Electronic Medical Record Availability and Primary Care Depression Treatment

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BACKGROUND: Electronic medical records (EMR) are commonly believed to improve quality of care. Primary care patients with multiple chronic conditions have potentially greater opportunity to benefit from receiving care at practices with EMRs if these systems help coordinate complex care.

OBJECTIVE: To examine how chronic conditions impact the odds that depressed patients receive depression treatment in primary care practices with EMRs compared to practices without EMRs.

DESIGN: The study uses logistic regression to analyze cross-sectional data of primary care physician office visits in freestanding, office-based practices from the 2006–2008 National Ambulatory Medical Care Surveys.

PATIENTS: All visits to primary care providers made by patients ages 18 and older with physician-identified depression (N=3,467).

MAIN MEASURES: Outcomes include depression treatment which is defined as receipt or ordering of antidepressant medication and/or mental health counseling.

KEY RESULTS: EMRs were associated with significantly lowered odds that depressed patients received depression treatment (OR=0.75, p=0.009, 95% CI: 0.61-0.93); however when stratified by the number of chronic conditions, this association was observed only in patients with three or more chronic conditions (OR= 0.50, p>0.001, 95% CI: 0.36-0.70). EMRs did not have a significant association with depression treatment for patients with two or fewer chronic conditions.

CONCLUSIONS: EMRs appear to have an unintended negative association with depression care provided during visits made by primary care patients with multiple chronic conditions.

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INTRODUCTION

Depression is comon[1], and although effective treatments exist[2] about one-third to one-half of patients receive no treatment for their depression.[3,4] Because depressed patients often present to a primary care doctor[1,4–9] who has the responsibility to manage physical as well as mental health problems, they may benefit from receiving care at practices with electronic medical records (EMRs). This potential is based on the EMR's capacity: (1) to collect structured information about depressive symptoms that can be efficiently retrieved, shared and analyzed to arrive at an accurate diagnosis, and (2) to cue physicians to deliver guideline-concordant care for depression once it is diagnosed.

The increasing use of EMRs and related health information technologies are generally thought to have great potential to improve the quality of physical health care;[10–12] however, prior research demonstrates EMR's widespread positive effect on quality is inconsistent,[13] with much of the demonstrated value being shown in a small number of institutions with home-grown systems.[14] Recent attempts to correlate EMR use with quality indicators across many ambulatory practices have shown mostly no positive relationship between EMR use and quality indicators.[15,16] Discouragingly, related work describes unintended consequences of EMRs that result from increasingly shifting the physician-patient interaction to a physician-computer interaction.[17–19] Thus, there is a continued need for studies that describe the general effect of EMR implementations on health care quality. This is especially important for complex patients. While the potential benefits of EMRs may be highest for complex patients whose care is informed by multiple practice guidelines, the potential costs may also be

high because physicians may need to spend more time during the visit to complete all the necessary prompts for patients with multiple chronic conditions.

The purpose of this study is to assess whether the probability of receiving depression treatment during visits by patients to primary care providers differs between visits to practices with EMRs and practices without EMRs and whether the effect differs by patient complexity. Given generally low rates of depression treatment and the expectation that EMRs are designed to improve recommended care delivery, we hypothesize that the odds of depression treatment (antidepressant medication and/or mental health counseling) will be greater in visits to primary care practices with EMRs compared to practices without EMRs, with the greatest positive impact occurring in patients with multiple chronic conditions.

METHODS

Data

This study uses data from the 2006–2008 National Ambulatory Medical Care Surveys (NAMCS), a nationally representative sample of physician office visits in the United States conducted annually by the National Center for Health Statistics.[20] NAMCS produces an annual national probability sample of visits to physicians providing outpatient care in freestanding, office-based practices including HMOs and non-federal government clinics. The NAMCS sample of visits is obtained using a three stage sampling design selecting primary sampling units (PSUs), physician practices within PSUs, and patient visits within practices. Physicians were asked to record information on visits made over a randomly selected one-week period during the year. During the 3 year study, physician participation rates averaged 61.3%. Physicians complete a standardized office visit form on each sampled visit containing detailed information including up to three physician diagnoses based on International Classification of Diseases codes, Ninth Revision (ICD-9), screening tests, medications and other treatment provided, ordered, or continued. A full description of the NAMCS sampling procedures are provided elsewhere.[21] All visits to primary care physicians by patients 18 years of age and older with physician-reported depression are included in the sample (N=3,467). Patients with physician reported depression were identified by the physician response to the included survey question "does the patient currently have depression?" Characteristics of the sample are shown in Table 1. The NCHS Institutional Review Board approved the data collection protocol including a waiver of the requirement for informed consent of participating patients. The University of Florida Institutional Review Board approved this analysis.

