Electronic Health Record "Super-Users" and "Under-Users" in Ambulatory Care Practices

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Healthcare organizations across the United States have invested substantially in electronic health record (EHR) systems, incentivized by federal investment and legislation.[1] Ambulatory care practices have steadily improved their EHR adoption over the last decade; 2014 estimates indicated that approximately 78% of ambulatory care practices had a certified EHR platform.[2,3] There is substantial heterogeneity within this group, however. The EHR acts as a backbone for a range of health information technology (IT) functionalities with multiple potential applications to care delivery; practices vary in their adoption of these functionalities and in the extent of their use of these tools in routine practice.

Empirical data show benefit to processes of care from an array of health IT functionalities, including data repository,[4] computerized order entry,[5,6] electronic messaging and health information exchange,[7] patient-facing tools,[8,9] and clinical decision support.[5,10] In addition, quality improvements from the EHR and associated functionalities likely transcend the individual provider organization, with some tools (such as health information exchange) designed to work in synergy for coordination of care among multiple practitioners.[11] Practices restricting themselves to the more basic features of this technology may limit the potential impact of the EHR on their own performance[4,12,13]; it is also possible that slow or elementary adopters may have a negative impact on the quality of the health system as a whole.

In this study, we explored variation in the extent of use of EHR-based health IT functionalities in the ambulatory care setting. We used data from the Healthcare Information and Management Systems Society (HIMSS) Analytics ambulatory practice surveys to create a new framework of EHR use across 7 domains of health IT functionality, and we identified practices that were high users of a range of functionalities ("super-users") and those that used these EHR tools only minimally ("under-users"). Noting that studies on hospital EHR adoption suggest that small and rural hospitals may experience greater barriers in implementing this technology,[14] we investigated how the rates of super-use and under-use vary

ABSTRACT

OBJECTIVES: This study explored variation in the extent of use of electronic health record (EHR)-based health information technology (IT) functionalities across US ambulatory care practices. Use of health IT functionalities in ambulatory care is important for delivering high-quality care, including that provided in coordination with multiple practitioners.

STUDY DESIGN: We used data from the 2014 Healthcare Information and Management Systems Society Analytics survey. The responses of 30,123 ambulatory practices with an operational EHR were analyzed to examine the extent of use of EHR-based health IT functionalities for each practice.

METHODS: We created a novel framework for classifying ambulatory care practices employing 7 domains of health IT functionality. Drawing from the survey responses, we created a composite "use" variable indicating the extent of health IT functionality use across these domains. "Super-user" practices were defined as having near-full employment of the 7 domains of health IT functionalities and "under-users" as those with minimal or no use of health IT functionalities. We used multivariable logistic regression to investigate how the odds of super-use and under-use varied by practice size, type, urban or rural location, and geographic region.

RESULTS: Seventy-three percent of practices were not using EHR technologies to their full capability, and nearly 40% were classified as under-users. Under-user practices were more likely to be of smaller size, situated in the West, and located outside a metropolitan area.

CONCLUSIONS: To achieve the broader benefits of the EHR and health IT, health systems and policy makers need to identify and address barriers to full use of health IT functionalities.

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according to practice size, type, urban or rural location, and geographic region.

METHODS

HIMSS conducts annual surveys of US health systems and organizations, with a particular focus on structural characteristics of their EHR and health IT functionalities in use, generating a comprehensive database that has been frequently used in empirical research.[15-18] To date, published studies that have employed these data utilized only the data regarding hospitals.[19] However, HIMSS also obtains data on ambulatory care practices, defined as facilities providing "preventative, diagnostic, therapeutic, surgical, and/or rehabilitative outpatient care where the duration of treatment is less than 24 hours—and is generally referred to as outpatient care." We used data from the 2014 ambulatory practice survey, which contains information on more than 75% of US health system–associated ambulatory care practices. HIMSS defines a health system as an organization composed of at least 1 hospital and its associated nonacute facilities, and "associated" as a governance relationship (ie, they are owned, leased, or managed by a health system). Eligible practices for our study were those that indicated they had a "live and operational" EHR and had completed at least 1 health IT functionality survey question. We linked the practice site zip code with a publicly available dataset providing a geographic taxonomy to develop a measure of rurality.[20]

