

VARIABILITY AMONG SPECIALTY AND PRIMARY CARE PHYSICIANS IN  
THEIR METHODS OF USING AND PERCEPTIONS OF ELECTRONIC HEALTH  
RECORDS

By

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CERTIFICATE OF APPROVAL

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**ABSTRACT**

*Despite federal incentives for adoption of electronic health records (EHRs), surveys have shown that EHR use is less common among specialty physicians than generalists. Concerns have been raised that current-generation EHR systems are inadequate to meet the unique information gathering needs of specialists. This study sought to identify whether information gathering needs and EHR usage patterns are different between specialists and generalists, and if so, to characterize their precise nature. We found that specialists and generalists have significantly different methods of incorporating EHRs into clinical workflow, perceptions of which elements of the EHR are most important, and opinions regarding how well these systems are suited to the display of relevant clinical information. Resolution of these disparities could have implications for clinical productivity and efficiency, patient and physician satisfaction, and the ability of clinical practices to achieve Meaningful Use incentives.*

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## CHAPTER ONE: INTRODUCTION

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Electronic health records (EHRs) have become an increasingly critical component of modern health care delivery, and are used in all clinical disciplines.<sup>1</sup> Fifty nine percent of hospitals and 48% of office-based providers currently use EHRs.<sup>2,3</sup> The prevalence of adoption is expected to continue to grow as federal initiatives<sup>4,5</sup> aggressively promote EHR incorporation by physicians and hospitals. There are numerous potential benefits of EHRs compared to traditional paper-based medical records, including the capability for better sharing of patient data between different providers and especially between different health systems, changes in the medicolegal environment, and unacceptable rates of medical errors due to misinterpretation of handwriting in paper records.<sup>6-8</sup> Additionally, the increased capabilities for storage and transfer of data using EHRs create new opportunities in public health and quality assurance that have the potential to improve quality, decrease unnecessary testing, and reduce the cost of care.<sup>9-12</sup> However, despite the growing ubiquity of these systems, there is still substantial variability in the prevalence of adoption between different clinical disciplines.<sup>1,3</sup> Specifically, adoption within surgical and medical specialties is approximately one half that of primary care physicians.<sup>1,13,14</sup>

Despite the potential benefits of EHRs, there are several impediments to more widespread adoption of these systems in clinical practice. These include concerns that EHR implementation may negatively affect clinical productivity and efficiency,<sup>15-28</sup> that the steep learning curve associated with EHR use is impractical, and that electronic systems may actually increase medical errors.<sup>4,29-34</sup> The disparities in adoption among different clinical disciplines also highlight concerns that different medical fields may

have varying levels of compatibility with current-generation EHRs. Numerous medical specialty societies have expressed the need for specialty-specific systems to meet the unique needs of their respective fields, including ophthalmology, orthopedic surgery, dermatology, oncology, obstetrics/gynecology, pediatrics, and pathology.<sup>35-41</sup> These unique needs stem from differences in typical workflow, information gathering requirements, and clinical documentation methods as well as variations in baseline clinical volume, billing and compliance requirements, and specialty-specific terminology.

Nonetheless, the widespread adoption of EHRs in the United States continues to increase, driven largely by federal incentives through the Centers for Medicare and Medicaid Services (CMS) Meaningful Use program.<sup>2,42</sup> As defined by the CMS, this program “provides incentive payments for certain healthcare providers to use EHR technology in ways that can positively impact patient care.”<sup>43</sup> During the first five years of the program, CMS has provided financial incentives to providers able to demonstrate Meaningful Use according to a number of objectives defined by the institution. However, beginning in 2015, penalties will begin to be levied against health care organizations that fail to meet several key EHR implementation requirements,<sup>44</sup> further incentivizing EHR adoption. These measures make the avoidance of EHRs highly impractical for most physicians due to the potential financial impact of these penalties, regardless of how suitable such systems are to their specialty-specific needs.

There are numerous potential implications if current-generation EHRs do not function adequately in medical disciplines of all varieties. These include disproportionately decreased physician and patient satisfaction in certain medical fields, impaired clinical productivity and efficiency, and difficulty meeting Meaningful Use

requirements.<sup>45-48</sup> However, to date there is no experimental evidence as to whether or not such a disparity in functionality exists among different clinical disciplines, or what the nature of those differences in information-gathering needs might be. While various disciplines have expressed differing ideas of how the EHR should function and what it should provide, there is no evidence that these groups use current generation EHRs differently from each other in clinical practice.<sup>49,50</sup> In order to better meet the health information technology needs of all clinical disciplines, determining whether such interdisciplinary differences exist and identifying their precise nature is imperative. To accomplish this, we developed a survey to characterize three parameters of physicians' methods of clinical information gathering using EHRs; these were 1) How the EHR is incorporated into typical clinical workflow, 2) Which elements of the chart are most important and useful to the clinician, and 3) The strengths and weaknesses of the electronic chart in displaying relevant clinical information. These parameters were then compared between specialty and primary care physicians to identify any differences that may exist.