Table 1. Characteristics of the Sample of Primary Care Visits by Patients with Depression to Practices with and without Electronic Medical Records (EMRs)

	Visits to Practices without EMRs (N=2,584)	Visits to Practices with EMRs (N=883)
Age	50.6	49.9
% Male	26.0	26.4
% White	73.1	78.1
% African American	10.3	5.9
% Latino	10.1	11.7
% Other Race	6.5	4.3
% Medicare	24.7	19.8
% Medicaid	22.9	18.3
% Self-Pay	9.6	5.9
% Private Insurance	45.8	58.2
% Physician-owned Practice	52.7	46.5
% Community Health Center	32.4	20.5
% HMO	1.0	6.5
% Academic Practice	3.1	2.6
Primary Care Visits in Past Year	4.5	5.7
% Median Income Quartile 1	27.4	25.8
% Median Income Quartile 2	26.2	27.5
% Median Income Quartile 3	22.3	19.8
% Median Income Quartile 4	18.0	18.5
% Living in North	20.9	25.8
% Living in Midwest	28.8	27.5
% Living in South	29.8	19.8
% Living in West	20.4	18.5

Data are from the 2006, 2007, and 2008 National Ambulatory Medical Care Surveys and are limited to visits to primary care providers by patients ages 18 and older with physician-identified depression

Chronic Conditions

The NAMCS instrument asks the physician to report whether the patient has any of 13 specific chronic conditions (arthritis, asthma, cancer, cerebrovascular disease, congestive heart failure, chronic renal failure, chronic obstructive pulmonary disease, depression, diabetes, hyperlipidemia, hypertension, ischemic heart disease, and osteoporosis). A variable was then created reporting the total number of chronic conditions experienced by the patient at the time of the visit. For the proposed analysis, variables were created indicating whether the patient has one (N=1,092), two (N=916), or three or more chronic conditions (N=1,459). Because depression is counted as a chronic condition, all patients had at least one chronic condition.

Outcome Measures

Receipt of antidepressant medication was defined as physician notation that the patient was prescribed, ordered, supplied, administered, or continued one or more of the following antidepressants at the visit: amitriptyline, amoxapine, bupropion, citalopram, clomipramine, desipramine, doxepin, duloxetine, escitalopram, fluoxetine, fluvoxamine, imipramine, isocarboxazid, maprotiline, mirtazapine, nefazodone, nortriptyline, paroxetine, phenelzine, protriptyline, sertraline, tranylcypromine, trazodone, trimipramine, and venlafaxine. Receipt of mental

health counseling was defined as physician notation that psychotherapy or mental health counseling was provided or ordered at the visit. Therefore, any ongoing treatment of depression, regardless of whether it was initiated during the sampled visit, was captured in the visit data. Three dummy variables were created to indicate if the patient was currently being prescribed an antidepressant medication, was receiving any mental health counseling, and was receiving any depression treatment. Any depression treatment was defined as either receiving antidepressant medication or mental health counseling.

Electronic Medical Records

The NAMCS includes information about practice characteristics, EMR use and other computerized capabilities. Physicians were asked if their practice had an EMR, and if so, whether it was partially (e.g. some paper records) or fully (e.g. no paper records) implemented. For this analysis, practices were defined as an EMR practice only if the EMR was fully implemented and a non-EMR practice if there was no EMR or the EMR was only partially implemented.

Statistical Analysis

This observational study uses multivariate logistic regression analyses of cross-sectional data comparing depression treatment in practices according to the presence or absence of an EMR. Among those visits by patients with physician-reported depression, we compared the odds of being treated with antidepressant medication, mental health counseling, or a combined measure of depression treatment (antidepressant medication and/or mental health counseling). All logistic regressions controlled for patient age, gender, race/ethnicity, type of insurance, the number of physician visits in the previous year, region, median income in the patient's zipcode, and the number of chronic conditions. The analyses also control for whether the practice is physician/privately owned, a community health center, HMO owned, or part of an academic medical center. Next, the analyses were repeated stratified by the patient's total number of chronic conditions, which was categorized as one, two, or three or more conditions. All analyses use the survey procedures of Stata 10.0 [22] to allow for standard errors to correctly account for the complex sampling strategy of the NAMCS, with 95% confidence intervals (95% CI) calculated using these weights for all estimated odds ratios.

RESULTS

Overall, 28.3% (95% CI: 21.5%-35.1%) of primary care visits made by adults with depression were to practices with an EMR. Antidepressant medication was offered or continued during 42.5% (95% CI: 39.6%-45.5%) of visits by adults with depression and mental health counseling was offered or provided during 4.3% (95% CI: 3.2%–5.3%) of these visits. Antidepressant medication and/or mental health counseling was offered or continued/provided in 48.6% (95% CI: 45.6%–51.6%) of these visits.