Existing EHR classifications applicable to the ambulatory care setting have limitations; many are defined by only short lists of Meaningful Use criteria,[21] and categorizations of "basic" or "comprehensive" systems are largely hospital-focused. We created a novel framework for classifying ambulatory care practices using 7 domains of health IT functionality, referencing the structure of the HIMSS survey and historical taxonomies (such as that by Des Roches et al[22]). The 7 domains were data repository, clinical decision support, order entry management, electronic messaging, results management, health information exchange, and patient use. The HIMSS survey asks respondents to indicate if they use any of more than 50 EHR-based health IT functionalities and, in some cases, assesses the intensity of this use (eg, "What proportion of orders are completed using the EHR?"). We matched all of these items to 1 of the 7 domains of functionality (details are given in the **eAppendix** [available at **ajmc.com**]).

We used a 3-step process to define a practice as a super-user or under-user of health IT functionalities. First, we classified practices into 3 categories based on the number of functionalities employed within each domain. Practices in the lower quartile for their sum total of functionality within a domain were categorized as "low" (score of 0), those in the upper quartile were defined as "high" (score

TAKEAWAY POINTS

As of 2014, 73% of ambulatory practices were not using electronic health record (EHR)-based functionalities to their full capability, and nearly 40% were classified as health information technology (IT) "under-users."

▸ Under-use of health IT in ambulatory care has implications for the ability of the health system as a whole to provide coordinated and efficient care.

▸ Facilitating the full use of a range of health IT tools in the ambulatory setting may help the broader health system gain the full benefit of investments in EHR-based technologies.

▸ Efforts to increase the use of health IT functionalities should focus on practices that are small, are located in nonmetropolitan areas, and provide specialty care.

of 2), and practices in the interquartile range were categorized as "moderate" (score of 1). Second, we created a composite "use" variable by summing the domain scores for each practice (composite scores ranged from a minimum of 0 to a maximum of 14). Third, we ranked practices according to this composite variable. We explored the natural distribution of the data in order to identify practices that were low and high outliers on the composite score. We defined practices as super-users if they had a composite score of 12 to 14 and under-users if their composite score was 0 to 2. We performed sensitivity analyses to explore the impact of alternative criteria; our findings were robust to alternate specification of the cut points.

We examined characteristics of practices according to their classification as a super-user or under-user, using Pearson's χ^2 test for the categorical variables and a 2-sided t test for the continuous variable. Variables of interest included the size of the practice (defined as number of affiliated physicians, in 4 categories), location (metropolitan, midsize, small town, or rural), geographical region (Northeast, Midwest, South, or West), and type of practice (primary/family care; single-specialty, multispecialty, and allied health; or urgent care and specialist services). Allied health practices included those practicing podiatry, occupational health, weight management, and holistic medicine, among others. Practices providing "specialist services" were those giving specialty-circumscribed care to a defined population (eg, patients undergoing dialysis or cardiac rehabilitation). Using multivariable logistic regression models, we estimated odds ratios associated with super-user and under-user status, according to practice characteristics. Analyses were performed using Stata version 14.2 (StataCorp LLC; College Station, Texas). We used Quantum Geographic Information Software to create maps showing the distribution of use categories across the United States.

RESULTS

There were 38,638 health system–affiliated practices in the HIMSS data; 32,236 (83.4%) indicated they had a live and operational EHR, and of these, 30,123 (93.5%) provided survey responses. The majority (77.4%) of responding practices in the sample had fewer than 7 associated physicians; however, the distribution of this variable

TABLE 1. Number and Percentage of Practices Reporting Use of Health IT Functionalities by EHR Domain (N = 30,123)

Domain	Low Use		Moderate Use		High Use	
	n	%	n	%	n	%
Data repository	9850	32.7	9707	32.2	10,566	35.1
Clinical decision support	12,553	41.7	9095	30.2	8475	28.1
Order entry management	12,533	41.6	5722	19.0	11,868	39.4
Electronic messaging	14,299	47.5	8032	26.7	7792	25.9
Results management	16,897	56.1	1931	6.4	11,295	37.5
Health information exchange	12,821	42.6	8839	29.3	8463	28.1
Patient use of EHR tools	14,649	48.6	7043	23.4	8431	28.0

EHR indicates electronic health record; IT, information technology.

