How Common Are Electronic Health Records In The United States? A Summary Of The Evidence

About one-fourth of U.S. physician practices are now using an EHR, according to the results of high-quality surveys.

by Ashish K. Jha, Timothy G. Ferris, Karen Donelan, Catherine DesRoches, Alexandra Shields, Sara Rosenbaum, and David Blumenthal

ABSTRACT: Electronic health records (EHRs) are promising tools to improve quality and efficiency in health care, but data on their adoption rate are limited. We identified surveys on EHR adoption and assessed their quality. Although surveys returned widely different estimates of EHR use, when available information is limited to studies of high or medium quality, national estimates are possible: Through 2005, approximately 23.9 percent of physicians used EHRs in the ambulatory setting, while 5 percent of hospitals used computerized physician order entry. Large gaps in knowledge, including information about EHR use among safety-net providers, pose critical challenges for the development of policies aimed at speeding adoption. [*Health Affairs* 25 (2006): w496–w507; 10.1377/hlthaff.25.w496]

DESPITE NATIONAL HEALTH SPENDING that far surpasses that of other countries, Americans often fail to receive consistently high-quality health care. Substantial data suggest that health information technology (IT) in general and electronic health records (EHRs) in particular have the potential to improve the quality of care while controlling health care costs.[1] However, although there is consensus that EHR adoption is not yet widespread, there is less agreement on the current level of EHR adoption and use.[2]

There are two reasons for this lack of agreement: First, there is no current standard regarding the meaning of *EHR adoption* in terms of EHRs' capabilities or functionalities; second, there is no unified approach to the measurement of EHR

Ashish Jha (ajha@hsph.harvard.edu) is an assistant professor at the Harvard School of Public Health in Boston, Massachusetts. Timothy Ferris and Karen Donelan are senior scientists at the Institute for Health Policy, Massachusetts General Hospital/Harvard Medical School, in Boston; Catherine DesRoches is a project director, and Alexandra Shields is an assistant in health policy there. Sara Rosenbaum is chair of the Department of Health Policy, George Washington University, in Washington, D.C. David Blumenthal is the director of the Institute for Health Policy.

DOI 10.1377/hlthaff.25.w496

adoption.[3] Prior studies have registered different adoption-rate estimates, but it is unclear whether the differences can be attributed to different design methodologies or to different ways of defining the function and use of technology. Given policymakers' interest in speeding the diffusion of EHRs and in achieving widespread and uniform capability and use, it is increasingly important to gauge the state of adoption reliably.

The Health Information Technology Adoption Initiative (hitadoption.org), a partnership between the federal government, a philanthropic organization, and several academic research institutions, represents such an effort to reliably measure EHR adoption and to provide guidelines for the future measurement of U.S. adoption rates. This initiative, launched in 2005, is focused on the collection of data related to EHR adoption levels in both physician practices and hospitals. The first task of this project was to develop a reliable baseline by systematically assessing EHR adoption, so that accurate evaluations can be made in coming years regarding the nation's progress toward the president's goal of widespread EHR use by 2014.[4] This paper reports on the results of that baseline assessment.

Rising interest in health IT adoption has led to a proliferation of surveys, which possess varying degrees of methodological rigor. Getting good estimates is critical to understanding the U.S. health care system's capability of producing high-quality care. Further, given that EHR adoption will likely become an important component of quality measurement, performance-related payment, and assessment of population health, understanding the level of adoption will be critical to the assessment of these programs. Finally, as efforts are made in EHR adoption, having a consistent measurement program with a clear baseline will be essential to understanding which policies improve adoption. Given these imperatives, we sought to answer three questions: (1) Based on current evidence, what is the best estimate of the level of EHR adoption by U.S. physicians and hospitals? (2) Do adoption levels vary by provider type (that is, physicians in solo versus large practices) or by clinical context (ambulatory care versus hospital care providers)? (3) What is the adoption level among providers who disproportionately care for minorities or other underserved patients? This last question was motivated by the belief that a lag in EHR adoption might further exacerbate already serious racial, ethnic, and socioeconomic disparities in the quality of health care.

