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## Electronic Medical Record Use by Office-based Physicians and Their Practices: United States, 2007

by Esther Hing, M.P.H., and Chun-Ju Hsiao, Ph.D.  
Division of Health Care Statistics

### Abstract

**Objectives**—This report presents information on the adoption of electronic medical records (EMRs) by office-based physicians in 2007. Percentages of medical practices and physicians within practices using EMR systems are presented by selected physician and practice characteristics.

**Methods**—Data from the physician induction interviews of the 2007 National Ambulatory Medical Care Survey (NAMCS) are presented. NAMCS is based upon a national probability sample of nonfederal office-based physicians who saw patients in an office setting. Sample data were weighted to produce national estimates of office-based physician characteristics and their practices.

**Results**—In 2007, 34.8 percent of office-based physicians reported using any EMR (all electronic or partially electronic medical record) system, which represented a 19.2 percent increase since 2006 and a 91.2 percent increase since 2001. Starting in 2005, NAMCS included additional questions about features of electronic record systems making it possible to categorize systems as basic or fully functional using similar definitions developed by health information technology (HIT) experts. Fully functional systems are a subset of basic systems. Some systems do not meet the requirements. In 2007, 11.8 percent of physicians had systems meeting the criteria of basic systems (95% CI: 9.6–13.9), unchanged from 2006 (10.5 percent). The percentage of office-based physicians with systems meeting the definition of fully functional (3.8 percent, 95% CI: 2.6–5.0) was similar to the 2006 percentage (3.1 percent). Physicians in practices with 11 or more physicians were most likely to use any EMR system (74.3 percent), whereas physicians in solo practice were least likely to use EMRs (20.6 percent). EMR use was higher among physicians in multi-specialty practices (52.5 percent) than in solo or single-specialty practices (30.3 percent). EMR use was inversely associated with physician age. If those without EMR systems in 2007 with definite plans to install one actually do so, 53.6 percent of physicians will have some type of an EMR system in 2010.

**Keywords:** National Ambulatory Medical Care Survey • health information technology

### Introduction

Policymakers' interest in the progress of health information technology (HIT) adoption by health care providers has increased since 2004 when the federal government set the goal that most Americans would have electronic health records (EHRs) by 2014 (1). The American Recovery and Reinvestment Act (ARRA) of 2009 may accelerate the pace of EHR adoption by health care providers, because it includes funding to promote adoption and use of EHR systems (2). Starting in 2011, physicians who can demonstrate meaningful use of interoperable systems may receive extra Medicare payments over 5 years (2).

This report examines use of any EMR system by office-based physicians in 2007, as well as their plans to install new EMR systems within the next 3 years. Trends in physicians' use of any EMR system since 2001 are updated (3–6).

This report also presents 2007 estimates of the percentage of office-based physicians with computerized systems defined by experts as basic and fully functional electronic systems (7,8). Based on items collected in the 2007 National Ambulatory Medical Care Survey (NAMCS), systems defined as



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**Table A. Survey items defining minimally functional, basic, and fully functional electronic medical record systems**

| Features of computerized systems                                    | Minimally functional system <sup>1</sup> | Basic system <sup>2</sup> | Fully functional system <sup>2</sup> |
|---------------------------------------------------------------------|------------------------------------------|---------------------------|--------------------------------------|
| Patient demographics . . . . .                                      |                                          | X                         | X                                    |
| Patient problem lists . . . . .                                     |                                          | X                         | X                                    |
| Physician clinical notes . . . . .                                  | X                                        | X                         | X                                    |
| Medical history and follow-up notes . . . . .                       |                                          |                           | X                                    |
| Guideline-based interventions or screening test reminders . . . . . |                                          |                           | X                                    |
| Test results (lab or imaging) . . . . .                             | X                                        |                           |                                      |
| Lab results . . . . .                                               |                                          | X                         | X                                    |
| Out-of-range values highlighted . . . . .                           |                                          |                           | X                                    |
| Imaging results . . . . .                                           |                                          | X                         | X                                    |
| Electronic images returned . . . . .                                |                                          |                           | X                                    |
| Computerized orders for prescriptions . . . . .                     | X                                        | X                         | X                                    |
| Drug interaction or contraindication warning provided . . . . .     |                                          |                           | X                                    |
| Prescription sent to pharmacy electronically . . . . .              |                                          |                           | X                                    |
| Computerized orders for tests . . . . .                             | X                                        |                           | X                                    |
| Test orders sent electronically . . . . .                           |                                          |                           | X                                    |
| Public health reporting . . . . .                                   |                                          |                           |                                      |
| Notifiable diseases sent electronically . . . . .                   |                                          |                           |                                      |

<sup>1</sup>Based on definition presented in Blumenthal D, DesRoches C, Donelan K, et al. Health Information Technology in the United States: The Information Base for Progress. Robert Wood Johnson Foundation. 2006.