TABLE 2. Odds of Super- or Under-Use by Practice Characteristics[a]

	Super-User		Under-User	
	OR	95% CI	OR	95% CI
Practice Size (number of associated physicians)				
<7	Reference			
7-19	1.61	(1.49-1.75)	0.77	(0.71-0.83)
20-99	2.06	(1.82-2.32)	0.66	(0.58-0.75)
≥100	3.24	(2.95-3.55)	0.78	(0.71-0.85)
Practice Type				
Primary/family	Reference			
Single or multiple specialty, allied health	0.89	(0.83-0.94)	1.08	(1.03-1.14)
Specialist services and urgent care	0.64	(0.57-0.72)	1.40	(1.27-1.55)
Location				
Rural	Reference			
Small town	1.02	(0.84-1.22)	0.99	(0.86-1.13)
Midsize	0.99	(0.83-1.18)	0.95	(0.84-1.08)
Metropolitan	2.45	(2.10-2.85)	0.61	(0.54-0.68)
Region				
Northeast	Reference			
Midwest	2.05	(1.90-2.22)	0.59	(0.56-0.64)
South	1.32	(1.22-1.42)	0.98	(0.92-1.04)
West	0.93	(0.85-1.03)	1.16	(1.07-1.26)

OR indicates odds ratio.
[a]Analysis excludes 115 practices without accurate zip code information.

was skewed by some practices with large numbers of physicians (maximum, 2300) such that the median number of physicians per practice was 2 and the mean was 5.6. The dominant practice type was single or multiple specialty and allied health practitioners (62.5%), whereas 30.8% were primary/family medicine. Nearly 75% of practices were located in metropolitan areas; only 4.7% were rurally located.

Table 1 shows the proportions of practices with low, moderate, and high use by domain of health IT functionality. The eAppendix provides the full table of functionalities and frequency of responses and the descriptive characteristics of the total sample and super-user and under-user practices. Among practices indicating any use of computerized physician order entry, only 35.6% used this capacity for more than 75% of orders. Additionally, although the majority of practices were adept at using their EHR for more elementary functions, such as data storage (100% of practices stored transcribed reports electronically and 61.1% used the EHR for nursing documentation), some of the more advanced functionalities (such as the ability to find and modify orders for all patients on a specific medication) were used at much lower rates (29.3%).

Table 2 gives the findings of the multivariable analyses, in which 8003 practices were classified as health IT super-users (26.6%). The odds of super-user status were lower for single-specialty, multispecialty, and allied health practices than for primary/family care clinics, and lower still for practices providing specialist services or acute care. The likelihood of super-use increased as the number of affiliated physicians increased, and super-users were more than twice as likely to be located in metropolitan areas than rural. Overall, the odds of being a super-user were highest for practices in the Midwest.

In contrast, 11,706 practices (38.9%) were classified as health IT under-users. Under-user practices were more likely to be situated in the West, have fewer affiliated physicians, and be located outside of metropolitan centers. Compared with primary/family care practices, single-specialty, multispecialty, and allied health practices were more likely to be under-users, as were those that provided specialist or acute care services. **Figures 1**, **2**, and **3** give the geographical location of super- and under-users and the proportion of these practices by county.