Study Data And Methods

■ **Definitions.** Although there is no universally accepted definition of *EHR*, consensus is emerging that electronic documentation of providers' notes, electronic viewing of laboratory and radiology results, and electronic prescribing (known as computerized provider order entry, or CPOE) are key components of an EHR. These are some of the elements identified by the Institute of Medicine (IOM) in its recent report on the features of EHR systems.[5]

EHRs represent only one component of health IT. Other potential components

might include the ability to exchange data electronically across organizations (known as health information exchange) or to collect electronic data for disease surveillance. Although these other components are important, our study focused specifically on EHR use.

■ **Survey identification.** We conducted a systematic review to identify and collect all existing surveys addressing EHR adoption and use, and we determined, based on the existing data, best estimates of the level of EHR adoption in the United States. We chose to include surveys that used either "adoption" or "use" of EHRs, despite the fact that "adoption" often refers to the availability of these systems, while "use" refers to their active employment in clinical care. We scored each identified survey against explicit criteria regarding quality of methodology and quality of content measurement. Using these ratings, we synthesized the available information on EHR adoption.

We limited our search to surveys completed between 1995 and 2004 and searched for both published and unpublished data and reports. To identify peer-reviewed literature, we searched the online databases Ovid and Medline using a variety of search terms, including "computer records," "electronic medical records," "electronic health records," and "health information technology." To obtain reports and data from non-peer-reviewed sources, we searched Google, Google Scholar, and other Internet search engines and asked local and national experts in EHR adoption to identify potential surveys for inclusion. To provide more current estimates, we included a high-quality survey conducted in 2005.

Once a comprehensive list of surveys was compiled, we sought to collect reports of the survey methodologies, results, and original survey instruments. If the instruments were proprietary, we requested cooperation with this project via telephone, e-mail, and formal letters. We included only those surveys in which the underlying population of interest consisted of physicians, physician group practices, or hospitals. For reports based on data from multiple surveys, we tried to obtain information about the underlying methodology and survey instruments, so that each survey could be rated separately.

■ **Survey abstraction process.** Our abstraction process was based on professional standards and best practices developed by the American Association for Public Opinion Research (AAPOR). The process included elements that professional organizations suggest should be disclosed in any publicly released survey.[6] We began by identifying the survey characteristics necessary to assess the quality of survey methods. These consisted of survey name, sponsor, fieldwork dates, survey population, sample source, sample size, mode of data collection, response rate information, and eligible respondent.

We also culled several additional items of interest from the surveys: clinical settings surveyed (for example, ambulatory versus inpatient care), practice size (for example, solo versus small group), clinical functionalities surveyed, measures of incentives and barriers to adoption, and variables useful in disparities research

such as payer mix and the race/ethnicity of patient populations.

■ **Assessing the quality of individual surveys.** We assessed the quality of surveys for which we had sufficient information to render a judgment. Our approach to this was guided by expert consensus regarding best practices in survey research, the Office of Management and Budget (OMB) survey clearance process, and consultation with experts on health IT and survey methodology.[7]

We rated each survey's methodology and content according to a prespecified set of criteria.[8] Members of the project team experienced in survey research or in health IT independently examined each survey, discussed assessments, and assigned scores. To assess the quality of survey methods, reviewers considered four domains: pretesting of content and methods; representativeness of the sample; the extent of response-rate effort; and the sufficiency of the sample size to support findings. A survey judged to be of high quality in all domains was rated "high." A survey judged to be of low quality in at least two domains was rated "low" overall. All other surveys were judged as "medium."

Five domains were assessed in the content ratings: presence of an EHR; functionalities; barriers to adoption; incentives for adoption; and disparities, as defined by the potential to assess EHR adoption among providers that care for the underserved. Because our primary interest was in understanding the presence or use of an EHR, we focused on results in the "presence of an EHR" domain. Surveys that asked about EHRs (or an important functionality such as CPOE) and resulted in valid, unbiased estimates were rated "high." Surveys that asked about EHRs but used questions that generated only modest confidence regarding validity and reliability were given a "medium" rating. All others were rated "low."

