Evaluation of a Statewide Implementation of Electronic Health Records

Chelsea A. Jenter, MPH[1], Steven R. Simon, MD, MPH[2,3], Lynn A. Volk, MHS[4], Eric Poon, MD, MPH[1], Rainu Kaushal, MD, MPH[5], Micky Tripathi, PhD, MPP[6], David W. Bates, MD, MSc[1,2,4]

[1]Brigham & Women's Hospital, Boston, MA, USA; [2]Harvard Medical School, Boston, MA, USA; [3]Harvard Pilgrim Health Care, Boston, MA, USA; [4]Partners HealthCare System, Wellesley, MA, USA; [5]Weill Medical College of Cornell University, New York, NY, USA; [6]Massachusetts eHealth Collaborative, Waltham, MA, USA

Introduction: EHRs and MAeHC

- Use of Electronic Health Records (EHRs) is increasingly widespread [1-8].
- Features of EHRs, such as electronic prescribing, interoperability and decision support, may enhance the safety, quality and effectiveness of healthcare.
- Barriers to EHR adoption include financial, technological and other challenges [5, 8-17].
- Massachusetts eHealth Collaborative (MAeHC):

  A coalition of 34 stakeholders, formed with aims of enhancing EHR adoption in MA. USA, setting up clinical data exchange, and encouraging hospitals to adopt computerized provider order entry (CPOE)
- In 2005, MAeHC proposed to implement EHRs in three MA communities, representing over 150 ambulatory practices with over 400 clinicians, as a pilot for statewide implementation.

Aims: Evaluating the Impact of MAeHC in Three Pilot Communities

- Assess the ways that EHRs are used by physicians, ranging from those who use them proficiently to those who are just starting to use EHRs
- Assess how EHR use affects medication errors and overall quality of healthcare
- Identify physicians characteristics that are correlated with the rate of EHR adoption, in addition to practice characteristics
- Facilitate EHR use through an intervention based on academic detailing and assess whether academic detailing will accelerate EHR adoption and physician EHR proficiency [18]
- Calculate the economic return on investment for EHR implementation
- Preliminarily evaluate health information exchange (HIE)

Evaluation Methods

- Rate and extent of EHR adoption with intervention:
  - Baseline office practice survey of EHR adoption in MA in 2005: random sample of 1829 ambulatory physician practices (30% of all practices in MA)
  - Follow-up survey is planned for mid-2007, as well as an assessment of usage rates for specified EHR features.
- Effects of EHR use on medication error rates:
  - Baseline analysis on the medication error rate in duplicate paper prescriptions collected from 30 physicians over approximately two weeks
  - After EHR implementation, analysis will be performed on 15 physicians' duplicate paper prescriptions and 15 physicians' electronic prescriptions, as compared with the baseline data.
  - Chart reviews and physician review panels aid this analysis.
- Effects of EHR use on quality of care:
  - Comparisons of pre-EHR implementation and post-EHR implementation claims-based quality data from the MA Health Quality Partners (MHQP)
  - Collection and assessment of quality data elements exported from EHRs

Evaluation Methods (cont.)

- Physician use of EHRs:
  - In 2005, an 8-page survey was mailed to 1884 randomly-selected physicians in MA (10% of physicians in the state), assessing office characteristics, physician attitudes toward health information technology (HIT), barriers to EHR adoption, facilitators of EHR adoption, etc.
  - Post-EHR implementation survey distributed in Spring 2007
- Effectiveness of academic detailing on implementation:
  - Academic detailing is a method of changing physician behavior that has been effective in improving prescribing behavior. [20]
  - An intervention group (~15 physicians) will receive 2 academic sessions to help them acclimate and adjust to their new EHR systems. A control group will receive the usual technology support offered through the MAeHC and the EHR vendor. Both groups will be assessed for EHR usage and satisfaction after the intervention.
  - At this point in time, clinicians local to the communities participating in this intervention have been hired and trained to serve as the academic detailers. Timing of the evaluation is dependent upon EHR implementation. Trained clinicians will begin the intervention in 2007.
- Economic evaluation:
  - Assessment of the costs, savings and return on investment related to MAeHC's EHR implementation and data exchange

