RELATIONSHIP BETWEEN ELECTRONIC HEALTH RECORD USE AND PREVENTIVE HEALTH COUNSELING: WILL MEANINGFUL USE IMPROVE COUNSELING SERVICES?

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By

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ABSTRACT

Following the enactment of the Medicare and Medicaid Electronic Health Record Incentive programs in 2009, several studies have sought to determine if there is a relationship between the use of electronic health records and the quality of care patients receive. The results of these studies have been mixed, and the most conclusive findings of positive correlation are currently found in cohort studies that are not generalizable to all U.S. physicians. This study seeks to build on previous efforts by looking at the relationship between the use of electronic health records and the provision of preventive health counseling to at risk patients using the National Ambulatory Medical Care Survey (NAMCS), a nationally representative sample of U.S. patient visits. This paper finds that patients with high blood pressure were twice as likely to receive diet and nutrition counseling during their visit when their physician had a system for electronic clinical reminders. When compared to visits with patients who did not have high blood pressure and where no clinical reminders were used, visits with patients who had high blood pressure had 42 percent higher odds of including diet and nutrition counseling when clinical reminders were present. Though there was no evidence of increased counseling among obese patients, visits with obese patients where clinical reminders were available had 18 percent higher odds of including exercise counseling than visits with non-obese patients without clinical reminders (p=0.005). In general, patients with risk factors have an increased odds of receiving preventive counseling of
17 percent when their physician utilized a system for electronic clinical reminders (p=0.002),
compared to patients with no risk factors and no clinical reminders. The gains in diet and
nutrition and exercise counseling were generally appropriate to the patient in model simulations,
suggesting efficient care.
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INTRODUCTION

“Too many doctors and hospitals are still using the same record-keeping technology as Hippocrates. Today, we are making it easier for health care providers to use new technology to improve the health care system for all of us.”

This was the statement of U. S. Secretary of Health and Human Services Kathleen Sebelius in a November 2011 press release highlighting the Obama administration’s efforts to improve the quality of health care in the United States through the adoption of health information technology. A lasting interest of U.S. policymakers for the past two decades, health care reform in the United States became a reality with the passage of the American Recovery and Reinvestment Act of 2009 (ARRA) and the subsequent passage of the Patient Protection and Affordable Care Act of 2010 (ACA).

ARRA and ACA have now converged in a flurry of policymaking activity centered on the overall goal of improving the quality and efficiency of health care. One dimension of quality targeted for improvement is preventive care. Several studies suggest that Americans do not receive preventive care and preventive counseling services at optimum rates. For example, one study by the RAND Corporation suggests that patients who opt into increasingly popular limited health benefit designs such as high deductible plans receive less preventive care than their counterparts in other types of health plans. Another study in the Archives of Family Medicine suggests that physicians may be biased to offer preventive services only to those patients who are

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already ill.\textsuperscript{3} There is also substantial anecdotal evidence to suggest that billing and coding systems pose substantial barriers to the provision of preventive care. According to the American College of Physicians, many health plans typically cover immunizations and screening tests, but do not cover preventive services like education and counseling.\textsuperscript{4}

Health care reform efforts seek to address this problem. Recent federal initiatives in support of the goal of improving the provision of preventive care services include:

- the Medicare and Medicaid Electronic Health Record (EHR) Incentive Programs;
- the Department of Health and Human Services Million Hearts Initiative; and
- ACA mandates for first dollar coverage of preventive services.

These efforts share a recognition of the need to improve U.S. health care in order to address the pressing problem of preventable chronic disease. The EHR Incentive Program in particular seeks to combat health care quality issues by incentivizing physicians, health professionals, and hospitals to adopt electronic record systems to manage their patients’ care. This paper examines the relationship between the use of electronic health record systems and the provision of appropriate health counseling services.

Many electronic health records have standard templates for data entry and include clinical decision support capabilities designed to prompt the physician to perform (or not perform) certain clinical services based on the information entered into the record. Given the automated features present in the EHR, physicians who use electronic health records are expected to


provide more appropriate health counseling services than physicians who rely solely on paper records.

JUSTIFICATION FOR ANALYSIS

As described above, ARRA created incentives for Medicare and Medicaid providers to adopt and “meaningfully use” electronic health records (EHRs) in clinical practice. Beginning in 2011, Medicare physicians who implement EHRs and attest to meeting a set of meaningful use criteria specified by the Centers for Medicare and Medicaid Services (CMS) were eligible to receive up to $44,000 in incentives over five years. Similarly, Medicaid physicians will be eligible to earn up to $63,750 over six years. In later years of the program, Medicare physicians who fail to adopt EHRs will be penalized with incremental cuts in their Medicare payments.\(^5\)

Congress sought to incentivize EHR adoption because of the potential for the technology to improve the quality of care. Public health goals such as reducing the incidence of preventable chronic disease are at the forefront of the meaningful use program. For example, current meaningful use objectives require physicians to record patient vital signs and report to immunization registries, and several of the meaningful use quality measures address preventive counseling related to weight and tobacco usage.\(^6\) EHRs have the potential to improve care in these areas by closing gaps in communication between health professionals, promoting patient education, and through built-in decision support modules. At the same time, health system reformers are examining the potential for EHRs to promote more appropriate care.