DISCUSSION

We examined variation in the extent of use of EHR-based health IT functionalities in a national sample of US ambulatory care

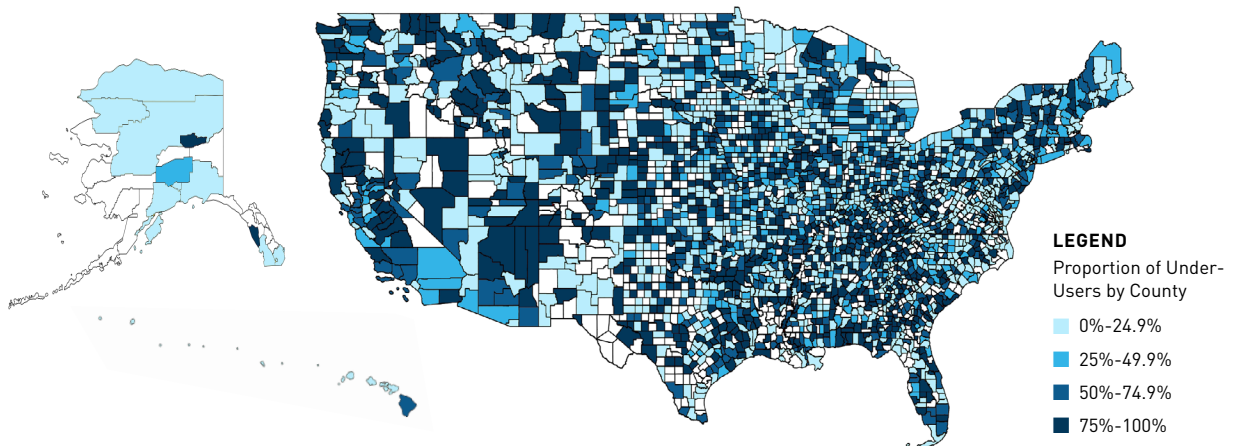**FIGURE 1.** Location of Super-User (Green) and Under-User (Blue) Practices
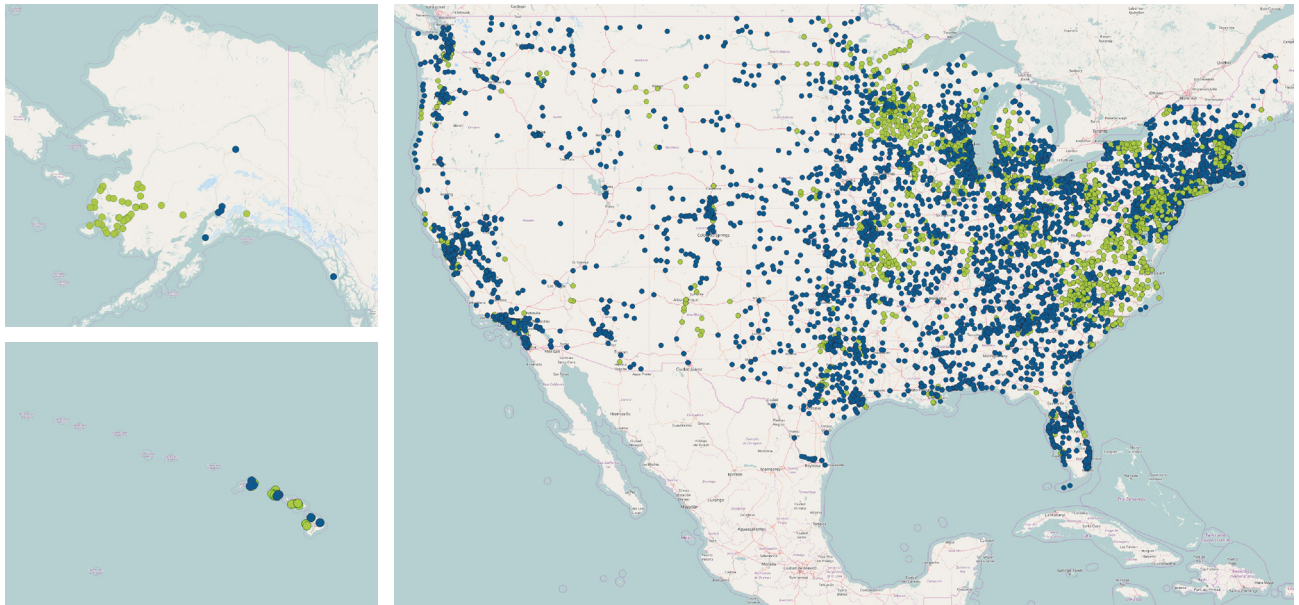
practices. Among 30,123 practices that were affiliated with a health system and had an operational EHR, only 27% were super-users, meaning they were maximally using EHR functionalities designed to improve patient care and facilitate high-quality performance across the broader health system. Of concern was that nearly 40% of ambulatory practices were categorized as under-users, indicating minimal use of the EHR and associated health IT functionalities. Under-use was more likely in smaller practices, those located outside of metropolitan centers, non–primary care practices, and those situated in the West.