Generally, high-quality surveys used representative sampling and had high response rates. They asked specifically about EHR use and defined "EHR" in the survey. Low-quality surveys often used convenience sampling, had low response rates, and had no or imprecise definitions of "EHR." We used a similar approach for rating other content domains.

Study Results

We identified thirty-six surveys conducted between 1995 and 2005 and were able to obtain both the survey instrument and complete results for twenty-two of them (Exhibit 1). For the remainder, we had some information and often limited results (such as those included in publications). In the results below, we discuss those surveys for which we could rate both methodology and content about the presence of an EHR.

■ **Quality of available surveys.** Of the twenty-two surveys whose methodological and content quality could be judged, ten had high-quality methodology, and nine had high ratings for "presence of an EHR" (Exhibit 1). However, only five surveys achieved a high rating for both methodology and this content domain. All five were surveys of EHR adoption in ambulatory care. When we included surveys that were

EXHIBIT 1
Quality Assessments Of Available Surveys Of Electronic Health Record (EHR) Adoption, 1994–2005: Summary

	Physicians or groups (n = 17)		Hospitals (n = 5)	
	Number	Percent	Number	Percent
Methodology rating				
High quality	8	47	2	40
Medium quality	3	18	1	20
Low quality	6	35	2	40
Content rating: practice/organization has EHR				
High quality	7	41	2	40
Medium quality	3	18	2	40
Low quality rating	4	24	1	20
High rating in methodology and EHR content	5	29	0	0
High or medium rating in methodology and EHR content	9	53	1	20

SOURCE: Authors' analyses of identified surveys on adoption of electronic health records, 1994–2005.
NOTE: Number of surveys evaluated = 36. Number of surveys with complete instrument, results = 22. For this exhibit, N = 22.

rated either medium or high in quality for methodology and content, we were able to identify ten surveys. Most surveys did not address barriers to EHR adoption, incentives for EHR adoption, or whether providers that disproportionately care for underserved populations were less likely than others to use EHRs (Exhibit 2).

■ **Ambulatory EHR use.** Among the surveys of outpatient EHRs (Exhibit 3), the four surveys found to be of high quality for both methodology and content estimated EHR use to be in the 17–25 percent range (Exhibit 4). The National Ambulatory Medical Care Survey (NAMCS), an annual, government-funded, nationally representative survey of all ambulatory visits to physicians whose practices are not hospital-based, recently added questions about EHR use. The latest version of this survey, from 2005, found that 23.9 percent of physicians were using an EHR.[9] NAMCS data from 2001–2003 found an EHR adoption rate of 17.6 percent, which suggests a small increase in the adoption rate.[10] If we restricted the analyses to physicians who had at least four of the key functionalities of an EHR as identified by the IOM, adoption rates would drop to only 9 percent.[11]

Another high-quality survey, conducted by the Commonwealth Fund in 2003, found that 18 percent of physicians "routinely" used an EHR.[12] A 2001 survey by the Center for Studying Health System Change reported on EHR use by specific EHR functions.[13] Approximately 25 percent of respondents used IT for at least one EHR function, while 10 percent reported using it for at least four EHR functions. Eleven percent of physicians appeared to use outpatient electronic prescribing. Finally, a 2000–2001 survey found that 9 percent of medical groups and independent practice associations (IPAs) with twenty or more physicians used electronic docu-

EXHIBIT 2
Quality Of Content Domains In Available Surveys Of Electronic Health Record (EHR) Adoption, 1994–2005

	Physicians or groups	Hospitals
Domain/content rating	**(n = 17)**	**(n = 5)**
EHR functionalities		
High-quality content rating	7	2
Medium-quality content rating	5	3
Low-quality content rating	1	0
Not reported	4	0
Barriers to adoption		
High-quality content rating	4	1
Medium-quality content rating	2	2
Low-quality content rating	1	0
Not reported	10	2
Incentives for adoption		
High-quality content rating	4	0
Medium-quality content rating	0	1
Low-quality content rating	0	1
Not reported	13	3
Disparities		
High-quality content rating	1	1
Medium-quality content rating	3	2
Low-quality content rating	0	0
Not reported	13	2