Results: Office Practice Survey

- Out of a sample of 1829, a total of 847 completed surveys were returned, yielding a response rate of 46%.
- Overall, 18% of practices reported having an EHR.
- All results are weighted to better represent statewide trends.
- Reported having EHRs:
  - 23% of primary care practices
  - 25% of mixed practices (both primary care and specialty)
  - 14% of specialty practices
- Smaller practices reported less EHR adoption.
- Of the practices that reported not currently having an EHR:
  - 13% have plans to adopt an EHR within the next year
  - 24% in the next 1-2 years
  - 11% in the next 3-5 years
  - 52% reported having no plans to adopt an EHR in the foreseeable future

Figure 1: EHR Functionality Usage

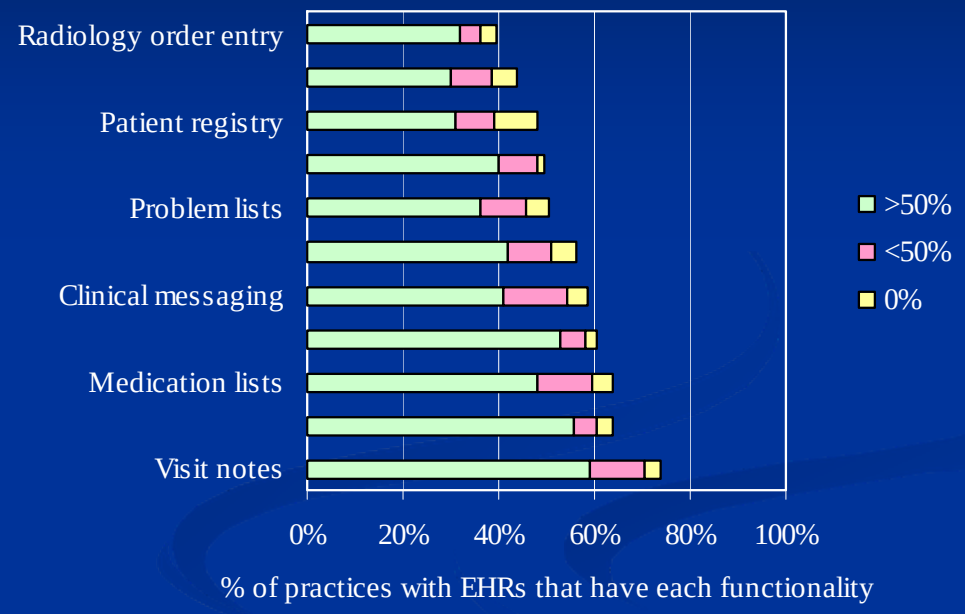


Figure 1: Availability and use of individual EHR functionalities among office practices with EHRs. The length of each bar indicates the percentage of practices that have each functionality available within their EHR system. The component segments of each bar reflect the proportion of practices in which 50% or more of the clinicians regularly use the functionality (green segment), less than 50% of the clinicians regularly use the functionality (yellow segment), and none of the clinicians use the functionality (blue segment).

Status: Medication Error Rate Evaluation

- Data collection is almost complete, with over 4000 prescriptions gathered from 30 ambulatory primary care physicians.
- Nearly 200 chart reviews were performed to assess whether near misses (prescription errors with the potential to cause harm) were actually adverse drug events (prescription errors that did cause harm).
- Challenges:
  - Many physicians opted out.
  - IRB approval processes were complex.
  - Communication with various stakeholders was difficult, since physicians came from many small independent ambulatory practices.

