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RESEARCH BRIEF

Meaningful Use of the Indian Health Service Electronic Health Record

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Objective. To understand the use of electronic health record (EHR) functionalities by physicians practicing in an underserved setting.

Data Source/Study Setting. A total of 333 Indian Health Service physicians (55 percent response rate) in August 2012.

Study Design. Cross-sectional.

Data Collection. The survey assessed routine use of EHR functionalities, perceived usefulness, and barriers to adoption.

Principal Findings. Physicians routinely used a median 7 of 10 EHR functionalities targeted by the Meaningful Use program, but only 5 percent used all 10. Most (63 percent) felt the EHR improved quality of care. Many (76 percent) reported increased documentation time and poorer quality patient–physician interactions (45 percent). Primary care specialty and time using the EHR were positively associated with use of EHR functionalities, while perceived productivity loss was negatively associated.

Conclusions. Significant opportunities exist to increase use of EHR functionalities and preserve physician–patient interactions and productivity in a resource-limited environment.

Key Words. Electronic health record, Meaningful Use, Indian Health Service, underserved

Electronic health records (EHRs) are consistently promoted as a key factor in improving the quality of care, though by 2013 one-half of outpatient providers were still using less than a basic EHR system (Furukawa et al. 2014). Providers in underserved areas and safety net settings have been particularly slow to adopt advanced EHR systems (DesRoches et al. 2008; Jha et al. 2009; Hsiao et al. 2011, 2013; Li 2011; King, Furukawa, and Buntin 2013; Adler-Milstein et al. 2015). This may be due to resource constraints, an evidence base that is mixed regarding the impact of EHRs on quality and outcomes (Chaudhry et al. 2006; Linder et al. 2007; Keyhani et al. 2008; Friedberg et al. 2009; Zhou et al. 2009; Buntin, Jain, and Blumenthal 2010; Poon et al. 2010; Buntin et al. 2011; Romano and Stafford 2011; Kern et al. 2012), or that there is

insufficient information to guide safety net providers regarding EHR implementation in the context of caring for underserved populations.

The Indian Health Service (IHS) is a federal health care agency providing care in rural and urban settings to American Indian and Alaska Native (AI/AN) people. The IHS has a long history of utilizing health information systems and by 2008 had completed implementation of a full EHR suite. The IHS EHR was subsequently certified in 2011 for both inpatient and ambulatory settings based on criteria defined by the Office of the National Coordinator for Health Information Technology (Sequist, Cullen, and Acton 2011). Implementation of the certified EHR made IHS providers and hospitals eligible to receive financial incentives related to the Medicare and Medicaid EHR Meaningful Use program (Blumenthal and Tavenner 2010). The Meaningful Use program identified specific EHR functionalities to engage providers in the most valuable aspects of EHRs and to overcome negative perceptions that EHRs lack clinically useful features (Hollingworth et al. 2007; Leu et al. 2012). While prior work has evaluated barriers to EHR adoption among Medicaid providers (Kissam et al. 2012), there are few other data examining meaningful use of EHRs in underserved settings (Adler-Milstein et al. 2015).

The Indian Health Service EHR implementation provides an opportunity to understand the use of EHR functionalities by providers caring for an underserved population in a setting with limited resources. The goals of our study are to understand how IHS physicians report using Meaningful Use–defined EHR functionalities, characteristics of routine users, perceived usefulness, and perceived impact on quality and efficiency.

METHODS

Study Setting

The IHS provides health care to 2 million AI/AN people across the country through a network of 46 hospitals and over 600 outpatient

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clinics. Starting in 2004, federally operated IHS health care facilities began implementing a common EHR developed for the IHS and based on a platform similar to that used by the Veterans Health Administration. The program was released for general use in 2005, and by 2011 the IHS became the first federal agency to achieve EHR certification, and all federally operated facilities are currently using the same EHR. Deployment of the IHS EHR across the IHS was complete in September 2008, although full adoption within facilities was variable.