There are likely multiple factors involved in EHR and health IT under-use by ambulatory care practices. Cost has been cited as the primary barrier to adopting an EHR system[23]; similarly, upgrading a basic EHR to one more comprehensive may not be financially possible for practices with limited resources. Cost may also be a factor for these practices because of the health IT support resources required to train users and maintain the systems. Smaller and rural practices were more likely to be under-users, a pattern also seen in the adoption of EHR and health IT in hospitals.[24] These types of practices may face financial, human resource, or structural barriers that impede their ability to use their EHR to full capacity. We found that super-use was least prevalent in practices providing specialist-level care and services; it is possible that these practices are less well served by existing health IT functionalities and require specific tools developed for more specialized clinical scenarios.

Policy makers should consider how to address the barriers of the small, nonmetropolitan, and specialist practices to using their

health IT functionalities more fully, as the relative under-use of these tools has far-reaching implications. First, suboptimal use of critical health IT functionalities may have direct relevance for the quality of care provided by an individual practice as part of routine patient care. Second, under-use of these technologies (such as health information exchange) may have consequences for the quality of care provided across the ambulatory care sector. Current policies, such as shared risk programs, encourage community-based strategies to avoid costly hospitalizations; similarly, value-based purchasing holds providers accountable for care delivered by multiple practitioners. It is also notable that the diversity of ambulatory care providers has expanded in recent years[25]; our sample included more than 50 types of ambulatory specialty services. This trend and the aforementioned policies suggest that communication and care coordination among ambulatory care providers is more crucial than ever.

Third, the interoperability of the broader digital health system is essential for the network benefits of health IT and EHR systems, yet differences in EHR capacity between the US hospital sector and ambulatory care are substantial. For example, transitions in care are a crucial task for both primary and tertiary health providers. The Office of the National Coordinator for Health Information Technology reported that approximately 49% of hospitals could generate a care summary document in 2014 (a low estimate that shows room for improvement)[26]; however, only 39% of ambulatory practices in our sample were able to create and transmit an equivalent report. Especially telling is the 2013 estimate that 77% of hospitals had the capacity to send laboratory results to ambulatory

FIGURE 2. Proportion of Super-User Practices, by County

LEGEND
Proportion of Super-Users by County
- 0%-24.9%
- 25%-49.9%
- 50%-74.9%
- 75%-100%
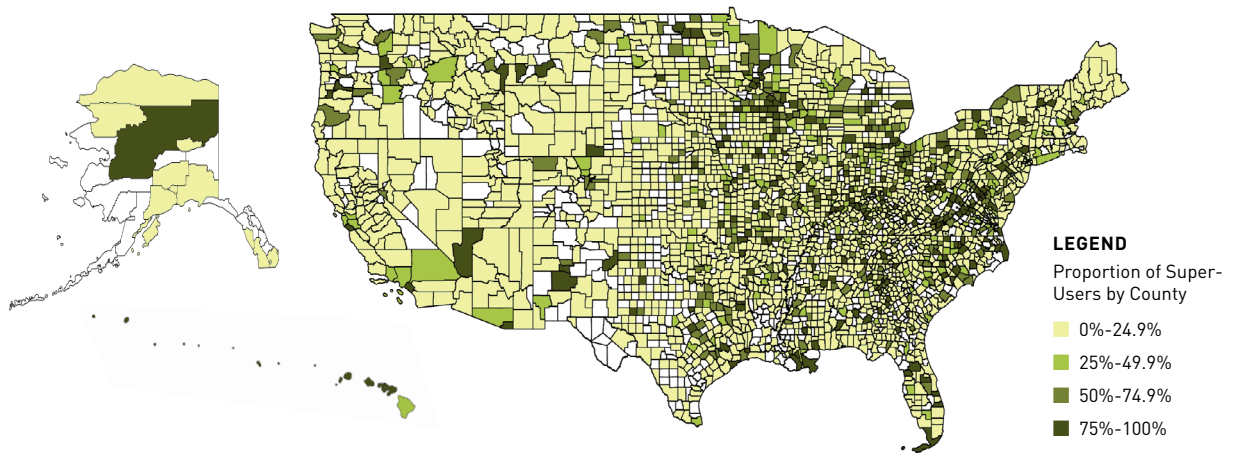
FIGURE 3. Proportion of Under-User Practices, by County