\(^6\) 42 CFR §495, 2010.
Currently the association of EHRs with patient education is unknown. In particular, several empirical questions remain unanswered:

- Is the faith in EHRs to improve quality through improved patient education well placed?
- Do EHRs improve efficiency of care, or do EHR adopters simply provide more services?
- Given the behavior observed of EHR adopters and non-adopters, are federal meaningful use requirements appropriately targeted to improve care?

This paper seeks to explore these issues using data from a nationally representative survey of U.S. physicians.

**REVIEW OF THE LITERATURE**

The literature suggests that the association between EHR use and better quality care is still undetermined, however several studies indicate that there may be a positive association between EHR adoption and preventive counseling services. Much of the research that does show a positive association between EHR adoption and clinical improvement in areas such as patient education is limited because it occurred in settings that are not nationally representative.


In “Electronic Health Records and Clinical Decision Support Systems: Impact on National Ambulatory Care,” Ramono and Stafford utilized data from the 2005-2007 NAMCS and the related National Hospital Ambulatory Medical Care Survey (NHAMCS) to assess whether use of an electronic health record with clinical decision support (CDS) capabilities impacted the quality of care a patient received. The authors looked at 20 clinical guideline indicators to assess quality of care:
• Antithrombotic therapy for atrial fibrillation;
• Angiotensin-converting enzyme inhibitor use for congestive heart failure;
• Aspirin use for coronary artery disease;
• Beta blocker use for coronary artery disease;
• Statin use for hyperlipidemia;
• Inhaled corticosteroid use for asthma in adults;
• Inhaled corticosteroid use for asthma in children;
• Treatment of depression;
• No benzodiazepine use alone for depression;
• Trimethoprim-sulfamethoxazole use for urinary tract infection;
• No antibiotic use for upper respiratory tract infection;
• Smoking cessation advice among smokers;
• Diet advice in high-risk adults;
• Exercise advice in high risk adults;
• Diet advice in adolescents;
• Exercise advice in adolescents;
• Blood pressure measurement;
• No routine electrocardiography in low-risk patients;
• No routine urinalysis in low-risk patients; and
• Avoiding prescribing inappropriate medications in elderly patients.
The authors hypothesized that CDS would be associated with higher quality outpatient care when compared with EHR use without CDS. They first looked at the effect of EHR use on quality and found a statistically significant positive association for only one quality indicator, diet counseling in high risk adults (28 percent vs. 20 percent; adjusted odds ratio 1.65; p=0.002). A second model examined CDS use and found that CDS use was positively associated with only one indicator, avoidance of unnecessary electrocardiography during routine examinations (98 percent vs. 93 percent; adjusted odds ratio 2.88; p=0.001). CDS use was not associated with better performance on any of the 19 other quality indicators.

The authors’ findings suggest that the effect of EHR use on quality remains inconsistent. The authors did find a statistically significant relationship between EHR use and diet counseling services in high risk adults, which suggest that there may be promise in this area. However, there was no significant relationship between diet counseling and clinical decision support. This could suggest that other features in the EHR are more important to improved quality in this area. It is also possible that the clinical decision support modules in use by the physicians surveyed did not address appropriate diet counseling services.

**Electronic Health Record Use and the Quality of Ambulatory Care in the United States, 2007**

Romano et al’s analysis built on the earlier work of Linder et al, which examined the impact of EHR adoption on a set of 17 quality indicators. Linder et al used data from the 2003 and 2004 NAMCS. The earlier NAMCS survey collected information on electronic health record use but

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8 Romano et al. 900.
9 Romano et.al, 902.
was limited in that it did not collect data on specific features of the EHR, such as clinical decision support capabilities. Linder et al’s analysis also differed in that their models examined all visits and then only those visits to physicians practicing in a primary care or cardiovascular specialty. The second model included visits to specialists in family medicine, general medicine, internal medicine, pediatrics, and cardiovascular diseases.\(^{10}\)

Linder et al.’s initial analysis for all specialties found that physicians who used EHRs had better performance on two quality indicators: avoiding prescribing benzodiazepines to patients with depression (91 percent vs. 84 percent, \(p=0.01\)) and avoiding routine urinalyses at routine general medical visits (94 percent vs. 97 percent, \(p=0.003\)). When specialty was limited to primary care, the authors found that EHR use was associated with better performance on the smoking cessation counseling indicator (39 percent vs. 25 percent, \(p=0.03\)).\(^ {11}\)

The results of this study also show an inconsistent association between EHRs and improved quality of care. Linder et al found significant differences in smoking cessation counseling among primary care visits, but saw no similar link between EHR use and diet or exercise counseling. As indicated above, Linder et al’s study was more limited in that EHR features were not explicitly defined in the data.

**Electronic Health Record Components and the Quality of Care, 2008**

“Electronic Health Record Components and the Quality of Care,” followed Linder et al’s paper with an analysis of the association between specific EHR components and two quality indicators: blood pressure control and receipt of appropriate therapy for chronic conditions.

\(^{10}\) Jeffrey A. Linder, MD, MPH; Jun Ma, MD, RD, PhD; David W. Bates, MD, MSc; Blackford Middleton, MD, MPH, MSc; and Randall S. Stafford, MD, PhD, “Electronic Health Record Use and the Quality of Ambulatory Care in the United States,” *Archives of Internal Medicine* 167(13) 2007: 1401.