SOURCE: Authors' analyses of identified surveys on adoption of electronic health records, 1994–2005.
NOTE: Number of surveys evaluated = 36. Number of surveys with complete instrument, results = 22. For this exhibit, N = 22.

mentation and that 24 percent used e-prescribing.[14]

By expanding our analysis to include surveys that were rated as medium or high in quality for both methodology and EHR content, we were able to examine a total of nine surveys of EHR adoption in ambulatory care. These estimates ranged from a low of 15 percent of physicians using EHRs in the *Medical Economics* survey to a finding that 15 percent of medical groups "had an EHR" in the Medical Group Management Association (MGMA) survey.[15] The University of Kentucky survey found that 21 percent of primary care providers in Kentucky used an EHR.[16]

Data from surveys that examined EHR adoption by practice size suggested that solo practitioners were less likely than physicians who worked in larger practices to have EHRs. The Commonwealth Fund survey from 2003 found large differences in use of EHRs between solo practitioners (13 percent "used occasionally") and physicians who practiced in groups of fifty or more (57 percent "used occasionally").[17] Similarly, the 2005 MGMA survey found that although 15 percent of all groups used EHRs, this number varied from 12.5 percent to 19.5 percent based on the size of the practice.[18] Finally, the 2005 NAMCS found that although only 13 percent of solo practitioners were using an EHR, nearly 39 percent in practices

EXHIBIT 3
List Of Health Information Technology Surveys, With Ratings On Selected Features

	Source of sample	Sample represented	Survey (years)	Representative	Methodology score	Functionality	Barriers	Incentives	Disparities	EHR
NAMCS (2005)	Yes	MDs	2005	Yes	High	Med.	–[a]	–[a]	High	High
NAMCS	Yes	MDs	2001–03	Yes	High	Med.	–[a]	–[a]	–[a]	High
Commonwealth Fund	Yes	MDs	2003	Yes	High	Med.	High	High	Med.	High
NHAMCS	Yes	Hospitals	2003	No	High	Med.	–[a]	–[a]	–[a]	High
Casalino	Yes	Practices with >3 MDs	2000–01	Yes	High	High	High	High	Med.	High
Medical Economics	Yes	MDs	2004	No	Med.	High	–[a]	–[a]	–[a]	Med.
MGMA	Yes	Medical group practices	2005	Yes	Med.	High	High	High	–[a]	High
University of Kentucky	Yes	Practitioners' office managers	2003	No	Med.	Med.	Med.	–[a]	–[a]	Med.
Blueprint Research & Design	Yes	CHC directors	2000–01	No	Low	High	–[a]	–[a]	–[a]	High
HSC	Yes	MDs	2000–01	Yes	High	High	–[a]	–[a]	Med.	–[a]
Commonwealth Fund/HSPH	Yes	MDs	2000	No	High	Med.	None	None	None	Med.
Loomis	Yes	MDs	2001	Yes	High	–[a]	High	High	–[a]	–[a]
Medical Records Institute	No	Providers	2005	No	Low	High	–[a]	–[a]	–[a]	Low
Medi-Network	No	Managing partner or administrator	2002	No	Low	–[a]	–[a]	–[a]	–[a]	Low
AHA	Yes	Hospitals	2005	No	Low	High	High	Low	High	Low
Ash	Yes	Hospitals	2002	Yes	High	Med.	–[a]	–[a]	–[a]	–[a]
AHA Most Wired	No	Hospitals	2005	No	Low	High	–[a]	–[a]	–[a]	–[a]
HIMSS 15th Annual Survey	Yes	Senior IT execs	2003	No	Low	Low	Med.	–[a]	–[a]	High
HIMSS 16th Annual Survey	No	Senior IT execs	2004	No	Low	–[a]	Low	–[a]	–[a]	Low
HIMSS/AstraZeneca Wireless Survey	Yes	Execs	2002	Yes	Med.	–[a]	–[a]	–[a]	–[a]	Low
Leapfrog Group	Yes	Hospital CEOs	2003	No	Med.	Med.	Med.	Med.	Med.	Med.
Mathematica	Yes	Hospitals	2005	Yes	High	Med.	–[a]	–[a]	–[a]	–[a]