LEGEND
Proportion of Under-Users by County
- 0%-24.9%
- 25%-49.9%
- 50%-74.9%
- 75%-100%

providers[27] compared with the 49% of ambulatory practices that were able to communicate with hospitals for clinical information. Hospitals with advanced EHR systems are fundamentally limited if there are functional restrictions on their ability to interact with caregivers and organizations in the community setting.

Limitations

This study has some limitations. First, we used 2014 reported data, and practices may have since expanded their health IT functionality. However, changes since this time are likely to be incremental only; given that we have focused on the "outliers" of EHR use, it is unlikely that there would be substantial alterations in the proportions of

either super- or under-users. Second, this is the first publication using HIMSS ambulatory care data, and their validity has not been examined by the research community. However, many published studies have used the HIMSS hospital dataset,[15-17] which utilizes the same sampling and survey methodology as the ambulatory practice survey that provided the data in our study. One such study describes this source as the "industry standard for information on EMR [electronic medical record] adoption."[18] Accordingly, a strength of our study is its presentation of the first-ever analysis of the corresponding data from HIMSS about ambulatory care health IT use. The HIMSS survey represents one of the most comprehensive assessments of use of health IT that currently exists; our

study extended the current taxonomy of EHR systems well beyond that of "basic" and "comprehensive." Finally, the survey includes only ambulatory practices that are affiliated with a health system. Given a presumed desire for system interoperability, we might expect greater use of some health IT functionalities (such as health information exchange) by the ambulatory practices in our sample compared with independent practices. The use of this subset, in conjunction with our focus on those practices with a preexisting operational EHR, suggests that our results may overestimate the true proportion of super-users in the broader ambulatory care setting and that the national rate is even lower; the reverse is also likely true for the estimates of under-users.

CONCLUSIONS

Although it is critical for ambulatory care practices to have the building block of the EHR, a substantial proportion of these practices use this technology only minimally, indicating there is capacity for significant improvement. It is important that policy makers and healthcare providers understand the limits of health IT functionality in ambulatory care practices, as strategies aimed at improving the coordination of care or those relying on the EHR as a vehicle for intervention may be hindered by the technological capacity of ambulatory care partners. We also suggest that policy makers identify the barriers limiting the use of these tools in ambulatory care (in particular those related to small, rural, and specialty practices) and consider how best to facilitate the full use of a range of EHR-based health IT functionalities. Investment in EHR-based health IT capacity of individual ambulatory practices will likely have benefits to providers across the ambulatory setting and to the performance of the broader health system. ∎

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eAppendix Table 1. Distribution of Responses by EHR Domain and HIT Functionality