\(^{11}\) Linder et al, 1402.
Keyhani et al. utilized newly included EHR feature data from the 2005 NAMCS and the 2005 NHAMCS to construct models examining the association between specific EHR components and a complete EHR on their quality indicators. Specifically, they examined six components:

- Physician notes;
- Nursing notes;
- Test results;
- Electronic reminder system (clinical decision support);
- Computerized prescription order entry (CPOE); and
- Computerized test order entry.\(^{12}\)

Complete EHRs were defined by patient visits where all six components were present and turned on. Only about 7 percent of visits utilized a complete EHR.\(^{13}\) The authors looked only at visits with a primary care provider for existing patients 18 years of age and older.

The authors defined blood pressure control as systolic blood pressure less than or equal to 140 and diastolic blood pressure less than or equal to 90. There was no clear relationship between EHR components and blood pressure control in the total sample. However, the authors did find an association between electronic reminders and blood pressure control in the Medicare population (54 percent, odds ratio = 1.54, p<0.004).\(^{14}\) The authors did not find any strong associations between EHR components and measures for management of chronic conditions (i.e., ischemic heart disease, cerebrovascular disease, diabetes and hypertension, and asthma).

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\(^{12}\) Salomeh Keyhani, MD; Paul L. Hebert, PhD, Joseph S. Ross, MD, MHS; Alex Federman, MD, MPH; Carolyn W. Zhu, PhD; and Albert L. Siu, MD, MSPH, “Electronic Health Record Components and the Quality of Care,” *Medical Care* 46(12) 2008: 1267-8.

\(^{13}\) Keyhani et al, 1269.

\(^{14}\) Keyhani et al, 1270.
Overall, the study is significant for its examination of the separate components of an EHR and their respective associations with quality of care.

**Electronic Health Records, Clinical Decision Support, and Blood Pressure Control, 2011**

Like Keyhani et al, Samal et al also found some positive relationship between electronic health records and blood pressure control in their study, “Electronic Health Records, Clinical Decision Support, and Blood Pressure Control.” Samal et al. used the 2007 and 2008 NAMCS to estimate the association between EHR use combined with electronic clinical decision support capabilities and blood pressure control. Their analysis was also limited to adult visits to primary care physicians. Primary care physicians were defined as those with a specialty in family practice, general practice, internal medicine, pediatrics, obstetrics, gynecology, adolescent medicine, sports medicine, geriatric medicine, or maternal/fetal medicine.

Samal et al found that the rate of blood pressure control was 5 percent higher in visits where physicians used both an EHR and CDS compared to visits where neither was used (p=0.004).\(^\text{15}\) By contrast, there was no significant association between EHR use alone and blood pressure control. Among patients with hypertension, the rate of blood pressure control was significantly higher when both an EHR and CDS were used (63 percent vs. 56 percent, p=0.01).\(^\text{16}\) The analysis builds on Keyhani et al’s finding that electronic reminders improved care in the Medicare population and demonstrates that in the case of blood pressure control, the specific functions and features of the EHR system can make a difference in quality of care. Their

\(^{15}\) Lipka Samal, MD, MPH; Jeffrey A Linder, MD, MPH; Stuart R. Lipsitz, ScD; and LeRoi S. Hicks, MD, MPH, “Electronic Health Records, Clinical Decision Support, and Blood Pressure Control,” *American Journal of Managed Care* 17(9) 2011:628.

\(^{16}\) Samal et al., 629.
findings also stand out as one of few positive clinical findings to be derived from nationally representative data, versus a cohort study of EHR implementation.

**Use of an Electronic Clinical Reminder for Brief Alcohol Counseling is Associated with Resolution of Unhealthy Alcohol Use at Follow-Up Screening, 2009**

Several cohort studies have examined the use of specific electronic clinical reminders and their effect on patient care over time. Williams et al examined implementation of a reminder to provide alcohol counseling services in eight veterans’ health clinics where providers routinely used clinical reminders. Given the study setting, it is not generalizable to a broader population. Of particular note, the authors cite that electronic clinical reminders used by the Veterans Affairs Health Care System are often linked to performance measures and financial incentives. The authors’ findings were positive, but it is unclear if physicians outside of the Veterans Health Care System would respond to the reminders in the same way.

The authors examined patients who screened positive for unhealthy alcohol use and had a documented return visit within one to 36 months after screening. Thirty-one percent of patients whose physician implemented the electronic reminder resolved their unhealthy alcohol use by their follow-up visit compared to 28 percent of patients whose physician did not use the clinical reminder (OR=1.18, p=0.031). The authors also found that there were no significant differences in severity of unhealthy alcohol use among patients with and without reminder use. Their findings suggest that reminder use may counteract the tendency of providers to primarily counsel patients with more severe indications. This is promising, because it could mean that

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17 Emily C. Williams, PHD, MPH; Gwen Lapham, MPH, MSW; Carol E. Achtmeyer, MN; Bryan Volpp, MD; Daniel R. Kiviahon, PhD; and Katharine A. Bradley, MD, MPH, “Use of an Electronic Clinical Reminder for Brief Alcohol Counseling is Associated with Resolution of Unhealth Alcohol Use at Follow-Up Screening,” *Journal of General Internal Medicine* 25(Suppl 1) 2009: 513.
electronic reminders help ensure patients receive counseling before problems progress to a severe level.