Survey

We surveyed all 626 physicians working at federally operated IHS facilities on their use of the EHR in August 2012. The survey was delivered by email invitation with a link to a web-based survey, followed by two emailed reminders to nonrespondents, and a final paper mailing, achieving a 55 percent ($n = 342$) response rate. We excluded nine respondents who were in specialties that do not routinely use the EHR for direct patient care (e.g., pathology and radiology) for a final sample of 333 physicians.

The survey assessed specialty, years in practice, and clinical volume. Practice characteristics relevant to EHR use included availability of computers in patient care areas, length of time using the IHS EHR, and EHR usage patterns (primary use during patient encounters, at the end of encounters, or at the end of clinical sessions). Physicians' perceptions of the EHR's impact on quality of care were evaluated using previously validated items (Sequist et al. 2007; Health Systems Change Health Tracking Physician Survey 2008; El-Kareh et al. 2009). Physicians reported on the availability, frequency of use ("not at all," "occasionally," and "routinely"), and usefulness ("not at all useful," "somewhat useful," "very useful") for 10 out of 14 required core EHR functionalities from the federally defined Stage 1 Meaningful Use standards for eligible providers. We also assessed 4 out of 10 Stage 1 optional Menu Objectives for Eligible Professionals, including viewing laboratory and other results as structured data, drug formulary checks, providing patients with reminders for preventive services, and patient-specific education resources. We selected these specific 14 EHR functionalities based on the likelihood that physicians could directly report on their availability, use, and usefulness; as opposed to other Meaningful Use criteria such as reporting quality measures to CMS or states.

Statistical Analysis

We measured the proportion of physicians reporting availability, routine use, and usefulness of all of the 10 core functionalities and the 4 optional functionalities. We determined the median number of functionalities which were available, used, and perceived to be useful. We further compared availability, use, and usefulness of all functions by physician specialty (PCP vs. specialist physician). We compared median number of functions available using the Kruskal–Wallis chi-square test and compared the proportion of physicians using individual functionalities using Pearson's chi-square tests.

We created a physician-specific index of Meaningful Use (score range 0 to 1.0) based on prior methods of measuring use of EHR functionalities (Sequist et al. 2007; Simon et al. 2007). To do this, we assigned a score to all 10 core functionalities plus 4 optional menu functionalities based on its being reported as "not at all used" (0 points), "occasionally used" (0.5 point), or "routinely used" (1 points), and calculated the proportion of functionalities used among those available. We fit a linear regression model to assess independent predictors of this Meaningful Use index. We examined variables which we hypothesized would be associated with functionality use including: physician specialty, years in practice, patient volume, length of time using the EHR, primary use of the EHR during patient encounters (compared to after encounters), whether practice transitioned to the IHS EHR from paper records (compared to transition from electronic records), presence of computers in patient care areas, and reporting lack of technical support and training or productivity loss as barriers to EHR use. We included all physician characteristics in our model plus clinic characteristics and reported barriers which were associated with our outcome in unadjusted models. We used generalized estimating equations to account for clustering of physicians within clinical facilities. We excluded 37 of 333 physicians from the multivariable model due to missing data. This study was approved by the Partners HealthCare Institutional Review Board. Analyses were performed using *SAS 9.3* (Cary, NC, USA).

RESULTS

The majority of physicians were male (60 percent) and white (70 percent), while 11 percent were AI/AN (Table 1). Three-quarters of physicians were in primary care, including family practice (49 percent), general internal medicine (10 percent), pediatrics (16 percent), and medicine-pediatrics (1 percent). The

Table 1: Characteristics of IHS Physician Respondents by Specialty, September 2012 (n = 333)

