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## Electronic medical records are not associated with improved documentation in community primary care practices

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### Abstract

The adoption of electronic medical records (EMRs) in ambulatory settings has been widely recommended. It is hoped that EMRs will improve care; however, little is known about the effect of EMR use on care quality in this setting. This study compares EMR versus paper medical record documentation of basic health history and preventive service indicators in 47 community-based practices. Differences in practice level documentation rates between EMR- and non EMR-using practices were examined using the Kruskal-Wallis non-parametric test and robust regression, adjusting for practice level covariates. Frequencies of documentation of health history and preventive service indicator items were similar in the two groups of practices. While EMRs provide the capacity for more robust record keeping, the community-based practices here are not using EMRs to their full capacity. EMR usage does not guarantee more systematic record keeping and thus may not lead to improved quality in the community practice setting.

### Introduction

The adoption of electronic medical records (EMR) in ambulatory settings has been widely recommended by both the Institute of Medicine and the Future of Family Medicine project as a means to reduce errors and improve the quality of health care.<sup>1–4</sup> An EMR could potentially improve acute care and chronic disease management<sup>5</sup> by lowering rates of missing clinical information, offering better guideline-based decision support, reducing medication errors,<sup>6</sup> and improving the coordination of patient care.<sup>7</sup>

To date, the majority of EMR research demonstrating the potential benefit of this technology has been conducted in large integrated health systems.<sup>8–10</sup> The practices in these systems typically use in-house developed EMRs and have access to technical support resources and information sharing capacities essential for the effective use of this technology. Often these resources are not present in community primary care practices where most medical care in the US is delivered,<sup>11, 12</sup> making it difficult to translate the findings into patient care

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improvements in the community practice setting.<sup>13, 14</sup> In fact, one previous study of community practices demonstrated that practices with EMRs had lower rates of adherence to diabetes care guidelines than practices with paper medical records.<sup>13</sup>

With recent mandates for health care reform through expanded health information technology use and incentives to use e-prescribing tools, both as stand alone systems or as part of a full-function EMR,<sup>15</sup> community-based practices are likely to adopt EMRs in ever increasing numbers. Therefore, understanding how the use of commercially available EMRs is associated with the quality, safety, and efficiency of health care is paramount.

This paper examines how clinical documentation varies in community primary care practices using paper medical records as compared to those using EMRs. The purpose of this analysis is to understand if the use of commercially available EMRs in the community practice setting is associated with differences in documentation.

## Methods

We conducted a secondary analysis of cross-sectional data collected at baseline from a quality improvement intervention study, Using Learning Teams for Reflective Adaptation (ULTRA). Data were collected from April 2003 through November 2004. This study used a multi-method assessment process<sup>16</sup> to inform a facilitated team-building intervention<sup>17</sup> aimed at improving guideline adherence for chronic disease among 47 primary care practices located in urban, suburban, and rural New Jersey and eastern Pennsylvania. We included solo, small group, and large group practices. Many practices in our sample were independent, community practices. Some practices in our sample were owned by or affiliated with health systems, but did not receive intensive support for EMR usage and implementation. Written informed consent to participate in the study was received from the medical directors and/or lead physicians of each practice as well as from staff members prior to participation. The University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School Institutional Review Board approved this study.

## Data Collection

Participating practices generated a list of patients seen in their office during the previous twelve months for any reason, as well as separate lists for asthma, coronary artery disease, diabetes, and hypertension using ICD-9 codes. Research nurses conducted medical record reviews for 20 randomly selected patients from each of the five lists. Where a practice had fewer than 20 patients with a particular condition, the medical records of all patients with the particular diagnosis code were examined. The medical record review collected information about a patient's basic health history, preventive services received, and chronic disease management. A total of 4115 medical records were reviewed and available for analysis.

Practice managers and lead physicians also completed a practice information form used to determine practice ownership, type of medical record system, characteristics of the patient population (e.g., payer mix, race/ethnicity), number of clinicians, whether there was a change in the medical record system in the previous year, and number of years the practice had been in existence.

## Measures

Research nurses examined each medical record and noted whether the following items were documented: race, weight, height, past medical history, family medical history, alcohol use status, medication lists, problem lists, cigarette smoking status in last three visits, cholesterol screening in the previous five years, and screening for breast (women age 40 and over),

cervical (women age 18 to 70 who did not have a hysterectomy), and prostate cancer (PSA testing, men age 50 and over). Colorectal cancer screening was not included due to missing data for some practices. Practice level documentation scores were constructed by averaging the documentation status for each item across all of the eligible medical records reviewed for a specific practice.

Based on information from the lead physician or office manager, we classified practice record systems as either EMR or paper.

