

## Use of Electronic Health Record Is Associated with Improved Glycemic and Cholesterol Control for Patients with Diabetes

Reed M, Huang J, Graetz I, et al. Outpatient electronic health records and the clinical care and outcomes of patients with diabetes mellitus. *Ann Intern Med* 2012;157:482–91.

### Study Overview

**Objective.** To examine clinical care and outcomes associated with outpatient electronic health record (EHR) implementation among patients with diabetes mellitus.

**Design.** Quasi-experimental cohort study.

**Setting and participants.** The study was conducted at Kaiser Permanente Northern California, a large integrated health care delivery system. Patients were eligible for the study if they were more than 1 year old, members of Kaiser, and in the diabetes clinical registry of the health plan as of 2003. This included 169,711 diabetic patients in 17 medical centers with 45 facilities. Among all participants, 37.7% were aged 50 to 64 years, 23.6% were between 65 and 75 years old, and 17.3% were above 75 years of age. About 52% were male; 48.5% were white, 10.2% black, 13.5% Hispanic, and 14.6% Asian. The most common chronic disease was hypertension, followed by coronary artery disease and asthma.

**Main outcome measures.** Glycemic control as measured by hemoglobin A1c (HbA1c) level and lipid control as measured by low-density lipoprotein cholesterol (LDL) level. Other outcomes included treatment intensification, defined as an increase in the number of drug classes, an increase in daily dosage of an ongoing drug, a switch to a drug in the same class with increase in bioequivalent dose, a switch to another drug in a different class, or the addition of insulin (for HbA1c).

**Analysis.** Because the 17 medical centers had staggered implementation of EHR, patients from medical centers where implementation of EHR had not occurred were used as concurrent controls for medical centers where EHR implementation had taken place. Implementation of EHR was defined as it being used for at least 80% of outpatient visits in a given calendar month. To examine the association between treatment intensifica-

tion and EHR implementation, data were analyzed using a multivariate logistic regression model. A linear regression model with fixed effects at the patient level was used to examine the association of follow up HbA1c level and LDL level with EHR implementation. Main results. EHR implementation was associated with an increased likelihood of treatment intensification for diabetes among patients with baseline HbA1c level  $\geq 7$  and  $< 9$  (odds ratio [OR] 1.12, 95% confidence interval [CI] 1.06 to 1.18) and among those with baseline HbA1c level  $\geq 9$  (OR 1.10, 95% CI 1.05 to 1.15). It was also associated with an increased likelihood of treatment intensification for cholesterol treatment among those with baseline LDL level  $\geq 100$  and  $< 130$  (OR 1.06, 95% CI 1.00 to 1.12). EHR implementation is associated with lower HbA1c levels among all patients, with the largest effect among those with baseline HbA1c level at or above 9, with an average change of  $-0.14\%$  (95% CI  $-0.18$  to  $-0.11$ ). EHR implementation was also associated with lower LDL level among all patients, with the largest effect among those with LDL level  $\geq 130$ , an average change of  $-2.2$  mg/dL (95% CI  $-2.7$  to  $-1.6$ ).

**Conclusion.** EHR implementation is associated with lower HbA1c and lipid levels and treatment intensification among patients with diabetes, with greater improvements among patients with worse disease control at baseline.

### Commentary

EHRs represent an important part of the health IT landscape, and meaningful use of EHRs is a cornerstone of the Affordable Care Act. The evidence that EHRs improve patient outcomes, however, has been inconsistent [1,2]. This study, one of the largest to date, provides evidence that EHR use is associated with improvement in clinical processes and outcomes in patients with diabetes, a common chronic disease. The study results are consistent with other recent studies examining health outcomes related

to EHR implementation among diabetic patients [3,4]. Although not a randomized controlled trial, the use of the quasi-experimental design with concurrent controls was a reasonable alternative, as a large-scale randomized controlled trial is not likely to be conducted in the future.

Of note, the association between EHR and follow-up HbA1c levels and LDL values was statistically significant, but the values were quite small, with the average change in HbA1c levels about 0.1% among those with baseline elevated HbA1c, and the average change in LDL levels were no more than 2.2 mg/dL. Many clinicians may not consider this a clinically relevant difference; however, on a population level, a small change in the average values may yield significant differences in patient outcomes.

What is lacking, however, is the evidence that EHR improves health outcomes downstream of glycemic and cholesterol control, such as incidence of cardiovascular events, morbidity such as functional loss, and survival. Although it is reasonable to assume that glycemic control and cholesterol control would affect these downstream events, tightening glycemic control may also have unintended and adverse consequences such as hypoglycemia and hospitalization, particularly in vulnerable older adult populations. Thus, patient outcomes related to diabetes care needs to be demonstrated clearly. Utilizing a large database, the study authors may have an opportunity to further examine these effects.

### **Applications for Clinical Practice**

The impetus for the transformation to EHR use in clinical settings thus far is often not based on evidence

on health outcomes but rather on anticipated improvements in clinical processes and availability of funding to support EHR adoption. The researchers' finding of an association between EHR implementation and improved patient outcomes helps make the case for the continuing efforts to support widespread implementation of EHRs. On the other hand, for clinics and health care facilities that have already adopted EHR, the relevant research questions may rather involve the examination of how inclusion of specific components of the EHR affect processes and outcomes in primary care [5] and also if the tools for decision support that are often built into EHRs, such as clinical reminders and order sets, affect clinical outcomes.

—William Hung, MD, MPH

### **References**

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