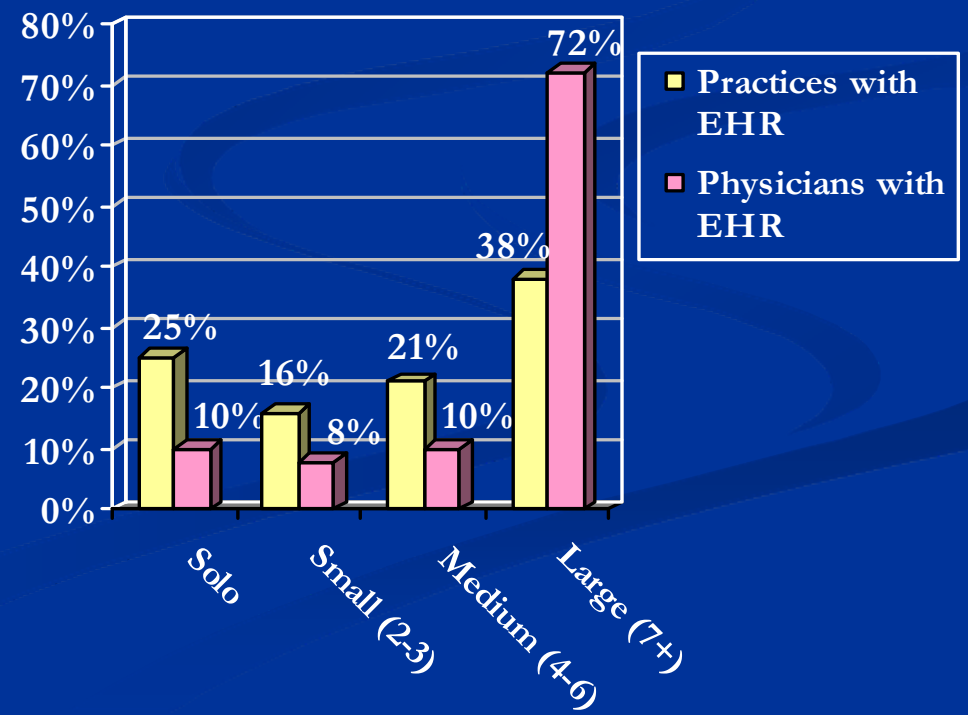
Status: Quality of Care Evaluation

- HEDIS data on ~80% of primary care physicians from our statewide physician survey sample have been received.
- Analyses comparing quality of care with reports of EHR usage have begun.
- Part of this evaluation involves using HEDIS measures via claims-based data from MHQP which requires 1-2 years after data collection to construct measures.
- We are in the process of determining methods for direct electronic data extraction from multiple EHR vendors.

Results: Physician Survey

- 1345/1884 physicians responded (71% response rate).
- Practice size was strongly correlated with EHR adoption (see Figure 2).
- Financial considerations were reported as the greatest barrier to implementation. Physicians who do not currently use EHRs more often reported this as a "major barrier" as compared with physicians who had EHRs.
- 81% of responders also reported that loss of productivity was a barrier.
- Additional analyses focusing on the characteristics of practices with EHRs and analyses comparing the statewide survey data with intervention communities are underway.

Figure 2 – Distribution of physicians and practices with EHRs by size of practice



Discussion

- Our survey results indicate that the rate of EHR adoption in MA in 2005 was higher than in other states in the U.S.
- Larger practice size, teaching, and hospital-based practices were correlated with EHR adoption.
- Visit notes and viewing lab test results were the most commonly available EHR functionalities.
- Though many physicians report *having* specific EHR functionalities, physicians were not necessarily *using* them in their practices.
- Decision support standards, additional training and appropriate motivation will aid the availability and use of quality-enhancing features in EHR systems.
- Many EHR non-adopters cite financial considerations as the main barrier to EHR adoption. Their plans for implementation vary greatly, with the majority reporting having no plans to adopt EHRs in the near future.
- Challenges in this evaluation include:
  - Physician concerns about privacy and security
  - Issues related to conducting research in small communities that are not accustomed to academic research
  - Logistical and technical difficulties associated with independent EHR vendor systems
- A community-oriented approach to interoperability and data exchange appears to be important.

Conclusions

Based on these preliminary results of ongoing research, measuring the impact of a fully-funded EHR implementation program requires a multimodal evaluation approach. The evaluation will be assessing quality, medication safety, adoption rates, and correlates of EHR adoption across the state. This Massachusetts, U.S. evaluation has the opportunity to compare pilot communities that have comprehensive support to implement EHRs with EHR adoption in the rest of the state. Information collected as part of this effort will inform implementation in the rest of the state, as well as both national and international audiences. Many countries have made great investments in EHRs, and it is important to understand the value of these systems. Evaluations such as this one may help justify future investments and policy choices, particularly pertaining to relatively new areas such as data exchange.