**Presentation of body mass index within an electronic health record to improve weight assessment and counseling in children and adolescents, 2010**

A retrospective study by Shaikh et al investigated appropriate evaluation of body mass index (BMI) in children and adolescents. The authors reviewed charts for a comparatively small sample of 550 children between ages two and 18 who visited a single primary care pediatric clinic. Charts were reviewed both before and after the clinic implemented an electronic health record system with automatic BMI calculation in November 2006.

The authors found no significant difference in documentation of BMI. Though the finding was not significant, documentation of BMI in the patient chart actually declined post-EHR implementation. By contrast, the authors’ preliminary analysis found several positive changes associated with EHR implementation. Documentation of assessment of high calorie food intake increased with EHR adoption from 8 percent to 13 percent (p=0.048). Counseling with respect to high calorie food intake also increased from 3 percent to 24 percent after EHR adoption (p<0.001). Other nutrition behaviors were similar both before and after the EHR was implemented. Counseling on physician activity also increased from 9 percent before adoption to 32 percent after adoption (p<0.001). Other types of counseling (e.g. television screen time, high risk family history) showed no significant difference before and after the EHR was implemented.

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18 Ulfat Shaikh, MD, MPH, MS, FAAP; Rachel Nelson, MD; Daniel Tancredi PhD; and Robert S. Byrd, MD MPH, “Presentation of body mass index within an electronic health record to improve weight assessment and counseling in children and adolescents.” *Informatics in Primary Care* 18(2011):238.
The positive outcomes described above did not hold up under multivariate analysis. EHR adoption did not appear to be associated with improved documentation or counseling services related to BMI, however, the post-implementation measurement was taken just two months after physicians first began using the EHR. Further physician direction on EHR features may have been necessary to realize the full potential of the system.

**Electronic Health Records and Quality of Diabetes Care, 2011**

In a randomized study, Cebul et al documented differences in the quality of diabetes care among electronic and paper-based practices. They found conclusively in favor of practices with electronic records. Electronic practices showed achievement on composite standards for diabetes care: 35.1 percentage points higher than paper-based sights (p<0.001). Achievement of outcomes was 15.2 percentage points higher and EHR sites (p=0.005). The study was limited to the Better Health Greater Cleveland practice group in northeastern Ohio. The group engages in a number of quality improvement activities, which may have contributed to physicians being more receptive to the EHR based changes.

**DATA SOURCE**

This paper builds on the literature summarized above by examining the association between EHR use and preventive counseling exclusively using a nationally representative sample. The dataset used is the 2006-2008 NAMCS, a cross-sectional dataset of patient visits with their physician. The dataset, survey forms, and documentation are publically available for download on the Centers for Disease Control and Prevention website.

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19 Randall D. Cebul, MD; Thomas E. Love, PhD; Anil K. Jain, MD; and Chirsopher J. Hebert, MD, “Electronic Health Records and Quality of Diabetes Care” New England Journal of Medicine 365(9) 2011: 825.
The NAMCS data is comprised of stratified samples of practicing physicians in 15 specialty categories across 112 geographic survey areas. Selected physicians are assigned one week to report on a systematic random sample of their patient office visits. The NAMCS also includes a supplemental survey to assess physician use and adoption of electronic health records (EHRs). NAMCS essentially captures patient chart data, such as diagnoses and procedures performed. Each visit is weighted to produce nationally representative estimates.

The United States Preventive Services Task Force (USPSTF) is an independent panel of clinicians and preventive health experts charged with making recommendations with respect to preventive care. Their role was elevated with the passage of ACA, which mandated first dollar coverage for services graded either an A or B for importance by the USPSTF. Several counseling services are included in the A and B list, including diet counseling, obesity counseling, and tobacco use cessation counseling (See Table 1).

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### Table 1 – Selected United States Preventive Services Task Force Recommendations: Health Counseling

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Grade</th>
<th>Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy diet counseling</td>
<td>The USPSTF recommends intensive behavioral dietary counseling for adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease. Intensive counseling can be delivered by primary care clinicians or by referral to other specialists, such as nutritionists or dietitians.</td>
<td>B</td>
<td>January 2003</td>
</tr>
<tr>
<td>Obesity screening and counseling: adults</td>
<td>The USPSTF recommends that clinicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss for obese adults.</td>
<td>B</td>
<td>December 2003</td>
</tr>
<tr>
<td>Tobacco use counseling and interventions: non-pregnant adults</td>
<td>The USPSTF recommends that clinicians ask all adults about tobacco use and provide tobacco cessation interventions for those who use tobacco products.</td>
<td>A</td>
<td>April 2009</td>
</tr>
</tbody>
</table>

NAMCS captures several explicit health counseling services, including those on the USPSTF list, by direct questions to the physician. These services are included in the analysis due to their policy importance, and they also represent guidelines that have been used in similar research with the NAMCS dataset. Asthma counseling is included as an additional counseling variable because it is captured as part of the counseling portion of the NAMCS survey.

NAMCS asks physicians if they utilized electronic records other than billing records during the patient visit. It also queries physicians on their use of specific electronic functions such as electronic notes, CPOE, and clinical decision support. The electronic records variable in this analysis is constructed as a binary variable and captures physicians who use a combination of basic EHR features. Patient visits with an EHR are those visits where the physician indicates the

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presence of a system to enter patient demographics, record electronic clinical notes, enter
electronic prescription orders, view lab test results, and view image results.