SOURCE: Authors' ratings of identified surveys on the adoption of electronic health records (EHRs). A complete list of sources is available in Appendix 2 online, http://content.healthaffairs.org/cgi/content/full/hlthaff.25.w496/DC2.
NOTES: NAMCS is National Ambulatory Medical Care Survey. NHAMCS is National Hospital Ambulatory Medical Care Survey. MGMA is Medical Group Management Association. CHC is community health center. HSC is Center for Studying Health System Change. HSPH is Harvard School of Public Health. AHA is American Hospital Association. HIMSS is Healthcare Information and Management Systems Society. IT is information technology. CEO is chief executive officer.
[a] Not available.

with twenty or more physicians were doing so.[19]

■ **Inpatient EHR use.** Surveys concerning use of inpatient EHRs were limited by at least two constraints: They often did not differentiate between inpatient and outpatient EHR use when surveying hospital-based physicians, and many of the sur-

EXHIBIT 4
Electronic Health Record (EHR) Adoption Through 2005, Based On Best Estimates From EHR Surveys

	Range from medium- or high-quality surveys (%)	Best estimates based on high-quality surveys (%)
EHRs in physician offices	17–25	24
Solo practitioners	13–16	16
Large physician offices[a]	19–57	39
EHRs in hospitals	–[b]	None
CPOE in hospitals	4–21	5[c]

SOURCE: Authors' ratings of identified surveys on the adoption of electronic health records (EHRs).

NOTES: No surveys of hospitals were rated high or medium in both methodology and content. CPOE is computerized physician order entry.

[a] "Large" is defined as twenty or more physicians by one study, with an estimate of 39 percent: C.W. Burt and J.E. Sisk, "Which Physicians and Practices Are Using Electronic Medical Records?" *Health Affairs* 24, no. 5 (2005): 1334–1343. It is defined as fifty or more physicians by another study, with an estimate of 57 percent: A.M. Audet et al., "Information Technologies: When Will They Make It into Physicians' Black Bags?" *Medscape General Medicine* 6, no. 4 (2004): 2.

[b] Not available.

[c] Based on a survey rated as medium in quality.

veys focused exclusively on the use of inpatient CPOE, which is only one of the critical EHR components.[20]

We identified no studies of EHR use in the inpatient setting that were rated high in quality for both methodology and content related to the presence of an EHR. When we expanded our scope to include surveys that were rated either medium or high in quality for both methods and EHR content, we found two: the Leapfrog Group's 2003 survey of inpatient CPOE, which found that 5 percent of hospitals were using CPOE, and the Ash survey of CPOE, which found that 9.6 percent of hospitals had CPOE.[21]

We found two surveys that addressed the prevalence of EHRs in the inpatient setting, as opposed to a more limited focus on CPOE. The Healthcare Information and Management Systems Society (HIMSS) 2005 survey found that 17 percent of hospitals have a fully integrated EHR, although the survey was rated low in quality.[22] A more recent study, which was rated high for methodology, suggested much higher rates of EHR adoption (59 percent).[23] However, this survey asked respondents (quality managers) to identify whether clinicians used "electronic clinical documentation," which included documentation of patients' characteristics, including demographics. Therefore, this survey could not differentiate between a hospital that had clinical notes in electronic format and a hospital that had only patient demographics in electronic format. The lumping of multiple types of clinical data into one question led to unreliable estimates of EHR use. Therefore, we could identify no high-quality estimate of inpatient EHR use (Exhibit 4).