<sup>2</sup>Based on items collected in the 2007 National Ambulatory Medical Care Survey (NAMCS) and features identified in Health Information Technology in the United States: Where We Stand, 2008. Robert Wood Johnson Foundation. 2008. Fully functional systems are a subset of basic systems.

NOTE: Survey items are from NAMCS.

basic include computerized systems with the following features: patient demographic information, patient problem lists, clinical notes, orders for prescriptions, and viewing laboratory and imaging results. Fully functional systems, a subset of basic systems, include all features of basic systems plus the following additional features: medical history and follow-up, orders for tests, prescription and test orders sent electronically, warnings of drug interactions or contraindications, highlighting out-of-range test levels, electronic images returned, and reminders for guideline-based interventions (Table A). For these classifications, any feature reported as “turned off” was considered available for use within the system (4.7 percent). These definitions provide information on the extent to which current electronic systems have the features of systems that the federal government hopes will be adopted by most health care providers by 2014 (1,2). For trend purposes—although not discussed in this report—the Table in the “Technical Notes” section includes 2007 estimates of physicians using minimally functional systems.

Because the decision to use an EMR system is usually made at the organizational level of the practice rather than by an individual physician, this report also presents estimates of medical practices that use EMR systems. Estimates of EMR use by medical practices, as well as the percentage of practices with systems meeting the criteria for basic or fully functional systems, are presented by selected practice characteristics.

## Methods

NAMCS is an annual probability survey of nonfederal, office-based physicians providing direct patient care who practice in the 50 states or the District of Columbia, excluding radiologists, anesthesiologists, and pathologists. The survey is conducted by the Centers for Disease Control and Prevention’s National Center for Health Statistics. A sample of office-based physicians who reported that they were in direct patient care was taken from the master files of the American Medical Association and the American Osteopathic Association. The sample design includes 112 geographic primary sampling units (PSUs). Within those

PSUs, physicians were stratified by specialty, and a sample of physicians was selected. Physicians were randomly assigned to 1 of 52 reporting weeks throughout the year. In 2007, the NAMCS sample was slightly larger than previous years because of sponsored supplementary samples (9).

Through 2005, the NAMCS sample design described above typically included too few community health center physicians to generate reliable estimates. To improve the precision of community health center physician estimates, starting in 2006, a dual sampling procedure was used to select community health center physicians and other providers (9). This report includes data on physicians selected from the traditional sample and on community health center physicians selected from sampled community health centers. Although the sample of community health center providers also included nonphysician clinicians (nurse practitioners, nurse midwives, and physician assistants), these clinicians were excluded for comparability purposes.

Of 3,540 sampled physicians, 2,399 were eligible to participate in the survey (in scope). Responses were obtained

from 1,743 sampled physicians who saw patients during their assigned week, which included those not scheduled to see patients during that week. For the first time, responses included physicians who refused to provide visit data but completed the induction interview. The unweighted response rate was 72.7 percent (72.3 percent weighted by the inverse of the probability of selection). For more information about NAMCS see <http://www.cdc.gov/nchs/ahcd.htm>.

During the 2007 induction interview, respondents were asked questions about current and planned EMR use (see the Figure in the “Technical Notes” section for the actual questions used in the survey). Data presented in this report are from physicians’ responses to these questions. Physicians described as using any EMR system included those who reported using either all electronic or partially electronic (part paper and part electronic) medical records, excluding systems used solely for billing. Physicians with missing data on EMR use (2.1 percent) were assumed not to have EMR systems. If missing data were randomly distributed, this approach might underestimate the EMR adoption rate.