**DESCRIPTIVE STATISTICS**

As expected, preventive counseling services were provided at very low rates nationally. Of
72,915 patient visits in the sample, only 12,759 included any preventive counseling. When
weights are applied, the data suggest that preventive counseling is only provided in 17.5 percent
of patient visits nationally. Asthma counseling is provided least frequently (less than 1 percent
of visits), followed by smoking cessation counseling (2.54 percent of visits). Diet and nutrition
counseling is provided most frequently, at 11.17 percent of patient visits.

Table 2: Descriptive Statistics for Key Variables* (n=72,915)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of EHR</td>
<td>16.85%</td>
<td>0.37</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Use of Clinical Reminder</td>
<td>24.96%</td>
<td>0.43</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Any Counseling</td>
<td>17.50%</td>
<td>0.38</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Asthma Counseling</td>
<td>0.63%</td>
<td>0.08</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Smoking Cessation</td>
<td>2.54%</td>
<td>0.16</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Counseling</td>
<td>11.17%</td>
<td>0.32</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Exercise/Weight</td>
<td>10.92%</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Reduction Counseling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Age</td>
<td>54</td>
<td>18.67</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>61.46%</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Patient Risk Factors</td>
<td>55.24%</td>
<td>0.50</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Asthmatics</td>
<td>5.19%</td>
<td>0.22</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Smokers</td>
<td>10.88%</td>
<td>0.31</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>15.27%</td>
<td>0.36</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>High Cholesterol</td>
<td>16.98%</td>
<td>0.38</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Obese BMI</td>
<td>33.76%</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Other controls will also be considered, but these represent the key variables in the analysis.
*The means presented in this table are weighted by patient visit weights.

By contrast, physicians report patient risk factors at much higher rates. Of the patient visits
sampled, over half (40,281) were with patients who had one of five risk factors (asthma,
smoking, obese BMI, high blood pressure, or high cholesterol). When weights are applied, visits with at risk patients represent over half of patient visits nationally. Adult obese patients were seen in 33.76 percent of patient visits, and 16.98 percent of visits are with patients who have high cholesterol. Of the 40,281 visits with at risk patients, 17,596 visits were with patients who had multiple risk factors.

Though electronic health record usage is becoming increasingly common, it is not surprising that EHRs are used in few patient visits. The weighted estimate of EHR usage defined as a combination of basic electronic features is 16.85 percent of visits, nationally. Electronic clinical reminders used alone or in combination with other EHR features are more common. About one quarter of patient visits used electronic clinical reminders.

**HYPOTHESIS**

Based on the preliminary data, I expect to find that EHR use is associated with improvements in health counseling services. There is the possibility that EHR use will improve preventive counseling rates simply because EHRs prompt collection of specific patient data and include features such as clinical reminders. However, it would be more desirable if EHR use improved preventive counseling service rates in the population most in need of targeted prevention. I expect to find that the improvements are appropriately and efficiently targeted to patients with relevant risk factors. “Appropriate” or “efficient” preventive health counseling services will be defined according to USPSTF guidelines. If counseling rates improve more for at risk individuals, this suggests that the improvement is appropriate and efficient.

The bivariate analysis shows that smoking cessation, diet, and exercise/weight reduction counseling are all provided at slightly higher rates when physicians use an EHR during the visit,
and these results are statistically significant. The diet and exercise counseling results are most encouraging. On average, diet and nutrition counseling is provided in 13.67 percent of visits where an EHR is used, compared to 10.67 percent of visits without an EHR (p<0.001).

Similarly, exercise counseling is provided at 12.73 percent of visits where an EHR is used, compared to 10.67 percent of visits without an EHR (p<0.001).

| Table 3: Relationship Between EHR Use and Health Counseling – Bivariate Analysis (n=72,915) |
|---------------------------------|------------|------------|
|                                  | EHR        | No EHR     |
| Asthma Counseling                |            |            |
| All                             | 0.64%      | 0.59%      |
| Asthmatics                      | 7.39%      | 9.33%      |
| Smoking Cessation Counseling    |            |            |
| All                             | 3.03%*     | 2.45%      |
| Smokers                         | 21.88%*    | 19.00%     |
| Diet Counseling                 |            |            |
| All                             | 13.67%***  | 10.67%     |
| High Blood Pressure             | 13.28%***  | 7.35%      |
| High Cholesterol                | 26.92%*    | 23.93%     |
| Exercise/Weight Reduction       |            |            |
| Counseling                      |            |            |
| All                             | 12.73%***  | 10.55%     |
| Obese Adults                    | 18.37%***  | 14.23%     |

All data are weighted by patient visit weights. *p<0.1, **p<0.01; ***p<0.001

When patient risk factors are considered in the analysis, the results become more pronounced. Visits with patients who have high blood pressure are significantly more likely to include diet counseling services when an EHR is used (13.28 percent vs. 7.35 percent). Visits with patients with high cholesterol are also significantly more likely to include diet counseling when the physician uses an EHR (26.92 percent vs. 23.93 percent). Similarly, visits with obese patients are more likely to include exercise or weight reduction counseling when an EHR is used (18.37 percent vs. 14.23 percent). These preliminary findings suggest that the difference in preventive counseling services between physicians who use an EHR and those who do not is efficient. EHR users are likely providing more appropriate counseling to at risk individuals.
METHODOLOGY

Logistic regressions controlling for patient and physician characteristics were used to assess the relationship between EHR use and preventive counseling during patient visits. The first models looked at the effect of the presence of some form of electronic record system during the visit and controlled for both patient and physician characteristics. This included electronic systems that had only the most basic features, such as allowing for the electronic entry of physician notes. These models, not shown, did not produce statistically significant results.