	N (%)
Demographics	
Age, median (IQR)	52 (44–59)
Female	39.6
Race	
White	69.9
Black	4.1
American Indian or Alaska Native	11.0
Asian or Pacific Islander	8.2
Other race	5.3
Hispanic ethnicity	10.2
Practice characteristics	
Primary care specialty[†]	76.3
Outpatient practice	95.2
Outpatient visits/week, median (IQR)	56 (40–75)
Inpatient practice	58.0
Inpatient visits/week, median (IQR)	6 (4–12)
Years in practice, median (IQR)	18 (9–26)
Years with IHS EHR, median (IQR)	4 (2–6)
Computer in every exam room	74.8
Use EHR during patient encounters	
Use EHR during each encounter	67.2
Use at the end of each encounter	25.1
Use at the end of clinic session	4.9
Do not use with clinic sessions	2.8
Transition from paper-based records (vs. electronic records)	47.7

Notes. EHR, electronic health record; IHS, Indian Health Service; IQR, interquartile range.
[†]Includes family practice, general internal medicine, general pediatrics, and medicine-pediatrics.

most common specialty fields included emergency medicine (5 percent), obstetrics/gynecology (5 percent), and general surgery (4 percent). One-quarter (25 percent) of physicians reported that computers were not available in every exam room in their main clinical practice and 33 percent did not use the EHR during patient encounters. Nearly half (48 percent) of physicians reported they were transitioning from a paper system to the IHS EHR.

Meaningful Use of EHR

Overall, 30 percent of physicians reported all 10 core functionalities were available, 5 percent used all 10 routinely, and 14 percent used all 10 at least occasionally. A median 9 of 10 core functionalities were reported as available,

and a median of 7 were used "routinely." Adding the four optional functionalities to the 10 core items, 6 percent of physicians used all 14 functionalities at least occasionally. Only 13 percent of physicians reported that all 10 core functionalities were "Somewhat" or "Very" useful. The core functionality least frequently perceived as useful was providing clinical visit summaries. Among the optional functionalities, patient engagement tools, such as patient-directed preventive service reminders and educational resources, were least often perceived as useful (Table 2).

Routine use of EHR functionalities generally paralleled availability (Table 2). However, some functions were available but often not used by physicians. These included preventive service reminders for patients (not used by 26 percent of physicians when available), providing patients with educational resources (not used by 20 percent), providing clinical visit summaries (not used by 29 percent), and accessing information on gender, race, and ethnicity (not used by 34 percent).

PCP and Specialist Physician Use of EHR

PCPs and specialists reported the same number of core functionalities were available (median 9 vs. 9 functionalities, $p = .12$). However, compared to specialist physicians, PCPs used more core functionalities "routinely" (median 7 vs. 5, $p < .001$) and more often reported that clinical visit summaries (40 percent vs. 23 percent, $p = .01$) and recording smoking status (83 percent vs. 65 percent, $p = .002$) were useful EHR functionalities.

Barriers to EHR Use and Quality of Care

Perceived barriers to EHR use included technical limitations of the system (46 percent major barrier, 42 percent minor), productivity loss (37 percent major, 42 percent minor), availability of technical support (39 percent major, 39 percent minor), lack of features to meet clinical needs (36 percent major, 39 percent minor), lack of EHR training (24 percent major, 46 percent minor), computer skills of staff (14 percent major, 54 percent minor), and patient privacy concerns (5 percent major, 23 percent minor). Most providers agreed that the EHR improves access to clinical information (83 percent), improves follow-up of results (76 percent), reduces medication errors (64 percent), and improves overall quality of care (63 percent). Many also agree that the EHR increases time required to complete a visit (77 percent), increases documentation time (76 percent), and decreases the quality of patient–physician