■ **Safety-net providers.** We identified no nationally representative surveys of EHR adoption that directly compared adoption rates among providers who care for the underserved populations and other providers. We found one survey of EHR

adoption among safety-net providers that we were able to rate. This survey asked community health centers (CHCs) in California about their use of IT systems.[24] The sample included 87 percent of the licensed CHCs in that state. Conducted in 2000–2001, the survey found that although 67 percent of the clinics had implemented basic IT systems to support business operations, fewer than 10 percent of clinics surveyed were using electronic systems to support individual patient care.[25]

Discussion

Our assessment of surveys on EHR adoption provides three distinct sets of observations. First, the best evidence, based on independent, high-quality surveys, suggests that as of 2005, approximately 24 percent of physicians used an EHR, although only 9 percent used EHR systems that have functionalities such as electronic prescribing.[26] Further, adoption rates varied by practice size: Solo or small physician practices have much lower adoption rates than larger practices have. The data on hospitals' use of health IT are more limited but suggest that during this time period, approximately 5 percent of hospitals had CPOE.[27] Whether these hospitals had a comprehensive EHR system with CPOE as a component or whether they had stand-alone CPOE systems is unknown. We found distinct shortcomings in the literature including varying EHR definitions, varying quality of survey methodology, and almost no information about the use of EHRs by safety-net providers.

■ **Data limitations.** Several important limitations of the evidence help put our assessment into context. First, despite the large number of surveys investigating this topic, most were not of sufficient quality to instill confidence in the estimates. Common problems with these surveys included nonprobability samples, reliance on online data collection (with potential for selection bias in measures of IT), poor response rates, and untested survey questions. Second, with few exceptions, surveys left important questions unaddressed, including whether or not the use of EHRs varied by provider characteristics and whether providers who care for the underserved differed in the adoption process, potentially contributing to health care disparities.[28] Third, nearly all of the available surveys are based on self-reports, with no auditing to confirm reported levels of use.

Another key limitation of the current data was the lack of uniformity in definitions and measures. A majority of the surveys did not define terms such as "electronic health record"; therefore, these terms were open to interpretation by respondents. This limited comparisons of results across surveys. This is of concern to policymakers and the Office of the National Coordinator for Health IT (ONCHIT). The American Health Information Community (AHIC) and others have made standardization of terms such as "EHR" a high priority. Creating consistency in terminology will greatly aid efforts to measure the adoption of this technology over time. Finally, although some surveys focused on purchase or availability, others focused on the actual use of EHRs. The lack of clarity about whether

providers simply purchased these systems, had them available, or actually used them made assessment about EHR penetration in clinical care difficult.

■ **Use among safety-net providers.** We failed to find substantial data on the adoption and use of EHRs among safety-net providers: Only one survey addressed adoption of EHRs in this group. The 2005 NAMCS collected enough demographic information about providers that future analyses of these data could provide insights into EHR use among providers who care for the underserved.[29] A recent subgroup analysis of a report by the University Health Systems Consortium (UHC) suggests that members who are part of the National Association of Public Hospitals and Health Systems (NAPH) might have less health IT than non-NAPH-member hospitals.[30] To the extent that EHRs improve the quality of care provided, ensuring access to these tools among all providers is critical to reducing disparities in health care. Tracking the adoption and use of EHRs among these providers, understanding if there are unique barriers to adoption in this group, and identifying appropriate policy levers to close this gap are important challenges.

■ **EHRs and quality.** Many policymakers believe that the adoption and use of EHRs are critical contributors to improving the quality and efficiency of the U.S. health care system. Given the importance of these systems, it is essential for policy development that reliable, valid information about them be available. The proliferation of estimates of varying quality, as well as the ongoing lack of policy consensus regarding the definition of "EHR," is likely to be confusing to policymakers, and future work in this area needs to be more standardized.

NAMCS represents an important vehicle for improving assessments of EHR adoption in the ambulatory care setting. It is a recurring, nationally representative, high-quality survey of U.S. ambulatory care. Its main shortcomings for assessing EHR use include the lack of clear definitions of individual EHR functionalities, inadequate sample size to calculate rates of adoption among subgroups of providers, and the timeliness of the data. Modification to the current survey and supplementing the sample of providers could greatly improve the quality of estimates of ambulatory EHR use.