In the absence of a relationship between the presences of an EHR and preventive counseling, it was determined necessary to look at specific features of the EHR that could prompt the physician to provide counseling services. As previously discussed, the NAMCS collects data on the specific electronic record features present during the visit. These features include:

- Recording patient demographics,
- Recording clinical notes,
- Computerized prescription orders,
- Viewing laboratory results,
- Viewing imaging results,
- Computerized test orders,
- Electronic prescribing,
- Electronic transmission of test orders,
- Highlighting out of range test levels,
- Automated warnings of drug interactions, and
- Automated clinical reminders.
The feature to provide automated clinical reminders was determined to be the most relevant to the analysis because electronic reminders within EHR systems are designed to prompt the physician to perform certain clinical tasks when patient data entered into the system shows particular risk factors or clinical conditions.

A second set of regressions examining the effect of clinical reminders were run using the logistic regression procedure in STATA 11.0. A third set of regressions examined the interaction of clinical reminders with patient risk factors to attempt to assess whether or not clinical reminders resulted in gains in appropriate care. These regressions form the core of the analysis.

As discussed above, the risk factors were selected per USPSTF guidelines. Asthmatics were defined as all adult patients with a diagnosis of asthma indicated on the patient record form. Tobacco users included all adult patients who reported that they currently use tobacco (i.e., patients who used tobacco in the past were not included). Patients with high blood pressure were defined as all patients with systolic blood pressure above 140 and diastolic blood pressure greater than 90; this definition has been used in prior analyses with the NAMCS, such as Keyhani et al.\(^22\) Patients with high cholesterol were coded with a diagnosis of hyperlipidemia in the dataset. Finally, obese patients were defined according to the medical definition of adult obesity, a BMI greater than or equal to 30.

All models controlled for patient and physician characteristics. Patient characteristics included age, gender, risk status, race and ethnicity, whether or not the visit was with the patient’s primary care provider, whether the patient was a new or established patient, the

\(^{22}\) Keyhani et al, 1268.
expected form of payment for the visit, and whether or not the reason for the visit was to receive preventive care. Patient risk factors considered included asthma, tobacco use, high blood pressure, high cholesterol, and obesity. Physician characteristics included the specialty of the physician, whether or not the physician was in solo practice, if the practice was owned by physicians or another entity (e.g., a health maintenance organization), the employment status of the physician, whether or not productivity factored onto the physician’s compensation, the percent of practice revenue based on performance-based payment, and the percent of practice revenue based on capitated payments. Physician specialty was coded as a binary variable with general and family practice, internal medicine, pediatrics, and cardiovascular diseases as the specialty category of interest and all other specialties as the reference.

**Results**

Initial regressions (not shown) looking at EHR use alone did not demonstrate a significant impact on the likelihood that the physician provided preventive counseling during the patient visit. However, physicians whose EHR systems included electronic clinical reminder functionality were more likely than other physicians to provide preventive counseling in the first set of models. On average, patient visits where the physician had an electronic reminder function in the EHR were 10 percent more likely to include some form of preventive counseling (p<0.001), controlling for patient risk factors. Clinical reminders were also associated with the provision preventive counseling services for diet and nutrition, exercise, and weight reduction. The results are summarized in Table 4.
Table 4: Summary of Initial Logistic Regression Results: Model of the Effect of Electronic Clinical Reminders on Preventive Counseling (n=72,915)

<table>
<thead>
<tr>
<th>Preventive Counseling Service</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Service</td>
<td>1.10***</td>
</tr>
<tr>
<td>Asthma Education</td>
<td>1.04</td>
</tr>
<tr>
<td>Tobacco Cessation Education</td>
<td>1.06</td>
</tr>
<tr>
<td>Diet and Nutrition Education</td>
<td>1.21***</td>
</tr>
<tr>
<td>Exercise or Weight Reduction Education</td>
<td>1.13***</td>
</tr>
</tbody>
</table>

All data are weighted by patient visit weights. Odds ratios are statistically significant in being different from 1.00 at the following levels: *p<0.1, **p<0.01; ***p<0.001

The next interacted models sought to determine whether or not the gains achieved in preventive counseling with the use of electronic clinical reminders resulted in more appropriate care for at risk patients who might benefit the most from targeted preventive counseling. The results of the interacted models are presented in Table 5, below.
Table 5: Logistic Regression Results: Odds Ratios for Interacted Model of the Effect of Electronic Clinical Reminders on Preventive Counseling (n=72,915).