## Statistical Analyses

Descriptive statistics, including proportions for all categorical variables and means with standard deviations for continuous variables, were calculated to describe the practices and patients. The Kruskal-Wallis test was used to test non-parametric relationships between type of medical record and presence of basic health history and preventive service indicators. Robust regression was used to model multivariate regressions investigating associations between the type of medical record and presence of basic health history and preventive service indicators. Models were adjusted for the following practice level variables: number of clinicians, number of years in business, owner of the practice (physician or other), and whether the practice changed medical record systems in the previous year. The SAS/STAT software (SAS system for Windows, Version 9.1.3)<sup>18</sup> was used for all statistical analyses, with the ROBUSTREG procedure for linear regression and the NPAR1WAY procedure for non-parametric testing. For both types of testing we used the Bonferroni correction for multiple tests.

## Results

Of the 4115 medical records examined, slightly more than half of the patients were female (54%) and the mean age was 53.8 years. Ninety three percent of patients had two or fewer of the medical conditions assessed. Race was not recorded in the medical record for most patients in our sample (78% missing data). See Table 1.

As shown in Table 2, 13 out of 47 practices (28%) were using EMRs. Three of these practices (6%) reported changes in the medical record system in the previous year. There was an average of 4.5 physicians seeing patients in a practice and 36 practices (77%) were owned by a physician. Of the practices not owned by a physician, 10 were owned by a health system and one by a church. On average, practices had been in existence for 10.2 years under the current owner.

Table 3 shows documentation frequencies for practices using electronic and paper medical records. Overall the frequency with which basic health history items were documented was high, with the exception of race/ethnicity and height, which were dramatically lower than all other items in both EMR and non-EMR using practices. Other than cholesterol screening in the past five years, the frequency with which preventive service indicators were documented was low in both EMR and non-EMR using practices. While practices that use paper medical records had slightly higher rates of documentation for most items than practices using EMRs, non-parametric analysis showed the type of medical record was not associated with the frequency of documentation by practice. Multivariate analysis (not shown in table) adjusted for number of clinicians, number of years in business, owner of the practice (physician or other), and whether there was a change in the EMR in the previous year did show an association between type of medical record and weight, race, breast cancer screening, and prostate cancer screening documentation ( $p=.0013$ ,  $p=.0400$ ,  $p=.0012$ , and  $p=.0059$  respectively) with practices with paper medical records more likely to document these items than practices with EMRs. Additionally, there was an association between

number of clinicians in a practice on documentation of family history, alcohol, problem lists, and past medical history (all  $p < .0001$ ) with practices with more clinicians being more likely to document all items except past medical history. We examined these relationships further by stratifying by number of clinicians, but did not find a significant effect of type of medical record on the documentation of these items.

## Discussion

We found that clinical documentation of basic health history and preventive service indicators were not significantly improved in primary care practices using EMRs as compared to those using paper medical records. Multivariate analysis controlling for practice level factors did show a statistically significant difference in documentation of weight, race, breast cancer screening, and prostate cancer screening, however all differences were in the direction of better documentation in paper medical records than in EMRs. Moreover, we found that documentation frequencies in both types of medical records were remarkably similar. Both record types had high documentation of basic health history items and lower documentation of race, height and many preventive service indicators. Given what we know about regular primary care practice patterns, these findings are not surprising. Basic health history items including problem lists, past medical history, family history, and medication lists are used by clinicians in most patient care encounters and are thus likely to be well documented, while preventive services, which are addressed less frequently, are less likely to be documented.

This high degree of correlation suggests that practices are using both charting systems similarly and that clinicians are thinking about how clinical tasks are performed in EMRs the same way they did when using paper systems, suggesting that work styles developed in paper-based settings are not being altered when transitioning to computer-based record systems. It is, however, concerning because we are unlikely to make the most of the EMR's capabilities as a result. All systems have certain capabilities and limitations. For clinicians and staff to use the EMR to its fullest potential, changes will need to be made to the way work is organized and how practice members interact with the documentation system. For example, the EMR has the capability of doing more for health care than just reducing medical errors and improving documentation. It also has the potential to enable information sharing across practices in response to a particular patient's needs, to enhance care, to improve care across populations, and to identify new opportunities for care. We need to think more about how to change our work processes to achieve these goals and make the most of this new tool.

There are several possible reasons why we may not have detected improvements in documentation in practices with EMRs. First, previous studies have found that EMRs are often used in unexpected ways in primary care practices, for example practices may disable certain features for various reasons, eliminating some of the potential added utility of the EMR.<sup>19</sup> Second, while we did not collect specific information on the features of the EMRs used in our sample, most practices did not have the financial resources required to develop customized systems or spend extensive time on implementation. Thus these practices are likely to use commercially produced EMR systems that have not been shown to improve quality.<sup>10, 13</sup> Third, among those practices with paper medical records, the frequency of documentation was already quite high for many basic health history items, suggesting that use of EMRs may merely be changing the tool but not the process that is already in place for documentation.