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## CHAPTER TWO: METHODS

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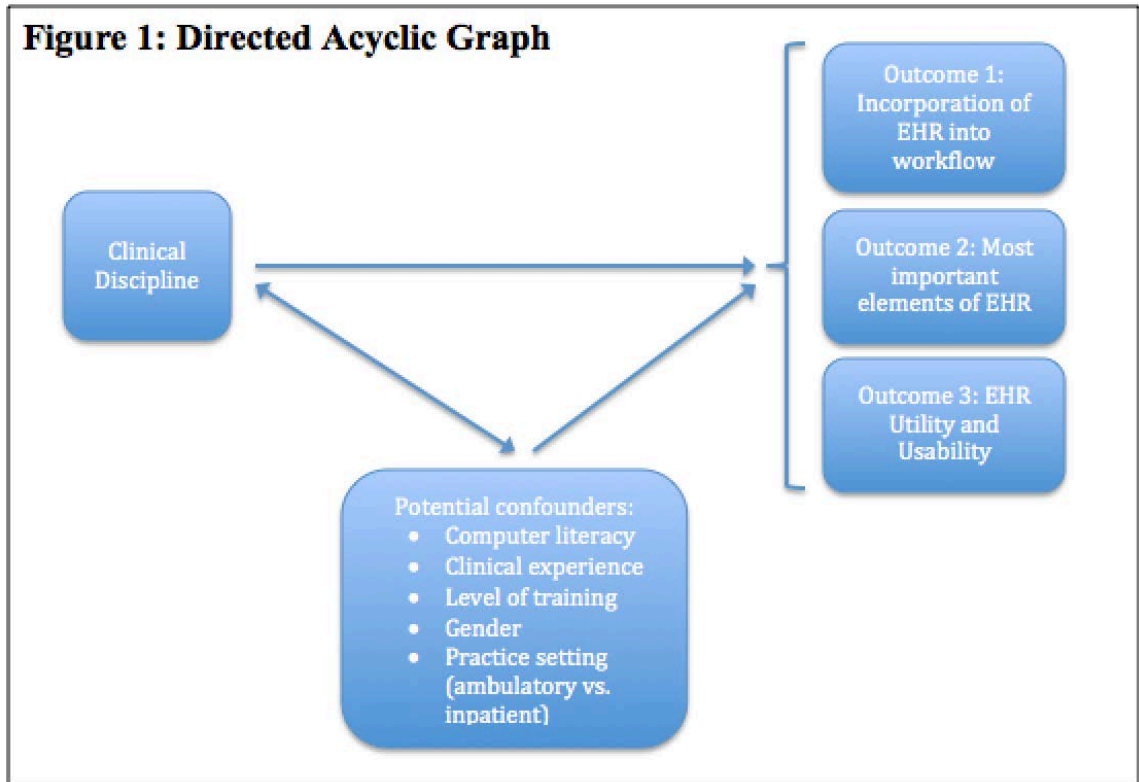
This study was approved by the Institutional Review Board at Oregon Health & Science University (OHSU, Portland, OR; IRB Approval #10027). Acknowledgement of an information sheet by survey participants was used in lieu of informed consent.

### Survey Development

We developed an 18-question survey for the purposes of data collection (**Appendix**). When answering these survey questions, respondents were asked to envision the scenario of evaluating a new patient rather than performing a follow up visit. This was because the

former is a situation that physicians of all specialties have experience with, and because it provides the greatest insight into the strengths and weaknesses of the interaction between physician and EHR.