<table>
<thead>
<tr>
<th></th>
<th>Any Education</th>
<th>Asthma Education</th>
<th>Tobacco Cessation Education</th>
<th>Diet and Nutrition (High BP)</th>
<th>Diet and Nutrition (High Cholesterol)</th>
<th>Exercise/Weight Reduction Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Clinical Reminders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(No)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.97</td>
<td>0.84</td>
<td>0.97</td>
<td>1.17***</td>
<td>1.16***</td>
<td>1.06</td>
</tr>
<tr>
<td>Patient Risk Factors</td>
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<tr>
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</tr>
<tr>
<td>Yes</td>
<td>2.35***</td>
<td>65.06***</td>
<td>38.72***</td>
<td>0.69***</td>
<td>2.66***</td>
<td>1.84***</td>
</tr>
<tr>
<td>Interaction</td>
<td>1.17**</td>
<td>1.25</td>
<td>1.16</td>
<td>1.42***</td>
<td>1.01</td>
<td>1.18**</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>1.00***</td>
<td>.99***</td>
<td>1.00</td>
<td>1.00**</td>
<td>1.00***</td>
<td>.1.00</td>
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<tr>
<td>Female</td>
<td>1.04*</td>
<td>1.13</td>
<td>0.99</td>
<td>1.02</td>
<td>1.08***</td>
<td>1.02</td>
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<td>Race and Ethnicity</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White, Non-Hispanic</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Black, Non-Hispanic</td>
<td>1.23***</td>
<td>1.69***</td>
<td>0.97</td>
<td>1.46***</td>
<td>1.50***</td>
<td>1.14**</td>
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<tr>
<td>Other, Non-Hispanic</td>
<td>1.10*</td>
<td>1.21</td>
<td>0.91</td>
<td>1.17**</td>
<td>1.19**</td>
<td>1.10*</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.20***</td>
<td>1.37*</td>
<td>0.94</td>
<td>1.45***</td>
<td>1.48***</td>
<td>1.28***</td>
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<tr>
<td>New or Established Patient</td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>(New patient)</td>
<td>1.00</td>
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<tr>
<td>Established patient</td>
<td>1.15***</td>
<td>0.98</td>
<td>0.98</td>
<td>1.20***</td>
<td>1.16***</td>
<td>1.18***</td>
</tr>
<tr>
<td>Expected Source of Payment</td>
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<td></td>
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<td></td>
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<tr>
<td>(Private Insurance)</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>0.83***</td>
<td>1.28*</td>
<td>0.87*</td>
<td>0.82***</td>
<td>0.82***</td>
<td>0.78***</td>
</tr>
<tr>
<td>Medicaid</td>
<td>1.07*</td>
<td>0.89</td>
<td>1.24**</td>
<td>1.01</td>
<td>1.04</td>
<td>0.95</td>
</tr>
<tr>
<td>Other</td>
<td>1.01</td>
<td>1.09</td>
<td>0.96</td>
<td>0.97</td>
<td>1.01</td>
<td>0.98</td>
</tr>
<tr>
<td>Major Reason for Visit</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>(Other)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Preventive Care</td>
<td>1.38***</td>
<td>0.92</td>
<td>1.26**</td>
<td>1.64***</td>
<td>1.68***</td>
<td>1.37***</td>
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<td>Physician Specialty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Other)</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
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<tr>
<td>General Practice or Cardiology</td>
<td>2.55***</td>
<td>3.09***</td>
<td>2.31***</td>
<td>3.45***</td>
<td>2.91***</td>
<td>2.63***</td>
</tr>
<tr>
<td>Physician is in Solo Practice</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.20***</td>
<td>1.19</td>
<td>1.13*</td>
<td>1.31***</td>
<td>1.32***</td>
<td>1.22***</td>
</tr>
<tr>
<td>Practice is Physician-Owned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Other ownership model)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Physician Owned</td>
<td>1.05</td>
<td>0.59**</td>
<td>0.88</td>
<td>1.07</td>
<td>1.05</td>
<td>1.10*</td>
</tr>
<tr>
<td>Employment Status of the Physician</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Overall, the availability of electronic reminders during the visit was not the best predictor of whether or not the patient received preventive counseling. Overwhelmingly, the specialty of the physician was a key determinant in receiving preventive counseling. When all types of counseling are considered, patient visits with physicians who specialized in general or family practice, internal medicine, pediatrics, and cardiovascular diseases had odds of receiving a preventive counseling service (p<0.001) that were twice as large when compared to visits under all other specialties. This finding held up under all five counseling-specific models.

In the aggregate education model, black non-Hispanic ethnicity, Hispanic ethnicity, being an established patient, preventive care as the major reason for the visit, physicians in solo practice, productivity as a factor in physician compensation, the percentage of revenue based on performance payments, and the percentage of revenue based on capitation were all associated with statistically significant gains in preventive counseling. However, these trends were not
consistent across all types of counseling. Medicare patients were significantly less likely than patients with private insurance to receive preventive counseling in all models but the asthma model.

In general, patients with risk factors were slightly more likely than average to receive preventive counseling when they saw a physician who used clinical reminders, compared to patients with no risk factors whose physician did not use clinical reminders (OR = 1.17, p=0.002). This suggests that in some cases, clinical reminders lead to gains in appropriate care. However, clinical reminders did not lead to any significant gains in asthma counseling or tobacco cessation counseling. When appropriateness was considered, the effect of clinical reminders on diet and nutrition counseling for patients with high cholesterol was no longer significant.