Depression Treatment by EMR Status

Antidepressant medication and/or mental health counseling was offered during 43.3% of visits (95% CI: 38.0%–48.6%) to practices with EMRs, while it was offered during 50.7% of visits (95% CI: 47.5%–53.9%) to non-EMR practices (see Table 2). After adjusting for patient characteristics (see Table 3), any depression treatment was significantly less likely to be offered during visits to EMR practices compared to non-EMR practices (OR=0.75, 95% CI: 0.61–0.93, p=0.009). When broken down by whether or not the practice had an EMR, 39.0% (95% CI: 33.6%–44.4%) received an antidepressant medication in visits to EMR practices compared to 43.9% (95% CI: 40.8%–47.1%) during visits to non-EMR practices (see Table 2). After adjusting for patient characteristics (see Table 3), visits to EMR practices had 82% of the odds of an antidepressant medication compared to visits to non-EMR practices, which was only marginally significant (OR=0.82, 95% CI:0.66–1.03, p=0.089). Mental health counseling was offered during 3.9% of these visits (95% CI: 2.3%–5.5%) to EMR practices compared to 4.4% of visits (95% CI: 3.0%–5.8%) to non-EMR practices (see Table 2). After adjusting for patient characteristics (see Table 3), visits to EMR practice were significantly less likely to receive any mental health counseling (OR=0.57, 95% CI: 0.39–0.82, p=0.003).

Comparison of Association by Number of Chronic Conditions. EMRs did not predict receiving depression treatment in visits by patients with one (OR=1.20, 95% CI: 0.85–1.69, p=0.288) or two chronic conditions (OR=0.99,

Table 2. Percent of Visits with Antidepressant Medication, Mental Health Counseling, or Depression Treatment by Presence of EMR

	% of Visits to Practices without EMR	% of Visits to Practices with EMR
Antidepressant Medication	43.9 (95% CI: 40.8–47.1)	39.9 (95% CI: 33.6–44.4)
Mental Health Counseling	4.4 (95% CI: 3.0–5.8)	3.9 (95% CI: 2.3–5.5)
Any Depression Treatment	50.7 (95% CI: 47.5–53.9)	43.3 (95% CI: 38.0–48.6)

Data are from the 2006, 2007, and 2008 National Ambulatory Medical Care Surveys and are limited to visits to primary care providers by patients with physician-reported depression (N= 3,467) for antidepressant treatment. EMR= Electronic Medical Record; Depression Treatment= Antidepressant Medication and/or Mental Health Counseling. 95% Confidence Intervals for estimates are in parentheses

Table 3. Association of EMR use with Odds of Antidepressant Medication, Mental Health Counseling, or Depression Treatment For Visits made by Patients with Depression by Number of Chronic Conditions

	Odds Ratio	P-Value	95% Confidence Interval
All Visits			
Antidepressant Medication	0.82	0.089	0.66–1.03
Mental Health Counseling	0.57	0.003	0.39–0.82
Depression Treatment	0.75	0.009	0.61–0.93
One Chronic Condition			
Antidepressant Medication	1.38	0.061	0.99–1.92
Mental Health Counseling	0.55	0.033	0.32–0.95
Depression Treatment	1.20	0.288	0.85–1.69
Two Chronic Conditions			
Antidepressant Medication	0.93	0.739	0.63–1.39
Mental Health Counseling	0.91	0.738	0.52–1.59
Depression Treatment	0.99	0.977	0.67–1.47
Three+Chronic Conditions			
Antidepressant Medication	0.57	0.004	0.39–0.84
Mental Health Counseling	0.41	0.005	0.22–0.76
Depression Treatment	0.50	< 0.001	0.36–0.70

Data are from the 2006, 2007, and 2008 National Ambulatory Medical Care Surveys. Analysis of odds of depression screen includes all primary care visits made by patients ages 18 and over with physician-reported depression. All analyses control for patient age, gender, race/ethnicity, type of insurance, number of previous primary care visits, region, median income in patient's zip code, and physician practice ownership. Depression is considered a chronic condition so all patients have at least one chronic condition

95% CI: 0.657–1.47, p=0.977). However, EMRs were significantly associated with reduced odds of depression treatment during visits made by patients with three or more chronic conditions (OR=0.50, 95% CI: 0.36–0.70, p<0.001; see Table 3). If a patient had three or more chronic conditions, depression treatment was offered during 35.8% of visits to practices with EMRs (95% CI: 30.0–41.7), compared to 52.1% of visits to practices without EMRs (95% CI: 47.0–57.2). EMRs did not predict antidepressant medication in visits by patients with one or two chronic conditions (OR=1.38, 95% CI: 0.99–1.92, p=0.061; OR=0.93, 95% CI: 0.63–1.39, p=0.739 respectively), but significantly reducing the odds in visits by patients with three or more chronic conditions (OR=0.57, 95% CI: 0.39–0.84, p=0.004). EMRs had a similar negative association (OR=0.41 95% CI:0.22–0.76, p=0.005) on the odds of mental health counseling among visits by patients with three or more chronic conditions and to a lesser extent, among visits by patients with a single chronic condition (OR=0.55, 95% CI:0.32–0.95, p=0.033), while EMRs were not associated with lower odds among visits by patients with two chronic conditions (OR=0.91, 95% CI:0.52–1.59, p=0.738).