Three primary outcomes were assessed by this survey: Outcome 1) How the EHR is incorporated into typical clinical workflow (*Questions 12-14*); Outcome 2) Which elements of the chart are most important and useful to the clinician (*Question 15*); and Outcome 3) The strengths and weaknesses of the electronic chart in displaying relevant clinical information (*Questions 17 and 18*). The main predictor variable was the respondent's primary clinical specialty. Potential confounding variables were also collected, including gender, clinical experience (years since graduation from medical school), level of computer experience, and primary practice setting (ambulatory vs. inpatient). The relationship of these variables is depicted graphically in **Figure 1**. The survey also included an optional free-text response eliciting any additional thoughts or comments. Survey reliability was confirmed using test-retest and alternate form methods.<sup>51</sup> Specifically, the survey was completed by 15 fourth year medical students at OHSU. One week later, the survey was resent to these 15 individuals, all of whom completed both iterations. The responses to 5 randomly selected survey questions were compared between both iterations for each respondent, and showed a very strong correlation ( $r=0.91$ ). The face and content validity of the survey were established iteratively through expert interviews and feedback.<sup>52</sup>



### Survey Administration

An email containing a link to the questionnaire was distributed to all practicing physicians at three health care organizations in Oregon (Oregon Health & Science University/Portland VA Medical Center, PeaceHealth Medical System, and Legacy Emmanuel Medical Center) and one in Pennsylvania (Children’s Hospital of Philadelphia). These institutions were selected because of the wide variety of primary care and specialty disciplines represented at each site, and because they represented a mix of academic and community-based practices. The email was then resent to all recipients after one month. The survey was administered using REDCap electronic data capture tools hosted at Oregon Health & Science University.<sup>53</sup>

### Statistical Analysis

The primary purpose of this study was to compare several aspects of physicians’ information gathering methods using the EHR across different clinical disciplines. In

order to perform this comparison, individual disciplines were combined into two groups: the Specialty group and the Primary Care group. Primary Care was considered to include General Internal Medicine, General Pediatrics, Family Medicine, and Geriatrics, in accordance with the definition of the term provided by Medicare.<sup>54</sup> The Specialty group was defined as any clinical discipline other than these four Primary Care disciplines, and in this case included respondents from Obstetrics & Gynecology, Ophthalmology, Orthopedics, General Surgery, Surgical Sub-Specialties, Emergency Medicine, Internal Medicine Sub-Specialties, and Pediatric Sub-Specialties.

Categorical response options were assessed using the Pearson Chi<sup>2</sup> test or Fisher Exact test, depending on the magnitude of the expected values for each cell. Binary outcomes were assessed using the Pearson Chi<sup>2</sup> test followed by multivariable logistic regression. This included parsimonious model selection to adjust for relevant covariates, followed by extensive model diagnostics. Ordinal outcomes were assessed using the Cochran-Armitage Test for Trend. One question (*Question 15*) provided multiple categorical responses for each respondent; in this case, proportions and 95% confidence intervals were compared between the Specialty vs. Primary Care groups for each potential response. Likert-type scale responses followed nearly normal distributions and were treated as discrete continuous variables. Two questions (*Questions 17 and 18*) included Likert-type scale ratings for multiple sub-sections within each question. These were assessed individually using summary statistics. Following this analysis, an overall composite score was determined for each of these questions by obtaining the group means across all sub-sections and comparing between the two main predictor groups using multivariable linear regression. Thus overall scores of the ability of the EHR to

display needed clinical information (*Question 17*) and of the severity of barriers to accessing needed information in the EHR (*Question 18*) were obtained from each respondent and compared between the Specialty vs. Primary Care groups, adjusting for relevant covariates as dictated by parsimonious model selection and model diagnostic results. All analyses were performed using Stata SE12 (StataCorp, College Station, TX).

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## CHAPTER THREE: RESULTS

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### Participant Demographics

Of the 3,649 physicians who received the survey link, 744 completed the questionnaire. This yielded a response rate of 20.4%. Of these 744 respondents, 90 were excluded either because they were not actively practicing medicine, did not

CLINICAL DISCIPLINE	<i>n (%)</i>
<i>Specialty</i>	350 (54)
Pediatrics Sub-Specialty	157 (24)
Internal Medicine sub-specialty	65 (10)
Ophthalmology	46 (7)
Surgical Sub-Specialty	26 (4)
Emergency Medicine	20 (3)
Obstetrics & Gynecology	17 (3)
Orthopedics	10 (2)
General Surgery	9 (1)
<i>Primary Care</i>	304 (46)
General Pediatrics	169 (26)
General Internal Medicine	101 (15)
Family Medicine	34 (5)

use an EHR on a regular basis, or did not identify with a relevant clinical specialty, resulting in 654 responses being included in the final analysis. Three hundred fifty respondents (54%) identified with a clinical discipline in the “Specialty” group, and 304 (46%) with a discipline in the “Primary Care” group (**Table 1**). Subjectively, there were minimal differences between these groups with respect to amount of clinical experience (number of years in practice), baseline computer experience, level of training, and primary practice environment (ambulatory vs. inpatient) (**Table 2**). However, there was a slightly higher proportion of males in the Specialty group (57%) compared to Primary Care (51%). A total of 13 EHR vendors were utilized by study participants; the most common of these were Epic (Verona, WI; 71%), Centricity (GE Healthcare, UK; 5%),

CPRS/Vista (US Department of Veterans Affairs; 5%), Cerner (Kansas City, MO; 3%), and Allscripts (Chicago, IL; 3%).

