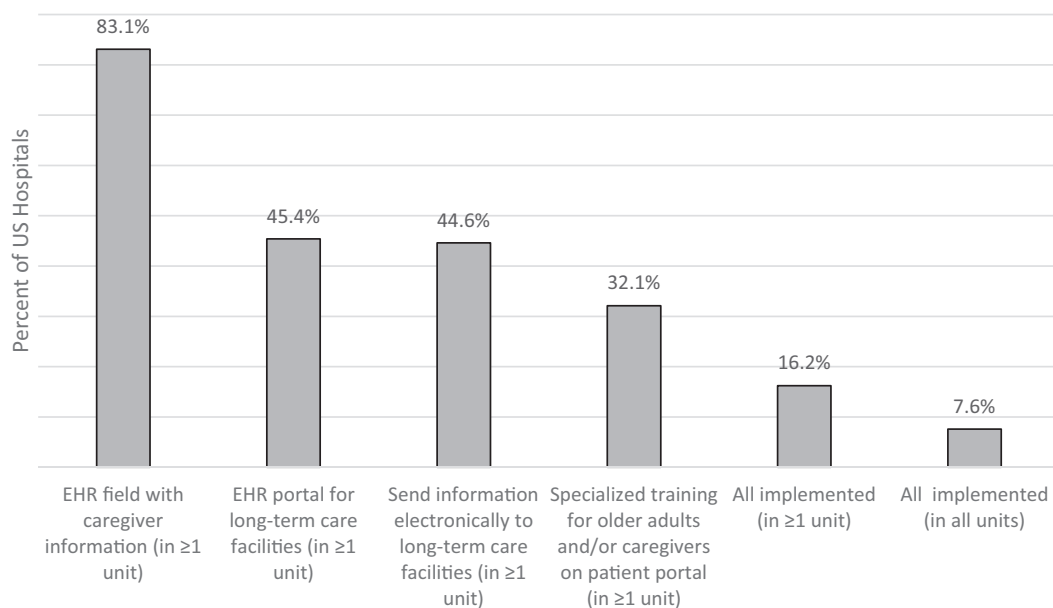
Figure 2. Hospital implementation of electronic exchange and communication EHR functions.

Table 3. Hospital characteristics associated with implementation of electronic exchange and communication EHR functions

	Exchange/communication fully implemented in at least 1 unit	Exchange/communication not fully implemented in at least 1 unit	P Value
Hospital size			.114
Small	34.9%	48.5%	
Medium	55.1%	41.5%	
Large	10.0%	10.0%	
Hospital teaching status			.391
Major teaching	6.2%	5.1%	
Minor teaching	17.7%	25.2%	
Nonteaching	76.1%	69.7%	
Profit status			.0675
Investor owned, for profit	10.3%	16.1%	
Nongovernmental, not for profit	74.7%	59.7%	
Government, non-Federal	15.0%	24.3%	
Urban			.0214
Rural	14.4%	25.2%	
Urban	85.6%	74.8%	
Census region			.461
Northeast	16.8%	13.5%	
Midwest	33.6%	26.3%	
South	28.3%	37.6%	
West	21.3%	22.6%	
Member of hospital system			.0014
Yes	26.0%	46.9%	
No	74.0%	53.1%	
EHR adoption			.283
Comprehensive EHR	76.8%	67.5%	
Basic EHR	13.1%	16.4%	
Less than basic EHR	10.0%	16.1%	
% Medicare admissions			.139
Top quartile	31.1%	17.8%	
2nd	21.4%	25.6%	
3rd	24.6%	27.0%	
Bottom quartile	22.9%	29.6%	
ACO participation			.769
Yes	23.2%	21.5%	
No	76.8%	78.5%	

Note: EHR: electronic health record; ACO: Accountable Care Organization.

While implementation of each of the 4Ms involves a specific set of activities, the EHR operationalization of those activities is optional. Experience in this community has revealed that when hospitals do leverage their EHRs to support implementation of the 4Ms, it typically comes late in the sequence of improvement activities. While there is no single driver of why this is a later step, contributors include the need to design and gain acceptance of process-based changes before instantiating those changes in the EHR. In addition, EHRs are highly customizable and often allow varied workflows,[22] which could be helpful to allow local EHR adaptation to the 4Ms but can impede the ability to create large-scale alignment with the 4Ms practices, by not having structured documentation of the 4Ms included as a standard feature of commercial EHRs. Finally, EHR customizations can be costly and complex.[22] Taken together, these reasons may help explain why we found that less than half of US hospitals had structured documentation of the 4Ms fully implemented across all units.