	Frequency	(%)	Median (mean)		Range	Interquartile range
Domain: Use of data repository capacity			4	(6.1)	1 – 12	1 - 11
Clinical research data analysis	9542	(31.7)				
Current encounter procedures	13302	(44.2)				
Current encounter vital signs including height, weight, blood pressure, temperature, etc	12467	(41.4)				
Nursing documentation	18391	(61.1)				
Physician documentation	18206	(60.4)				
Problem lists	13251	(44.0)				
Structured document templates (e.g. diabetic workup, annual physical, etc.) creating discrete data	15269	(50.7)				
Transcribed reports are stored electronically	30123	(100.0)				
Ability to create growth charts from the capture of structured data (vital signs, immunizations, BMI, etc.)	12637	(42.0)				
Ability to incorporate current encounter procedures into standardized format (e.g. CCD, CCR)	12546	(41.6)				
Medication lists on-line for all patients	14011	(46.5)				
Medication reconciliation	13225	(43.9)				
Domain: Clinical decision support			2	(3.1)	0 - 10	0 - 6
Basic medication screening (drug/drug, drug/allergy)	16182	(53.7)				
Clinical guidelines or protocols	13551	(45.0)				
Data from the community based EHR is incorporated into the EMR's rules engine and triggers alerts	5653	(18.8)				
Genomics profiling is incorporated into the EMR and could result in a suggested order or order change	1829	(6.1)				
Preventive medicine (e.g. immunizations, follow-up testing)	14805	(49.1)				
Receipt of diagnostics results trigger relevant clinical alerts and clinical	9018	(29.9)				

	Frequency	(%)	Median (mean)	Range	Interquartile range
guidance/recommended care					
Remote device monitoring process alerts clinician when clinically significant changes in data are detected	4319	(14.3)			
Capable of comparing patient follow-up recommendations to care rendered by all providers with access to the community-based EMR and variance and compliance alerts are generated	5664	(18.8)			
EMR suggests recommended follow-up based on date, patient problem list and procedures rendered by current provider and others.	9894	(32.8)			
Follow-up notices sent to the patients are initiated by flags set by provider	11245	(37.3)			
Domain: Order entry management			2 (1.8)	0 - 4	0 - 3
Ability to find and modify orders for all patients on a specific medication	8824	(29.3)			
e-Prescribing for new medications	17281	(57.4)			
e-Prescribing for refill medication requests	16906	(56.1)			
75% or more orders completed in this way	10720	(35.6)			
Domain: Electronic messaging			1 (2.0)	0 - 5	0 - 5
Consult communications	12494	(41.5)			
Disease management communications	8634	(28.7)			
Internal clinic communications	15545	(51.6)			
Patient communications	11120	(36.9)			
Referral communications	12620	(41.9)			
Domain: Results management			0 (1.03)	0 - 3	0 - 2
All lab reports are electronically imported and stored in discrete structured form OR Textual/data results may be returned via HL 7 transactions and stored directly into patient records	12716	(42.2)			
Textual/data results returned electronically in formats such as PDF, CCR, and CCD, and then attached to patient record	11183	(37.1)			
Output from diagnostic and intelligent medical devices are incorporated directly into patient's EMR when appropriate.	7627	(25.3)			

	Frequency	(%)	Median (mean)	Range	Interquartile range
Domain: Health information exchange			4 (5.3)	1 - 13	1 - 10
Capable of exchanging data across multiple vendor platforms for the purpose of health information exchange	10254	(34.0)			
Web browser on physician/nurse desktops for access to online reference material, eligibility information, lab results, etc.	30123	(100.0)			
With external registries for reporting of patient data (e.g. immunization, disease or device)	10087	(33.5)			
With governmental agencies (e.g. local, county, state)	11475	(38.1)			
With hospitals for clinical information OR web-only access	14663	(48.7)			
With hospitals for demographic and insurance information	13516	(44.9)			
With internal disease registries for case management	5631	(18.7)			
With other clinics for clinical information	13585	(45.1)			
With pharmacies or pharmacy clearinghouses (e.g. SureScripts)	13636	(45.3)			
With reference laboratories	12149	(40.3)			
With the Centers for Disease Control	5286	(17.5)			
Ability to transmit standardized format (e.g. CCD, CCR) or other standardized individual components of patient's electronic record	11680	(38.8)			
Ability to update the patient's EHR where there is a community-based HIE	7983	(26.5)			
Domain: Patient use			1 (1.6)	0 - 4	0 - 4
A patient portal allowing the patient to see personal health information, pay bills, request a schedule, request an appointment, etc.	11663	(38.7)			
Email communications with physicians or nurses	12506	(41.5)			
Patient Health Record	10816	(35.9)			
Patient specific medical education content	12183	(40.4)			

All functionalities are questions taken verbatim from the Healthcare Information and Management Systems Society survey on ambulatory care practices. BMI = Body Mass Index, CCD = Continuity of Care Document; CCR = Continuity of Care Record; PDF = Portable Document Format; HL 7= Health Level 7 format; EHR = Electronic health Record; EMR = Electronic Medical Record; HIE = Health information Exchange.