Incorporation of the EHR Into Clinical Workflow (*Outcome 1*)

Approximately one half of physicians in both the Specialty and Primary Care groups used the EHR as the primary source of initial information when evaluating a new patient (**Table 3**).

However, there were significant differences between the two groups with

regard to the other sources of information utilized (Pearson Chi<sup>2</sup> test; p=0.02; **Table 3**).

Of the Specialty physicians surveyed, 296/332 (89%) reviewed the chart prior to entering the room with the patient, compared to 244/295 (83%) of Primary Care physicians (p=0.02). This relationship was not confounded by gender, amount of computer experience, or level of training. After adjusting for the amount of clinical experience and primary practice setting (ambulatory or inpatient), Primary Care physicians were still significantly more likely to delay chart review until during or after the patient encounter than Specialty physicians (OR=2.15, p<0.01). The duration of this initial chart review session was quite variable in both groups, with the majority of respondents indicating a time frame of 2-10 minutes (64% in the Specialty group and

CHARACTERISTIC	SPECIALTY	PRIMARY CARE
<i>Gender</i>		
	<i>n (%)</i>	<i>n (%)</i>
Male	200 (57)	156 (51)
Female	150 (43)	148 (49)
<i>Baseline computer experience</i>		
Basic	22 (7)	35 (12)
Somewhat experienced	262 (78)	193 (64)
Very experienced	54 (16)	73 (24)
<i>Level of training</i>		
Resident	20 (6)	56 (19)
Fellow	42 (12)	3 (1)
Attending Physician	276 (82)	242 (80)
<i>Years in practice<sup>a</sup></i>		
1-10	108 (32)	104 (35)
11-20	98 (29)	89 (30)
21-30	66 (20)	56 (19)
31-40	51 (15)	36 (12)
>40	14 (4)	15 (5)
<i>Primary practice environment</i>		
Ambulatory	154 (52)	158 (52)
Inpatient	140 (48)	143 (48)
<sup>a</sup> Self-reported years since graduation from medical school		

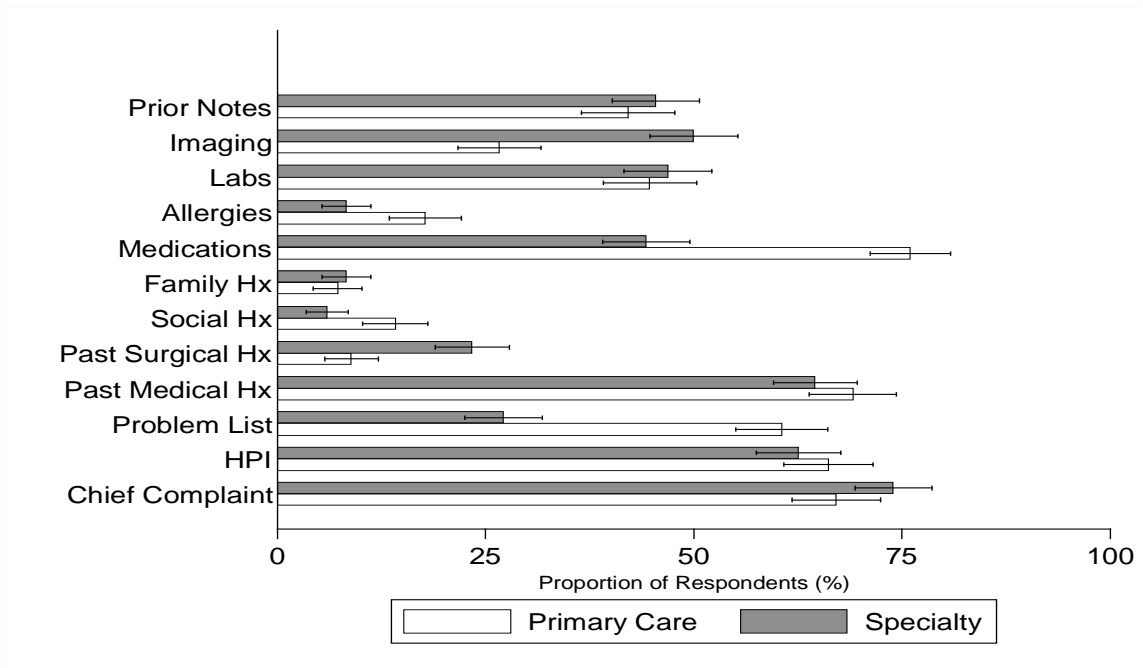
57% in Primary Care). There was no significant difference between the two groups with respect to duration of chart review ( $p=0.91$ ).