In the future, it will also be helpful to assess not only structured documentation of the 4Ms but more details about this documentation and its advanced uses. For example, in the Medication domain, it would be useful to drill down on the structured capture of specific medication lists and classes that are known to be high-risk for older adults, in addition to helping care providers align medication use with patient care goals. More sophisticated functions may include clinical decision support to guide safe, effective, and goal-concordant prescribing of these medications, as well as end dates of prescribing, dose-adjusting, and deprescribing, as appropriate. In the Mentation domain, it would be useful to capture the use of EHR-embedded screening tools and determine how those screening results guide care. Such measures would help reveal how specific implementation of the 4Ms functions could be tailored to more directly address the goals of the model.

We were surprised that many of the hospital characteristics that typically predict the adoption of advanced EHR functions (ie, large, urban, not-for-profit, teaching) were not associated with the adoption of structured documentation of the 4Ms. It may be that the drivers of technology adoption differ from the drivers of care delivery models focused on older adults, with the latter driven more by

local geriatrics champions or hospital leadership that is attuned to these issues given the needs of their patient community. As efforts to advance EHR capabilities that support age-friendly care evolve, this finding means that there is not a standard profile of a hospital type to target. Instead, efforts may be best served by large-scale policy- or practice-based efforts to transform care for older adults, much in the same way that primary care transformation has targeted an entire care setting with general models, such as the patient-centered medical home, leading to new investments in technology capabilities.

Our results related to low levels of information sharing reflect the broader national challenge of building robust interoperability across the care delivery spectrum. The 2009 Health Information Technology for Economic and Clinical Health Act and derivative meaningful use criteria featured hospitals' ability to electronically send a transition of care document when patients were discharged.[23] However, the criterion only required that this occur for 10% of care transitions. Our results make plain that the majority of hospitals are still not able to send information electronically to long-term care facilities: a critical gap that must be addressed to ensure safe and effective transitions for the disproportionately frail set of patients who make this transition. Our finding that a potential substitute approach—allowing long-term care facilities to log in to the hospital EHR to access patient data—was also adopted by less than half of hospitals suggests that electronic sharing simply isn't happening, and that record sharing instead continues to occur via fax and phone. This represents a huge missed opportunity that could have resulted from the federal investment in hospital EHRs. Finally, our results point to the need to also engage patients in accessing their own information. With less than one-third of hospitals offering specialized training for older adults or their caregivers on how to access their medical information via the patient portal, there is another clear missed opportunity in terms of how federal funding could have been structured to ensure not just the availability but the meaningful use of information-sharing capabilities within EHRs.[24]

Our study has important limitations. First, despite receiving a 60.1% response rate, the characteristics of the hospitals that responded to the survey were different from the characteristics of those that did not respond. While we adjusted for these differences with nonresponse weights, these adjustments may not fully account for differences, and our results may therefore not accurately reflect the population of US hospitals. Second, our study relies on self-reported data, which we were not able to validate and which could contain respondent errors. Each of the EHR functions that we examined could be interpreted with some variability. For example, we were not able to capture variation in the completion of structured documentation for the 4Ms. Relatedly, our measures did not extend to capture the "use" of the implemented functions, or their impact on the patient experience or quality of care. Finally, we could not identify the causal mechanisms underlying the relationships that we observed between adoption of the EHR functions and hospital characteristics.

CONCLUSION

We collected the first national data on the extent to which hospital EHRs support documentation of the 4Ms, which are a set of priorities for meeting the care needs of older adults, as well as electronic exchange and communication functions specifically relevant to this population. We found high adoption of some functions, including structured documentation of medications and caregiver information, and low adoption of others, including electronically sending infor-

mation to long-term care facilities and specialized training on the patient portal. Less than half of US hospitals had either set of EHR functions fully implemented in all units. Despite the significant national investment in hospitals' adoption of EHRs, along with the ability to promote electronic exchange and communication, our results reveal that EHRs have not yet been tailored to support optimal gains in health outcomes for older adults across settings.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Journal of the American Medical Informatics Association* online.

CONFLICT OF INTEREST

Terry Fulmer is the President and CEO of the John A. Hartford Foundation.

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