In 2007, questions on specific features of computerized systems were asked of all physicians, whereas comparable questions in 2005 and 2006 were asked only if physicians reported “yes” to the question asking about EMR use (see the Figure in the “Technical Notes” section for the actual questions used in the survey). In other words, the 2007 questionnaire asked about the components of their system, regardless of whether the physician reported using EMR. Removal of the skip pattern permits more complete reporting of computerized systems with the features that HIT experts considered necessary in EHR systems. For example, it is possible that some physicians not using EMRs may have multiple systems with the features of a basic system, such as use of hospital portals for sharing lab and imaging results with physicians (10) or e-prescribing systems (11). Reporting differences in EMR use and feature-

defined systems may stem from different interpretations of systems or having systems that are not implemented or used. Using similar definitions developed by HIT experts (Table A), these detailed questions make it possible to categorize systems as basic or fully functional. Fully functional systems are a subset of basic systems.

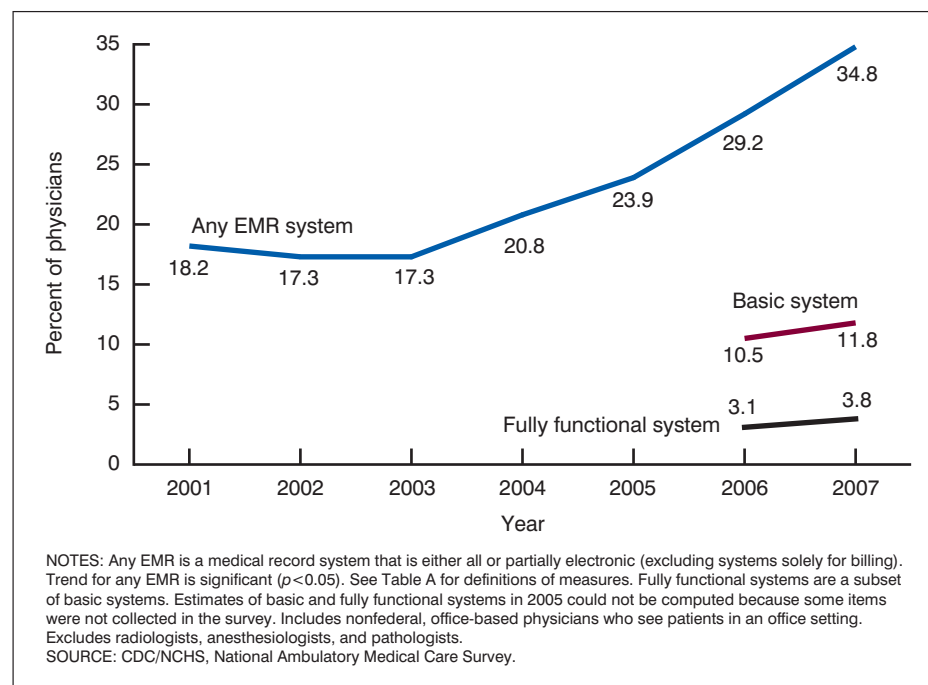
National estimates of EMR use among both medical practices and physicians within practices are presented. Because NAMCS is based on a multistage sample of physicians, compound sampling weights were applied to make national estimates of EMR use and corresponding estimates of sampling error (12). The NAMCS physician sample weight includes three basic components: 1) inflation by reciprocals of the sampling probabilities, 2) adjustment for physician nonresponse, and 3) a calibration ratio adjustment between the number of physicians in the sample frame between the time the sample was selected and the time that the NAMCS data were collected. Medical practice estimates were derived from NAMCS physician data by adjusting the weighting scheme using a multiplicity estimator. The number of

physicians in a practice was used to modify the physician weight to yield a practice weight (13). County-level estimates of population characteristics of the location of the physician’s practice were obtained from the Area Resource File (14). Statements of differences in estimates are based on statistical tests (e.g., chi-square tests of independence, students-*t*, or weighted linear regression) with significance at the  $p < 0.05$  level. Terms relating to differences such as “greater than” or “less than” indicate that the difference is statistically significant. A lack of comment regarding the difference does not mean that the difference was tested and found to be not significant.