The most noteworthy findings of the analysis related to diet and nutrition counseling for patients with high blood pressure and exercise/weight reduction counseling for obese patients. Visits with obese patients where clinical reminders were available had 18 percent higher odds of including exercise counseling than visits with non-obese patients without clinical reminders (p=0.005). Visits with patients who had high blood pressure where electronic clinical reminders were available had 42 percent higher odds of including diet and nutrition counseling than visits with patients who did not have high blood pressure without clinical reminders (p<0.001). The findings are especially noteworthy when only patients with high blood pressure are considered. Patients with high blood pressure are more than twice as likely to receive diet and nutrition counseling when clinical reminders are available during the visit (OR=2.06).
DISCUSSION

Though the data show a substantial significant relationship between electronic clinical reminders and certain types of preventive counseling, overall the analysis is consistent with previous studies that show that the impact of EHRs on clinical care is mixed. While the findings for diet and nutrition counseling and weight reduction counseling appear encouraging from a policy standpoint, more widespread adoption of electronic clinical reminders will result in only modest gains in preventive health counseling. On average, the expected gains are between three and five percentage points, depending on the type of counseling. While modest, the greatest gains are for patients who possess the risk factors in question. This supports the hypothesis that clinical reminders are associated with appropriate care. These findings are displayed in Table 6, below.

<table>
<thead>
<tr>
<th>Type of Education</th>
<th>Percentage Point Gains for patients with Risk Factors</th>
<th>Percentage Point Gains for patients without risk factors</th>
<th>Total Percentage Point Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any education</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Diet and Nutrition Education (for high blood pressure)</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Exercise/Weight Reduction Education (for obesity)</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

There is some concern that use of electronic clinical reminders may be endogenous to providing health counseling services in the model. It is possible, for example, that both health counseling and electronic clinical reminder use are correlated with simply being a good physician. Use of an instrumental variable in future work would overcome this limitation, however this analysis did not identify a suitable instrument.
The study utilizes patient visit data and therefore is limited in the conclusions that it can draw. The patient visit data yields only a snapshot of the patient care, and does not allow for following patients over time to see if they improved. As a result, the study only measures the process of providing a counseling service. It does not seek to draw conclusions about whether or not the quality of care the patient received improved as a result of the electronic clinical reminder. This limitation may contribute to the study’s findings on diet and nutrition counseling for patients with high cholesterol. While blood pressure can be measured and interpreted during the course of the visit, cholesterol screening requires the physician to draw blood to be sent for analysis. The results of cholesterol screening are generally not available until after the patient leaves the office, and therefore counseling cannot be provided during the same visit.

This analysis relies on data collected from 2006-2008, which creates a major limitation of the study. The Medicare and Medicaid incentives authorized by the *American Recovery and Reinvestment Act (ARRA)* first became available to physicians in 2011. These incentives are expected to be a major driver for physician adoption of electronic health records, particularly among smaller practices. Furthermore, physicians must possess an electronic health record that includes a minimum set of requirements to participate in the program. For the first phase of the incentive program, called Stage 1, physicians must implement at least one clinical reminder in order to qualify for the incentive payment. When finalized, the recently released proposed rule for the second phase (Stage 2), will require physicians to implement five clinical reminders that
relate to measures of clinical quality of care in order to continue to qualify for the incentive payments.23

The fact that results for use of a basic EHR system did not hold up under multivariate analysis is also significant. The EHR Incentive Programs require physicians to adopt systems that possess a minimum set of standard features. Additional analyses such as this one that seek to examine the effect of specific EHR features can help to guide future regulations governing this minimum feature set. Based on the findings of this analysis and the prior literature, clinical decision support appears to have value for inclusion in physician EHR systems, at least as it pertains to preventive counseling.

Because the data were collected before the ARRA was even enacted, it is not possible to assess the response to the program. It is possible that greater standardization of electronic health records, prompted by ARRA, will tighten the relationship between clinical reminders and the provision of preventive health services. In this analysis, general practitioners, internists, pediatricians, and cardiologists were most likely to provide preventive health services. With few exceptions, all physicians are required to meet the Stage 1 requirements of the program. Because the requirements are designed to further public health goals such as prevention and wellness, this could lead to other specialties for whom the patient risk factors are relevant (e.g., obesity for orthopedists) providing preventive counseling at higher rates.

Another limitation of the study is that we do not know from the data what specific clinical reminders were in use by physicians in the sample. The data only show if clinical reminders were available; it does not specify the clinical conditions addressed by the reminder. While the

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USPSTF-recommended preventive counseling services are likely targets for clinical reminders in EHR systems, it is impossible to know for certain whether these specific reminders were present or not. Clinical reminders are likely to become more standardized through the EHR incentive program, particularly in its second phase. The Stage 2 reminders must be based on clinical quality measures. Clinical quality measures in turn are usually based on clinical practice guidelines such as those developed by USPSTF.

Finally, the EHR incentives are driven by the Medicare and Medicaid programs and stand to benefit those patients. It is noteworthy that the data show that Medicare patients are significantly less likely to receive preventive counseling than their counterparts with private insurance. This is likely to change with the adoption of electronic health records and with new policies enacted as part of the ACA, particularly the requirements for first dollar coverage for preventive services.

In conclusion, the relationship between electronic clinical reminders and preventive health counseling appears to be dependent on the specific counseling service. There is a positive association between clinical reminders and certain types of preventive counseling, particularly diet and nutrition counseling and exercise/weight reduction counseling. The greatest increase in counseling services appears to be appropriately targeted to those patients with risk factors. However, estimates of the benefit to society if electronic reminders were adopted by all physicians were modest at best. Future analyses will be better able to assess how the ARRA EHR incentives and other legislative changes impact the relationship between EHRs and the provision of preventive counseling.
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