DISCUSSION

Counter to our hypothesis, EMRs were associated with *half* the odds of depression treatment including antidepressant medication and/or mental health counseling in visits by patients with three or more chronic conditions, while EMRs were not associated with receipt of depression treatment including antidepressant medication in visits by patients with two or fewer chronic conditions.

Carefully conducted studies have demonstrated that EMRs encourage biomedical exchange between the physician and patient including discussion of medication.[23–27] In contrast, EMRs have been observed to have a negative impact on psychosocial exchange, with screen gaze being inversely related to physician engagement in psychosocial questioning and emotional responsiveness.[24,25,28,29] It is possible that the clinical workflows embedded in EMRs inadvertently encourage physicians to focus on these multiple physical problems and push depression treatment "off the radar screen" even after physicians diagnosed the condition. Implementation and use of health information technology typically involves significant changes to clinical processes and workflows, which can have unintended positive and negative effects on care quality.[17–19,30] While most prior research has been conducted in inpatient settings, it has shown that physicians often find that EMR interfaces create additional work by forcing them to click through many screens and options as well as imposing tasks previously handled by others, especially when placing orders.[31,32] Similar effects in primary care may take away significant visit time and reduce physician's cognitive performance in terms of ability to provide comprehensive care. Such effects are also likely to be significantly greater during visits by patients with multiple chronic conditions than patients with few chronic conditions.

While the relationship we observe may be attributable to EMR impact on physician–patient interaction, the study's non-experimental design does not allow for causal inference and makes it important to consider other competing explanations for the relationships observed, particularly differences between EMR and non-EMR practices in patients, physicians, and other practice characteristics. It is possible that patients with multiple chronic conditions who do not want depression treatment may self-select into practices with a "high tech" focus, whereas patients who have yet to develop chronic conditions may be more open to both "high tech" practices and to depression treatment. Similarly, patients whose diagnosed depression is more severe may be more likely to select practices without EMRs. While there is no way to evaluate this possibility, we suspect that self-selection cannot account for the sizable effects we report in comorbid patients given the complex considerations that influence patient selection of physicians. Additionally, the analysis controls for type of insurance, income, and past utilization of office visits, which should help minimize any potential bias.

It is also possible that primary care physicians who do not want to provide depression treatment may self-select into practices with a "high tech" focus; however, it is hard to

explain why these physicians would deliberately identify their patient's depression if they had no intention to treat it, making this type of selection unlikely. Additionally, the analyses control for practice ownership, which should capture some differences in "tech" focus. Lastly, it is possible that other characteristics of the practice which co-vary with EMR use are the actual causal factor. We think other practice characteristics are an unlikely explanation for the relationships we observed because these practice characteristics that co-vary with EMR use should have influenced depression treatment of all depressed patients in the practice, not just depressed patients with multiple chronic conditions.

The internal and external validity of our findings is subject to the following considerations. First, the diagnostic accuracy of the sample is imperfect because it relies on physician judgment rather than objective assessment tools. While policy analysts find it useful to generalize to patients who receive "real world" diagnoses, this potential measurement error is problematic if diagnostic accuracy differs by the availability of EMRs. Second, the database does not contain a comprehensive set of clinical covariates so we can only hypothesize that the differences we observe by the number of chronic condition is reflective of varying clinical complexity. Third, since the unit of analysis is a single office visit, frequently visiting patients with potentially greater severity may be over-represented; however given that each office sampled visits for a one-week period only, this source of measurement error is not likely to greatly bias findings. Even with these limitations, the database is the most comprehensive national survey of EMR use by office-based physician visits over geography, population, and time.

Although this study cannot identify the exact reasons why depression treatment is less likely during visits to EMR practices than non-EMR practices, this study should raise questions about a potential downside of EMR use. EMR use involves significant changes to clinical processes and workflows compared to paper-based medical care. These changes need to be well understood in order to guard against unintended negative consequences. While EMRs certainly have advantages within primary care settings, they may result in encouraging physicians to focus on issues identified by the EMR rather than those raised by the patient, necessitating EMR re-design. Physician training on EMR and the systematic incorporation of depression treatment guidelines into EMR systems may also help to address unintended consequences we observed. EMRs require additional study to identify the extent and cause of the negative association between EMRs and depression treatment we observed, especially as more and more practices implement EMRs.

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