Tables A2 and A3 show the descriptive characteristics of the practices, according to their super-user and under-user status of EHR-based HIT functionalities, and that of the total sample. Note that the super- and under- categories are not complementary; the majority of practices fall into the middle 'unclassified' category of being neither a super nor under-user. Also note that the significance of the p-values likely reflects the large sample size; differences between the groups may not be practically meaningful.

eAppendix Table 2. Descriptive Characteristics of Ambulatory Care Practices Defined as Super-users of EHR-Based HIT Functionalities

		Super-user (%)		p	Total	(%)
		8003	(26.6)		30123	
	Median, mean	3,9.2		< 0.0001	2,5.6	
Size (number of associated physicians)	< 7	5303	(66.3)		23324	(77.4)
	7-19	1146	(14.3)	< 0.0001	3415	(11.3)
	20-99	487	(6.1)		1222	(4.1)
	>100	1067	(13.3)		2162	(7.2)
	Primary	2458	(30.7)		9289	(30.8)
Practice Type	Single or multiple specialty, allied health	5116	(63.9)	<0.0001	18823	(62.5)
	Specialist services and urgent care	429	(5.4)		2011	(6.7)
	Rural	222	(2.8)		1402	(4.7)
Location	Small town	355	(4.5)	<0.0001	2234	(7.4)
	Mid-size	590	(7.4)		3933	(13.1)
	Metropolitan	6833	(85.4)		22518	(74.8)
	Northeast	1310	(16.4)		6141	(20.4)
Region	Midwest	3264	(40.8)	<0.0001	9756	(32.4)
	South	2496	(31.2)		9767	(32.4)
	West	933	(11.7)		4459	(14.8)

P values calculated with Pearson's χ^2 for categorical variables, they estimate the statistical significance of differences in proportions between categories of practice variables in super-use practices compared to the total sample. Two-sided t test performed to test significance of difference in mean number of associated physicians. The analysis for the location excludes 36 practices which did not have an accurate zip code-rurality crosswalk.

eAppendix Table 3. Descriptive Characteristics of Ambulatory Care Practices Defined as Under-users of EHR-Based HIT Functionalities

		Under–user (%)		p	Total (%)	
		11706	(38.9)		30123	
Size (Number of associated physicians)	Median, mean	2, 4.3		< 0.0001	2, 5.6	
	< 7	9465	(80.9)		23324	(77.4)
	7-19	1142	(9.6)	< 0.0001	3415	(11.3)
	20-99	365	(3.1)		1222	(4.1)
	>100	734	(6.3)		2162	(7.2)
Practice Type	Primary	3534	(30.2)		9289	(30.8)
	Single or multiple specialty, allied health	7267	(62.1)	< 0.0001	18823	(62.5)
	Specialist services and urgent care	905	(7.7)		2011	(6.7)
Location	Rural	640	(5.5)		1402	(4.7)
	Small town	1041	(8.9)	<0.0001	2234	(7.4)
	Mid-size	1844	(15.8)		3933	(13.1)
	Metropolitan	8179	(69.9)		22518	(74.8)
Region	Northeast	2556	(21.8)		6141	(20.4)
	Midwest	3042	(26.0)	<0.0001	9756	(32.4)
	South	4089	(34.9)		9767	(32.4)
	West	2019	(17.3)		4459	(14.8)

P values calculated with Pearson's χ^2 for categorical variables, they estimate the statistical significance of differences in proportions between categories of practice variables in under-use practices compared to the total sample. Two-sided *t* test was performed to test significance of difference in mean number of associated physicians. The analysis for the location excludes 36 practices which did not have an accurate zip code-rurality crosswalk.