	SPECIALTY <i>n (%)</i>	PRIMARY CARE <i>n (%)</i>	P
<i>Initial source of information on a new patient</i>			
Other physician (referring provider)	53 (16)	23 (8)	0.02 <sup>a</sup>
Patient chart	167 (50)	153 (52)	
The patient	98 (30)	109 (37)	
Technician/Ancillary staff	4 (1)	4 (1)	
Other	9 (3)	7 (2)	
<i>Timing of initial chart review</i>			
Before entering patient room	296 (89)	244 (83)	<0.01 <sup>b</sup>
In room with patient or after exiting the room	36 (11)	51 (17)	
<i>Duration of initial chart review</i>			
0-2 minutes	57 (17)	63 (21)	0.91 <sup>c</sup>
>2-5 minutes	124 (37)	97 (33)	
>5-10 minutes	90 (27)	72 (24)	
>10 minutes	61 (18)	63 (21)	
<sup>a</sup> Pearson Chi <sup>2</sup> Test			
<sup>b</sup> Multivariable logistic regression adjusting for clinical experience and inpatient vs. outpatient practice setting			
<sup>c</sup> Cochran-Armitage Test for Trend			

### Relative Importance of EHR Elements (*Outcome 2*)

Participants ranked several elements of the EHR to identify the top 5 “most important” when evaluating a new patient. Specialty physicians ranked these sections as (in descending order of importance): 1: Chief Complaint, 2: Past Medical History, 3: History of Present Illness, 4: Imaging, and 5: Lab Values. Among Primary Care physicians, these sections were: 1: Medications, 2: Past Medical History, 3: Chief Complaint, 4: History of Present Illness, and 5: Problem List (**Figure 2**). Two individual elements of the EHR were perceived as significantly more important by the Primary Care group compared to the Specialty group; the first was the Problem List, ranked among the top 5 most important sections of the EHR by 61% of Primary Care physicians (95% confidence interval [CI]: 55-66%) compared to only 27% of Specialty physicians (95% CI: 23-32%). Secondly, the Medications section was ranked in the top 5 by 76% of Primary Care physicians (95% CI: 71-81%) compared to 44% of Specialty physicians (95% CI: 39-

50%). One element of the EHR was significantly more important to Specialty physicians; this was the Imaging section, ranked in the top 5 by 50% (95% CI: 45-55%) compared to only 27% of Primary Care physicians (95% CI: 22-32%). There were also small but statistically significant differences in the rankings of the Allergies, Social History, and Past Surgical History sections (**Figure 2**).



**Figure 2: Relative Importance of Various EHR Elements among Primary Care and Specialty Physicians.** Proportion of respondents ranking the indicated section among the top 5 “most important” EHR elements. Hx=history; HPI=history of present illness.

### EHR Usefulness and Usability (*Outcome 3*)

Two Likert-type scale questions assessed this parameter. The first (*Question 17*) asked respondents to rank how well information was displayed in various sections of the EHR on a scale from 1 to 5 (1 indicating the display was “Very good”, 3 indicating “Neutral”, and 5 indicating “Very bad”). Average ratings of these sections ranged from mean  $\pm$  standard deviation (SD) of  $2.04 \pm 1.08$  for “Laboratory Results” to  $2.64 \pm 1.21$  for “ICU Bedside Data” (**Table 4**). The composite score representing the overall ability of the EHR

to display relevant clinical information had a mean  $\pm$  SD of  $2.40 \pm 0.75$  (range: 1-5). Multivariable linear regression showed no difference in this composite score between the Specialty and Primary Care groups

**Table 4: Ease of Accessing Different Types of Information in the EHR**

Ranked on a Likert-type scale from 1 (very good) to 5 (very bad)