■ **Recommendations for future measurement.** Our review of the available studies of health IT suggests four recommendations for measuring this phenomenon going forward. First, surveys should clearly define *EHR use* based on standard definitions developed by the IOM, ONCHIT, or other certification organizations such as the Certification Commission for Healthcare Information Technology (CCHIT). Second, as mentioned above, changes should be made to NAMCS, so that this government survey becomes a foundation for understanding changes in EHR adoption. Third, organizations conducting surveys of EHR adoption should use and report standard survey techniques as outlined by the AAPOR, including reliance on probability sampling, assuring that data collection efforts reach knowledgeable respondents, improving response rates, and understanding nonresponse. Finally, greater efforts should be made to identify EHR adoption rates among providers who care for

underserved populations.

■ **Study limitations.** Our study has several limitations. First, although we made substantial efforts to identify existing surveys on EHR adoption, surveys might have been missed. However, given our process, including vetting our list with experts in the field, it is unlikely that we failed to identify any high-quality national surveys that would have aided in our estimates. Second, we were unable to rate many surveys either because they were proprietary or because we could not locate the authors to collect more detail. It is unlikely, based on the information that we did have, that the unrated surveys would have greatly changed our results.

UNDERSTANDING WHERE AMERICAN PROVIDERS ARE on the adoption curve of health IT use is critical to creating policies that promote its adoption. Current estimates suggest that adoption rates are still low. For policymakers to understand the effectiveness of efforts to improve EHR adoption, we will need ongoing tracking with high-quality surveys.

The project was supported by the Office of the National Coordinator for Health Information Technology and the Robert Wood Johnson Foundation.

NOTES

1. B. Chaudhry et al., "Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care," *Annals of Internal Medicine* 144, no. 10 (2006): 742–752.
2. B. Middleton, "Achieving U.S. Health Information Technology Adoption: The Need for a Third Hand," *Health Affairs* 24, no. 5 (2005): 1269–1272.
3. For example, the Health Information Technology Promotion Act, H.R. 4157, reported by both the House Commerce and Ways and Means Committees in June 2006, prescribes no minimum functionality or capability standards but instead intends that these standards evolve over time through industry-centered activities.
4. Office of the National Coordinator for Health Information Technology, "President's Vision for Health IT," April 2004, http://www.hhs.gov/healthit/presvision.html (accessed 21 May 2005); White House, "Executive Order: Incentives for the Use of Health Information Technology and Establishing the Position of the National Health Information Technology Coordinator," 27 April 2004, http://www.whitehouse.gov/news/releases/2004/04/20040427-4.html (accessed 26 May 2005); and the ONCHIT home page, http://www.hhs.gov/healthit.
5. Institute of Medicine, "Key Capabilities of an Electronic Health Record System: Letter Report," July 2003, http://www.nap.edu/catalog/10781.html (accessed 8 September 2006).
6. American Association for Public Opinion Research, "Best Practices for Survey and Public Opinion Research," 2005, http://www.aapor.org/default.asp?page=survey_methods/standards_and_best_practices (accessed 29 August 2006); and AAPOR, "Code of Professional Ethics and Practices," 2005, http://www.aapor.org/pdfs/AAPOR_Code_2005.pdf (accessed 29 August 2006).
7. Ibid.; and Office of Management and Budget, *Standards and Guidelines for Statistical Surveys*, September 2006, http://www.whitehouse.gov/omb/inforeg/statpolicy/standards_stat_surveys.pdf (accessed 28 September 2006). A list of members of the expert consensus panel is available in Appendix 1 online, http://content.healthaffairs.org/cgi/content/full/hlthaff.25.w496/DC2.
8. The quality of the methodology of a survey was based on the following: the disclosure of sample source, sample size attempted, sample size completed, response rate, fieldwork dates, sponsors, and the name of the survey organization. Surveys were also evaluated on their representativeness, response-rate efforts, pretesting for reliability and validity, and the adequacy of the sample size.
9. C.W. Burt, E. Hing, and D. Woodwell, "Electronic Medical Record Use by Office-based Physicians: United States, 2005," August 2006, http://www.cdc.gov/nchs/products/pubs/pubd/hestats/electronic/electronic