Acknowledgements & References

Thanks to Alexis Tumolo, Madeline McCarthy and Deborah Williams for their support and diligent work on this project. This work was supported in part by grant number 1 UC1HS015397 from the Agency for Healthcare Research and Quality, and also by the Massachusetts eHealth Collaborative. Neither organization is responsible for the contents of this paper.

[1] Hillestad R, Bigelow J, Bower A, Girosi F, Meili R, Scoville R, and Taylor R. Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Aff* 2005; 24(5):1103-1117.

[2] Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. National Academy Press, 2001.

[3] Institute of Medicine. Key capabilities of an electronic health record system. Accessed on June 24, 2006, http://www.nap.edu/catalog/10781.html?onpi_newsdoc073103.

[4] Bates DW, Ebell M, Gotlieb E, Zapp J, and Mullins HC. A proposal for electronic medical records in U.S. primary care. *J Am Med Inform Assoc* 2003; 10(1):1-10.

[5] Bates DW. Physicians and ambulatory electronic health records. *Health Aff* 2005; 24(5):1180-1189.

[6] Michael Bainbridge, chair, Primary Health Care Specialist Group, British Computer Society, personal communication with Dr. David Bates, 16 February 2004.

[7] Bomba D. A comparative study of computerised medical records usage among general practitioners in Australia and Sweden. *Medinfo* 1998; 9 Pt 1:55-59.

[8] Miller RH, and Sim I. Physicians' use of electronic medical records: barriers and solutions. *Health Aff* 2004; 23(2):116-126.

[9] Simon SR, Kaushal R, Cleary PD, Jenter CA, Volk LA, Poon EG, Orav EJ, Lo HG, Williams DH, and Bates DW. Correlates of electronic health record adoption in office practices. *J Am Med Inform Assoc* (in press).

[10] Simon SR, McCarthy ML, Kaushal R, Jenter CA, Volk LA, Poon EG, Yee KC, Orav EJ, Williams DH, and Bates DW. Electronic health records: which practices have them, and how are clinicians using them? *J Eval Clin Pract* (in press).

[11] Gans D, Kralewski J, Hammons T, and Dowd B. Medical groups' adoption of electronic health records and information systems. *Health Aff* 2005; 24(5):1323-1333.

[12] Burt CW, and Sisk JE. Which physicians and practices are using electronic medical records? *Health Aff* 2005; 24(5):1334-1343.

[13] Baron RJ, Fabens EL, Schiffman M, and Wolf E. Electronic health records: just around the corner? Or over the cliff? *Ann of Int Med* 2005; 143(3):222-226.

[14] Audet AM, Doty MM, Peugh J, Shamasdin J, Zapert K, and Schoenbaum S. Information technologies: when will they make it into physicians' black bags? *Med Gen Med* 2004; 6(4):2.

[15] Miller RH, West C, Brown TM, Sim I, and Ganchoff C. The value of electronic health records in solo or small group practices. *Health Aff* 2005; 24(5):1127-1137.

[16] Poon E, Jha A, Christino M, Honour M, Fernandopulle R, Middleton B, Newhouse J, Leape L, Bates DW, Blumenthal D, and Kaushal R. Assessing the level of healthcare information technology adoption in the United States: a snapshot. *BMC Med Inform Decis Mak* 2006; 6(1):1.

[17] Loomis GA, Ries JS, Saywell RM, Jr., Thakker NR. If electronic medical records are so great, why aren't family physicians using them? *J Fam Pract* 2002; 51(7):636-641.

[18] Soumerai SB, and Avorn J. Principles of educational outreach ('academic detailing') in improve clinical decision making. *JAMA* 1990; 263(4): 549-556.

[19] Chaudhry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, Morton SC, Shekelle PG. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med* 2006; 144(10): 742-752.

[20] O'Brien, MA; Oxman, AD; Davis, DA; Haynes, RB; Freemantle, N; Harvey, EL. Educational outreach visits: effects on professional practice and health care outcomes. Cochrane Database of Systematic Reviews 2000: 2: CD000409.

Address for correspondence:

Chelsea A. Jenter, MPH
Project Manager
Clinical & Quality Analysis, Information Systems
Division of General Medicine, Department of Medicine
Brigham & Women's Hospital
93 Worcester Street, 2nd Floor
Box 81905
Wellesley, MA 02481