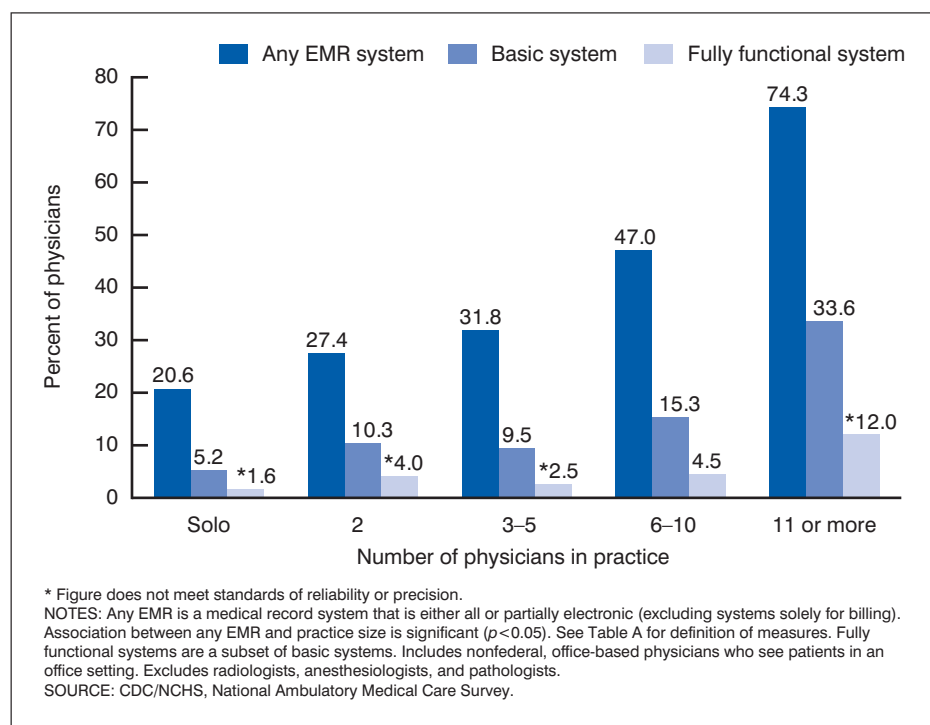
## Results

### Any EMR use

- Excluding systems used solely for billing, 34.8 percent of physicians (95% CI: 31.7–37.9) reported any EMR (all electronic or partially electronic medical records) in their office-based practice in 2007, representing a 19.2 percent increase since 2006 and a 91.2 percent



**Figure 1. Percentage of office-based physicians with electronic medical record (EMR) systems: United States, 2001–2007**



**Figure 2. Percentage of office-based physicians with electronic medical record (EMR) systems, by practice size: United States, 2007**

increase since 2001 (Figure 1). Most of this increase occurred from 2006 to 2007 among physicians using all electronic medical record systems. Use of all electronic medical record systems increased by 35.2 percent since 2006, from 14.5 percent in 2006 (6) to 19.6 percent in 2007 (Table 2). Use of partially electronic medical record systems (15.2 percent) in 2007 did not differ significantly from 2006 (14.8 percent).

- Any EMR use did not vary by physician gender or specialty type; however, it was inversely associated with physician age (Table 1). EMR use was more likely as the number of physicians in the practice increased, from 20.6 percent for solo physicians to 74.3 percent for physicians in practices of 11 or more physicians (Figure 2). EMR use was higher among physicians in multispecialty practices (52.5 percent) than those in solo or single-specialty practices (30.3 percent). EMR use was less likely among physicians with no managed care contracts (21.7 percent) compared with those with 3–10

contracts (29.3 percent) and 11 or more contracts (39.0 percent) (Table 1). Physicians in the Northeast (24.2 percent) were less likely to use EMRs than were those in the Midwest (35.6 percent), South (35.1 percent), and West (43.1 percent) (Table 1).

- EMR use was related to several practice characteristics. EMR use by physician-owned solo or group practices and community health centers was lower than the use by practices owned by health maintenance organizations (86.1 percent) and all other types of ownership (46.3 percent). Among physician-owned solo or group practices (31.4 percent), EMR use was not statistically different from use by community health center physicians (40.0 percent). Use of EMR systems did not vary by whether the practice was in a metropolitan statistical area.

### Basic systems

- In 2007, 11.8 percent of physicians reported having computerized systems

with features that met the definition of a basic system (95% CI: 9.6–13.9) (Table 1). The difference in percentage of physicians with basic systems in 2006 and 2007 was not statistically significant (Figure 1).