Table 2: Use and Usefulness of EHR Functionalities

	Available, %	*Routine Use, %*	*"Somewhat Useful," %*	*"Very Useful," %*
Core functionalities				
Up-to-date decision support for diagnostic and treatment recommendations	62.2	43.0	16.1	44.9
Access patient notes, medications, or problem lists	98.5	95.7	14.6	82.4
Access patient medication allergy lists	97.8	90.1	17.6	76.8
Order laboratory, radiology, or other diagnostic tests	97.2	91.6	11.8	82.0
Provide patients with clinical summaries for each visit	55.0	18.6	22.9	12.4
Access information on patients' gender, race/ethnicity	83.0	24.8	33.7	18.6
Record vital signs	96.0	84.8	12.1	82.0
Record smoking status	89.4	52.0	34.4	43.0
Transmit electronic prescriptions to pharmacy	77.3	69.4	10.8	63.8
Obtain information on drug interactions	86.6	58.5	26.9	49.5
Optional functionalities				
Drug formularies	69.5	44.0	23.8	39.9
Generate reminders for patients about preventive services	43.6	16.7	19.2	15.5
Provide patients with patient-specific educational resources	48.0	16.1	22.0	18.0
View structured laboratory, radiology, or other diagnostic tests	97.2	91.6	12.4	82.7

EHR, electronic health record.

interaction (45 percent). Compared to specialist physicians, PCPs more often reported productivity loss as a barrier to adoption (40 percent major barrier, 43 percent minor vs. 30 percent major, 40 percent minor, $p = .04$), and agree that the EHR increases visit time (82 percent vs. 64 percent, $p = .001$), increases documentation time (80 percent vs. 66 percent, $p = .01$), and decreases the quality of patient–physician interaction (49 percent vs. 36 percent, $p = .05$).

Multivariable Analysis

The median value for our Meaningful Use index was 0.85 (IQR: 0.75–0.92). In our multivariable model, primary care specialty (vs. specialist physicians) and time using the IHS EHR were positively associated with the Meaningful Use index (Table 3). Transition from a paper system and perceived productivity loss were inversely associated with the index. The coefficients in Table 3 denote the increase in proportion of available functions used associated with each independent predictor. For example, PCP specialty was associated with a 7.8 percent increase in use of available functions compared with specialists.

DISCUSSION

In this national sample of physicians providing care to an underserved population using a federally certified EHR, we found that only 14 percent were using all 10 of the core meaningful use functionalities we assessed. PCPs routinely used meaningful use functionalities more than specialist physicians. The most often used functionalities were also the most often identified as being useful, while patient engagement functionalities, such as clinical visit summaries, patient reminders for preventive services, and patient educational materials, were least often reported to be useful. Technical support, system limitations, and productivity loss were the most commonly reported barriers to implementation and nearly half thought their EHR negatively impacted the patient–physician interaction.

Our study expands on the prior literature by studying meaningful use of the EHR among a group of physicians providing care for a rural and underserved population, groups which lag behind in EHR adoption (Adler-Milstein et al. 2015). It is important to note that despite the diverse AI/AN patient population and inherent resource limitations of the IHS, we found that many of

Table 3: Multivariable Predictors of Meaningful Use Index Score[†] ($n = 296$)[‡]

	Unadjusted b	*95% CI*		*p*	*Adjusted b*	*95% CI*		*p*
Primary care specialty	0.089	0.053	0.125	**	0.078	0.040	0.116	**
Outpatient visits/week	0.001	0.000	0.001	*	0.001	0.000	0.001	
Inpatient visits/week	0.001	−0.001	0.002		0.001	0.000	0.003	
Years in practice-centered at median	−0.001	−0.003	0.001		−0.001	−0.002	0.001	
Years using IHS EHR	0.007	0.001	0.013	*	0.007	0.001	0.013	*
Use EHR during each encounter	0.030	−0.004	0.064		0.026	−0.007	0.058	
Transition from paper-based versus electronic records	−0.039	−0.070	−0.007	*	−0.033	−0.065	−0.001	*
Barrier: Productivity loss	−0.042	−0.081	−0.003	*	−0.043	−0.082	−0.004	*

Notes. CI, confidence interval; EHR, electronic health record; IHS, Indian Health Service.
[†]Meaningful use index ranges from 0 to 1 based on proportion of available functions used, assigning a value of 0.5 for occasional use and 1.0 for routine use, among 10 core functionalities plus 4 optional menu functionalities.
[‡]Thirty-seven physicians were excluded due to missing data.
*$p < .05$, **$p < .001$.