.htm (accessed 29 August 2006).
10. C.W. Burt and J.E. Sisk, "Which Physicians and Practices Are Using Electronic Medical Records?" *Health Affairs* 24, no. 5 (2005): 1334–1343.
11. IOM, "Key Capabilities."
12. A.M. Audet et al., "Information Technologies: When Will They Make It into Physicians' Black Bags?" *Medscape General Medicine* 6, no. 4 (2004): 2.
13. M.C. Reed and J.M. Grossman, "Limited Information Technology for Patient Care in Physician Offices," Issue Brief no. 89, September 2004, http://hschange.org/CONTENT/708/?topic=topic13 (accessed 12 September 2006).
14. L. Casalino et al., "External Incentives, Information Technology, and Organized Processes to Improve Health Care Quality for Patients with Chronic Diseases," *Journal of the American Medical Association* 289, no. 4 (2003): 434–441.
15. K. Terry, "Doctors and EHRs," *Medical Economics* 82, no. 2 (2005): 72–84; and D. Gans et al., "Medical Groups' Adoption of Electronic Health Records and Information Systems," *Health Affairs* 24, no. 5 (2005): 1323–1333.
16. J.E. Andrews et al., "Current State of Information Technology Use in a U.S. Primary Care Practice–based Research Network," *Informatics in Primary Care* 12, no. 1 (2004): 11–18.
17. Audet et al., "Information Technologies."
18. Gans et al., "Medical Groups' Adoption."
19. Burt et al., "Electronic Medical Record Use."
20. IOM, "Key Capabilities."
21. D.M. Cutler, N.E. Feldman, and J.R. Horwitz, "U.S. Adoption of Computerized Physician Order Entry Systems," *Health Affairs* 24, no. 6 (2005): 1654–1663; and J.S. Ash et al., "Computerized Physician Order Entry in U.S. Hospitals: Results of a 2002 Survey," *Journal of the American Informatics Association* 11, no. 2 (2004): 95–99.
22. Healthcare Information and Management Systems Society, *Sixteenth Annual HIMSS Leadership Survey, Healthcare CIO Results: Questionaire Index* (Chicago: Superior Consultant Company/ACS Healthcare Solutions, 2005); and HIMSS, *Sixteenth Annual HIMSS Leadership Survey, Healthcare CIO Results: Final Report* (Chicago: Superior Consultant Company/ACS Healthcare Solutions, 2005).
23. M. Laschober et al., *Hospital Responses to Public Reporting of Quality Data to CMS: 2005 Survey of Hospitals* (Washington: Mathematica, 12 October 2005).
24. Blueprint Research and Design, "Wiring California's Health Care Safety Net: How Community Health Centers Are Using Information Technology to Improve Their Services," 2001, http://www.communityclinics.org/files/518_Wiring_California_s_Healthcare_Safety_Net.pdf (accessed 26 September 2006).
25. Ibid.
26. Burt et al., "Electronic Medical Record Use."
27. Cutler et al., "U.S. Adoption."
28. T.G. Ferris et al., "Are Minority Children the Last to Benefit from a New Technology? Technology Diffusion and Inhaled Corticosteriods for Asthma," *Medical Care* 44, no. 1 (2006): 81–86.
29. Burt et al., "Electronic Medical Record Use."
30. C. Moylan et al., *NAPH Health Information Technology Source Book: Findings from the 2004 Electronic Medical Record Survey,* May 2005, http://www.naph.org/Content/ContentGroups/Policy_Priorities/Health_Information_Technology/2005_06_NAPH_HIT_SourceBook.pdf (accessed 12 September 2006).