The degree to which EMRs will improve care quality depends not just on the usefulness of the EMR system, but on how well the system is implemented into the practice.<sup>20</sup> Effective

EMR implementation requires understanding and changing workflow to optimize EMR use in patient care. While health system and hospital owned practices may have access to institutional resources to address EMR implementation, independently owned practices like those in our study do not and this may lead to suboptimal EMR implementation. Although we can hope to improve care quality in the United States by expanding EMR use through incentive programs<sup>21, 22</sup> and by pushing to integrate guidelines into EMRs; unless we help practices effectively implement this tool it is unlikely that these hopes for improved quality will be fulfilled. While many of the recently funded Regional Extension Centers (REC) may focus on fostering greater EMR adoption, there may be real opportunities for these Centers to improve health care quality by improving EMR use among practices that have already adopted and are using this tool. The focus of this effort could be on using the EMR to enhance patient care processes.

Several specific findings require a brief comment. Race was infrequently documented which we believe is a result of disagreement within the medical community about whether race/ethnicity should be routinely noted in medical records or noted only when clinically relevant.<sup>23–25</sup> We believe the low frequency of documentation for breast and cervical cancer screening is due to a preference by many women in our region for seeking this care from gynecologists, which has been reported in previous studies.<sup>26, 27</sup> The relatively high frequency of alcohol use documentation is likely a factor of how this measure was assessed, with any mention of alcohol in the chart counted. Cigarette use, in contrast, had a more stringent measure, which explains its lower frequency and suggests that the practices in this study are not treating smoking status as a vital sign to be assessed at every visit.

There are several limitations to this analysis. This analysis is cross-sectional in nature, thus we are not able to examine change over time. Further, since this was a secondary data analysis, we did not have access to all of the information we might have in a study designed solely to answer this research question. Thus, for practices that have EMRs, we do not have information on the date that an EMR was implemented, what type of specific training and support was available to the practices, which EMR systems were used, and whether the practice uses the EMR exclusively or still uses paper medical records in some situations. As noted previously, some practices in our sample were owned by health systems and may have had access to more training or resources than the typical independent, community practice. As with any observational study, there may be additional confounders that were not adjusted for in our analysis.

## Conclusion

Our analysis found that documentation of basic health history and preventive service indicators was not significantly different in practices with EMRs than practices with paper medical record systems. This may be due in part to already high documentation frequencies in paper medical records for some items. More research is needed to fully understand the factors shaping EMR use and health care quality in the community practice setting.

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**Table 1**

## Patient Characteristics

Characteristics	% or Mean N=4115
Gender	
Male	46%
Female	54%
Age	53.8 (SD 18.5)
Race	
White	17%
Black/African American	3.5%
Asian	0.5%
Other	1%
Unknown	78%
Number of medical conditions*	
0	17.6%
1	49.7%
2	25.8%
3	6.7%
4	0.2%

\* Documentation in the medical record of the following medical conditions: diabetes, asthma, heart disease, and hypertension. Maximum score is 4.



**Table 2**

## Practice characteristics

Characteristics	% or Mean N = 47
Type of medical record system	
EMR	28% (n=13)
Paper	72% (n=34)
Number of clinicians	Mean = 4.5
Owner	
Physician	77% (n=36)
Other	23% (n=11)
Number of years under current ownership	Mean = 10.2
Change in medical record system during the previous year?	
Yes	6% (n=3)
No	94% (n=44)

**Table 3**Practice Level Medians (25<sup>th</sup> and 75<sup>th</sup> percentiles) and Kruskal-Wallis Test Results for Medical Record Type

Variable	EMR Practices	Non-EMR Practices	
	Median (25, 75)	Median (25, 75)	Kruskal-Wallis p-value
<b>Basic Health Measures</b>			
Problem list	98.0 (34.5, 99.0)	98.3 (89.9, 100)	.3127
Past medical history	100 (97, 100)	98.8 (92.6, 100)	.3039
Medication list	95.0 (64.0, 99.0)	96.9 (92, 99)	.6152
Family history	93.9 (87, 98.6)	96.5 (87.4, 98.9)	.3851
Cigarette smoking status noted in past 3 visits	29.3 (12.9, 64.0)	28.8 (16.1, 63.2)	.9905
Alcohol	89.8 (66.7, 97.1)	90.3 (84, 96.6)	.7035
Race	2.0 (0, 14.9)	15.1 (4, 41.7)	.0320*
Height	40.9 (7.1, 77.1)	54.8 (19.2, 84.8)	.6591
Weight	96.9 (94.9, 98.9)	99 (96.9, 100)	.0568
<b>Preventive Health Services</b>			
Cholesterol screening in past 5 years	70.2 (64.4, 77.8)	75.1 (71.0, 82.3)	.2487
Mammography (women age 40 and over)	18.4 (3.8, 24.1)	22.7 (17.9, 26.3)	.1280
Pap smear (women 18–70, no hysterectomy)	19.5 (10.0, 29.7)	20.9 (11.8, 34.6)	.8304
PSA (men age 50 and over)	15.4 (5.3, 45.8)	42.0 (30.0, 52.4)	.0618

\* Non-significant after Bonferroni correction » .05/13=.00385