our findings were consistent with prior studies. In particular, physicians in practices with Meaningful Use–capable systems use most core EHR functionalities, but few physicians use all of them (Hsiao et al. 2013). We did find that IHS physicians were least supportive of EHR functionalities focused on patient engagement. While our survey did not explore this in detail, it is possible that this relates to issues of cross-cultural care, health literacy, or other factors unique to caring for the AI/AN population. It is extremely important that EHRs be designed in a way that can meet the needs of diverse populations, particularly as it relates to patient engagement tools.

Our study adds to prior work by studying the predictors of EHR use including barriers to EHR adoption, EHR use during patient encounters, length of physician experience with the EHR, and physician specialty. About one-third of IHS physicians reported using the EHR at the end of each encounter or session rather than during the encounter. Real-time decision support tools prompting delivery of preventive care or presenting drug interactions are of limited utility if not used during a visit. However, a tension exists, as there are concerns and recent findings that EHR use during visits is associated with a worse patient experience (Frankel et al. 2005; Ratanawongsa et al. 2015). Indeed, we found that almost half of PCPs and one-third of specialists reported that EHR use worsened the physician–patient interaction. This is clearly a concern, and efforts should be made to measure the negative impact of EHRs on interactions and intervene through provider curriculum and software redesign (Duke, Frankel, and Reis 2013).

Our findings are also consistent with prior studies finding greater utilization of EHRs by PCPs compared to specialists (Decker, Jamoom, and Sisk 2012; Patel et al. 2013; Furukawa et al. 2014). Federal initiatives specifically target PCPs and this may contribute to the higher use rates (Decker, Jamoom, and Sisk 2012). If specialists are not fully using their EHR, the potential for information sharing to improve care across the health care continuum is compromised. It will be important to understand why specialists may not perceive value in using the EHR, and how EHRs might be designed to encourage meaningful use by specialists.

We found that, consistent with prior work (Boonstra and Broekhuis 2010), limited access to technical support and system limitations were a commonly identified barrier to EHR adoption. This highlights the importance of technical support and EHR training which was addressed by the HITECH regional extension centers (Buntin, Jain, and Blumenthal 2010).

Regarding efficiency, there is a need for sharing of best practices for incorporating EHR use into existing clinic workflows (Dimitropoulos 2009; Kissam et al. 2012). IHS providers reported EHRs were associated with longer documentation times and lower productivity. Productivity loss was of heightened concern to PCPs in this resource-limited setting. The discrepancy between perceived usefulness and routine use of some functionalities in our study may reflect challenges with incorporating some EHR functionalities into clinic workflow. Compared to functionalities that were already routinely performed using paper systems, such as writing prescriptions, providing patients with visit summaries, for example, may require additional steps to be completed during an office visit which increases visit time and harms productivity.

Limitations

Our study has important limitations. First, while we assessed a nationally representative physician population, our findings may not extend to other safety net settings. The IHS is a unique organization providing care for AI/AN, and it may not reflect the challenges faced by inner-city underserved populations. Second, our survey-based method focused on physician perceptions, and we could not measure actual EHR use or actual impact on quality and efficiency. Finally, we did not assess all 14 core meaningful use functionalities included in the Medicare and Medicaid EHR Incentive Programs. We focused our study only on specific items that would provide insight into the usability of the EHR by practicing physicians.

CONCLUSIONS

As the nation continues the push to adopt EHRs, it is critical to understand how and why providers, especially those caring for underserved populations, use or fail to use core functionalities of an EHR. Challenges to EHR adoption faced by IHS physicians likely have implications for other providers of underserved populations. Our study suggests that supporting specialists to become meaningful users, examining methods to maintain productivity and preserve patient–provider relationships, and developing appropriate, effective patient engagement materials may help optimize EHR adoption in underserved settings and improve the quality and efficiency of care delivered across the health care continuum.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.