EHR ELEMENT	SPECIALTY <i>Mean <math>\pm</math> SD</i>	PRIMARY CARE <i>Mean <math>\pm</math> SD</i>
Laboratory Results	2.04 $\pm$ 1.05	2.04 $\pm$ 1.11
Imaging	2.25 $\pm$ 1.24	2.25 $\pm$ 1.18
Vital Signs	2.27 $\pm$ 1.05	1.94 $\pm$ 0.96
Medication List	2.35 $\pm$ 1.18	2.23 $\pm$ 1.16
Procedure Notes	2.37 $\pm$ 1.04	2.62 $\pm$ 1.10
Operative Reports	2.37 $\pm$ 1.04	2.70 $\pm$ 1.10
History & Physical Documentation	2.37 $\pm$ 1.34	2.80 $\pm$ 1.74
Outpatient Clinical Documentation	2.42 $\pm$ 1.14	2.24 $\pm$ 1.08
Discharge Summary	2.43 $\pm$ 1.08	2.28 $\pm$ 1.06
Problem List	2.50 $\pm$ 1.17	2.40 $\pm$ 1.27
Inpatient Progress Notes	2.51 $\pm$ 1.20	2.44 $\pm$ 1.22
ICU Bedside Data	2.65 $\pm$ 1.20	2.61 $\pm$ 1.22

SD=standard deviation  
ICU=intensive care unit

( $p=0.73$ ). However, there was a significant association with practice setting. Specifically, ambulatory physicians rated the composite score significantly worse than inpatient physicians ( $2.48$  vs.  $2.29$ , respectively;  $p<0.01$ ).

The second Likert-type scale question asked respondents to rank the severity of 6 potential barriers to accessing needed information in the EHR on a scale from 1 to 5 (1 indicating a “Not a barrier”, 3 indicating “Moderately strong barrier”, and 5 “Severe barrier”).

Average ratings of these barriers ranged from mean  $\pm$  standard deviation (SD) of  $2.86 \pm 1.27$  for “Information in the chart is inaccurate” to  $3.32 \pm 1.11$  for “Others don’t record information consistently”

**Table 5: Severity of Six Potential Barriers to Accessing Information in the EHR**

Ranked on a Likert-type scale from 1 (not a barrier) to 5 (severe barrier)

POTENTIAL BARRIER	SPECIALTY <i>Mean <math>\pm</math> SD</i>	PRIMARY CARE <i>Mean <math>\pm</math> SD</i>
“Information in the chart is inaccurate”	2.94 $\pm$ 1.29	2.76 $\pm$ 1.24
“Information I need is not in the chart”	3.11 $\pm$ 1.24	2.98 $\pm$ 1.18
“I can’t find it in the chart”	3.23 $\pm$ 1.23	2.88 $\pm$ 1.28
“Too much information”	3.27 $\pm$ 1.31	3.20 $\pm$ 1.31
“Information is poorly displayed/difficult to interpret”	3.29 $\pm$ 1.20	3.00 $\pm$ 1.25
“Other don’t record information consistently”	3.38 $\pm$ 1.09	3.26 $\pm$ 1.13

SD=standard deviation

(Table 5). The composite score of these six potential barriers had a mean  $\pm$  SD of  $3.11 \pm$

0.86 (range: 1-5). Multivariable linear regression showed a small but statistically significant difference in this composite score between the Specialty and Primary Care groups ( $p < 0.01$ ) after adjusting for gender, clinical experience, and level of training. This association was not confounded by amount of computer experience or practice setting. Using this regression model, the mean response value for the Primary Care group was 2.93 (95% CI: 2.69-3.18), whereas the mean response for the Specialty group was 3.12 (95% CI: 2.95-3.29).

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## CHAPTER FOUR: DISCUSSION

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This study assessed potential differences in EHR requirements among different clinical disciplines. Key findings were: 1) Both specialty and primary care physicians relied on the EHR as the most common initial source of clinical information; 2) The EHR was incorporated into clinical workflow in different ways by the two groups of clinical disciplines; 3) There were significant differences between primary care and specialty physicians regarding which sections of the EHR were considered most important; 4) Specialists identified stronger barriers than primary care physicians with regard to ability to access clinical information in the EHR.

The first key finding was that both specialists and primary care physicians identified the chart as the most important initial source of patient information. This emphasizes the critical role of EHRs in modern health care, and the potential impact of using systems that do not adequately meet all providers' needs. Interestingly, while the importance of the EHR was uniform between both groups, its method of use and incorporation into clinical workflow were not, as described by the second key finding. Specifically, primary care physicians were much more likely to delay initial chart review

until during or after entering the patient room. This resulted in them being more likely to utilize the patient as their initial source of information, while specialists were more likely to obtain information from other/referring providers. This is not surprising, given that most specialists receive new patients via referrals from outside providers while primary care providers are, by definition, often patients' initial point of contact with the health care system. These differences in workflow provide additional opportunities for optimization of EHRs to meet the varying needs of different disciplines.

The third key finding identified several elements of the chart that were considered important by one group but not the other. Specifically, primary care physicians showed significantly greater interest in the Problem List and Medications sections than their specialty counterparts. As one respondent stated, "I'm a surgeon...I write 2 or 3 prescriptions a month, but the patient's pharmacy is thrust before me in almost every screen." Conversely, specialty physicians considered the Imaging section much more important than primary care physicians. This sentiment was also echoed in the respondent comments; said one physician, "In image driven specialties, like neurosurgery, it is crucial to get actual outside imaging and not just reports. The difficulty in doing this often leads to unnecessary CT/MRI scans and better communication/transmission of these data would be valuable."

The fourth key finding was that specialists face slightly stronger barriers than primary care physicians in accessing needed information from the EHR. This difference was small but statistically significant, and is consistent with the complaints raised by numerous specialty societies. One respondent summarized this by saying, "I think that most of the major systems that try to serve multiple specialties are full of an unbelievable

amount of bloat. My system is specialty specific and is tailored to do exactly what I need it to do.” Said another, “The electronic medical record is very poorly organized for a pediatric ICU patient. We have to create workarounds to get the information displayed in a meaningful manner.”

These results clearly demonstrate several differences between primary care and specialty fields with respect to how the EHR is incorporated into clinical workflow, which elements of the EHR are considered most important when gathering clinical information, and physicians’ perceptions of how well these systems are able to provide such information. These differences have several important implications. The first is impaired satisfaction among physicians using systems ill-suited to their practice; one recent survey suggested that 31% of all surgical and medical specialists were “very dissatisfied” with their EHR systems, compared to only 8% of primary care providers.<sup>55</sup> In addition to physician satisfaction, inefficiencies introduced by poorly-integrated EHRs could impair clinical productivity and in turn affect patient satisfaction as well.<sup>56</sup> Another potential sequela of this situation is greater difficulty in achieving Meaningful Use criteria, with large potential impacts on reimbursement.<sup>45</sup> This is important, as it has been shown that EHR selection is heavily influenced by financial and organizational factors independent of clinical demands.<sup>57</sup> In response to this concern, several medical specialty societies have successfully advocated for the inclusion of rules, exemptions, and options in stage 2 of Meaningful Use to better suit the practices of specialists.<sup>45</sup> However, prior to this study there have been no data to guide these modifications, making their adequacy uncertain. Importantly, CMS does permit Meaningful Use exclusions for providers that do not collect core measures outside their scope of practice; however, these exclusions

must be applied for on an individual provider basis.<sup>38,58</sup> This places the burden of appropriately collecting these measures on the end user rather than the system, and does not provide a large-scale solution to the problem.

The results of this study inform several potential interventions to address these concerns. First, EHRs must be targeted to meet the unique documentation needs of individual specialties. Several such “specialty-specific” systems already exist, but further assessment of the precise information-gathering requirements of each specialty is required to optimize these systems.<sup>59</sup> Second, the method of implementation of EHRs across health care organizations must be carefully considered. The vast majority of EHR-using physicians in the United States practice in health systems employing a single EHR system incorporated across multiple clinical departments (the so-called “Enterprise” or “Single Vendor” EHR solution).<sup>60,61</sup> This has benefits for interdepartmental communication and ease of logistical processes such as billing and scheduling, but as the results of this study suggest, it may be difficult for a single EHR to meet the needs of all specialties simultaneously. Alternatively, a “Best of Breed” approach involving a network of specialty-specific systems can be employed.<sup>59</sup> However, establishing this network of multiple products from a variety of vendors is extremely challenging from logistical and interoperability perspectives, and can result in a fragmented and ineffectual hospital information system.<sup>62,63</sup> More recently, a third strategy has emerged: the so-called “Best of Suite” approach.<sup>62,64,65</sup> This strategy involves a point-by-point assessment of the relative merits of integration vs. differentiation at each node of the information system, resulting in a framework falling somewhere between the “Single Vendor” and “Best of Breed” models. This approach may provide a more balanced solution, improving

hospital efficiency<sup>66</sup> while simultaneously meeting the varying needs of different clinical disciplines as identified in this study.

This study has several limitations. First, the response rate is on the low-normal end for similar surveys of this nature.<sup>67</sup> Thus our respondent pool may not be representative of the population as a whole, and may instead be a collection of physicians with the most strongly-held beliefs on this topic. However, the wide ranges and standard deviations of responses to Likert-type scale questions indicate adequate variability of opinion among the respondents. Second, our grouping of clinical disciplines was fairly coarse due to overrepresentation of some disciplines compared to others. For example, there were many more pediatricians than surgeons in our respondent pool. However, subjectively there were minimal differences between individual specialties within groups, indicating an appropriate categorization scheme. Additionally, these differences resulted in inadequate power to identify differences between individual specialties, requiring the grouping of disciplines into “Specialty” and “Primary Care” categories. Consequently, our results provide a broad assessment of differences between clinical disciplines, but future studies are needed to identify differences between individual disciplines. Third, not all EHR systems were represented in our study. However, our sampling scheme did capture several of the most heavily used products nationwide. Finally, Likert-type scale responses were analyzed parametrically, which assumes that the intervals between ordinal categories are of equal size. For example, we assume the difference between “Not a barrier” (1 out of 5) and “Moderate barrier” (3 out of 5) is the same as that between “Moderate barrier” and “Severe barrier” (5 out of 5). However, this assumption was

supported by the fact that responses to these questions followed approximately normal distributions.

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## **CHAPTER FIVE: CONCLUSIONS**

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This study demonstrates several differences between specialty and primary care physicians in their methods of using EHRs for clinical information gathering, and in their perceptions of the most important elements of these systems. This has important implications for clinical workflow and efficiency, patient satisfaction, physician satisfaction, and appropriateness of financial reimbursement models. Future studies must continue to delineate the unique requirements of individual specialty fields to facilitate informed modification of EHR design, implementation, and governmental oversight.

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## Appendix: Selected Survey Questions (exactly as viewed by survey respondents)

### Survey Question 12:

<p><b>Where do you most often get initial information about a new patient? (Select one)</b></p>	<input type="radio"/> Other physician (e.g., referring provider) <input type="radio"/> Patient chart <input type="radio"/> The Patient <input type="radio"/> Technician or other ancillary staff <input type="radio"/> Other
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### Survey Question 13:

<p><b>When do you most often initially review the patient's medical record?</b></p> <p>* must provide value</p>	<input type="radio"/> Before entering patient room <input type="radio"/> In the room with the patient <input type="radio"/> After exiting patient room
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### Survey Question 14:

<p><b>How long is this first review of the patient's medical record?</b></p>	<input type="radio"/> 0-2 minutes <input type="radio"/> >2-5 minutes <input type="radio"/> >5-10 minutes <input type="radio"/> >10 minutes
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### Survey Question 15:

<p><b>What information is most important to you to know about a new patient? Please select the top 5.</b></p> <p>* must provide value</p>	<input type="checkbox"/> Chief complaint/reason for consultation <input type="checkbox"/> History of present illness <input type="checkbox"/> Problem list <input type="checkbox"/> Past medical history <input type="checkbox"/> Past surgical history <input type="checkbox"/> Social history <input type="checkbox"/> Family history <input type="checkbox"/> Medication list <input type="checkbox"/> Allergy list <input type="checkbox"/> Laboratory values <input type="checkbox"/> Imaging results <input type="checkbox"/> Previous clinic note assessment & plan <input type="checkbox"/> Other
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## Survey Question 17:

In the EHR that you use, please indicate how good each section of the system is at displaying the information you need (1 = very good, 3 = neutral, 5 = very bad).						
	1, Very good	2	3, Neutral	4	5, Very bad	N/A, Not a feature of my EHR
Inpatient admission note (H&P)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Outpatient clinic notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Inpatient progress notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Procedure notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Operative reports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Medication list	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Problem list	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Laboratory values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Imaging results (in the EHR)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Vital signs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
ICU bedside data (Ins/outs, ventilator, telemetry)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Discharge summary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>

## Survey Question 18:

The following are potential barriers to physicians obtaining the information they need in the EHR. Please rate the severity of these barriers in preventing you from getting the information you are looking for. (1 = not a barrier, 3 = moderate barrier, 5 = severe barrier)						
	1, Not a barrier	2	3, Moderate barrier	4	5, Severe barrier	N/A, Not a feature of my EHR
Information I need is not in the chart	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
I can't find it in the chart	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Information is poorly displayed/difficult to interpret	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Too much information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Information in the chart is inaccurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Others don't record information consistently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
						<a href="#">reset</a>