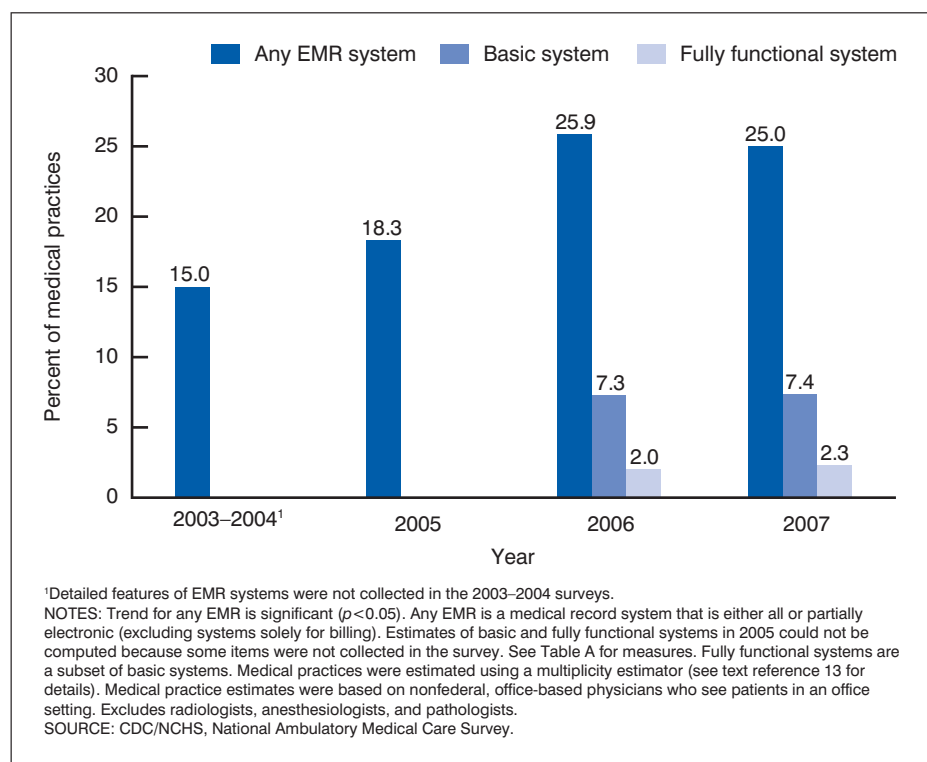
- Physician and practice characteristics associated with having basic systems were generally the same as those associated with having any EMR system with the following exception: female physicians were more likely than male physicians to have systems meeting the criteria for basic systems (Table 1).

### Fully functional systems

- In 2007, a subset of physicians who had basic systems had systems that met the criteria of fully functional systems (3.8 percent, 95% CI: 2.6–5.0) (Figure 1). The percentage of physicians using fully functional systems in 2007 was not statistically different from the comparable 2006 percentage (3.1 percent) (15). The small sample size resulted in many unreliable estimates and limited comparisons shown in Table 1.

### Features of computerized systems

- Table 2 presents specific features of computerized systems used by physicians. Percentages are provided for all physicians and for physicians using either all electronic or partially electronic medical record systems. In 2007, physicians were asked about computerized system features, regardless of their initial response to the question asking if they used an EMR system. The removal of the skip pattern in 2007 for EMR system features may account for the increased usage of every feature for all physicians compared with the percentage among all physicians in 2006 (6). For example, in 2007, 73.9 percent of all physicians reported having computerized systems with patient demographic information, whereas only 26.2 percent of all



**Figure 3. Percentage of medical practices with electronic medical record (EMR) systems: United States, 2003–2004 through 2007**

physicians in 2006 reported using an EMR system with that feature (6). When the analysis is limited to physicians using any EMR system in 2007, there is no difference in percentage of physicians having this feature (88.3 percent in 2006 compared with 91.9 percent in 2007—data not shown).

- Among physicians reporting that they use all electronic medical record systems, availability of each feature shown in Table 2 was similar to 2006 with the following exceptions: medical history and follow-up notes decreased by 12.1 percent, from 83.3 percent to 73.2 percent in 2007, and warning for drug interactions or contraindications decreased by 30.8 percent, from 66.2 percent to 45.8 percent in 2007 (6). Among physicians reporting that they use partially electronic medical record systems, availability of each EMR feature was similar to 2006 with the following exceptions: highlighting of out-of-range lab values increased by 43.3 percent, from 29.1 percent to 41.7 percent in 2007, and electronic

viewing of imaging results increased by 54.3 percent, from 34.1 percent to 52.6 percent in 2007 (6).

- For the most part, basic and fully functional systems are subsets of EMR systems as 92.8 percent of physicians with basic systems also reported using an EMR system and 95.8 percent of physicians with fully functional systems also reported using EMRs. However, a small percentage of physicians with basic (7.2 percent) and fully functional systems (4.2 percent) did not consider their systems to be EMR systems. As shown in Table 2, 30.0 percent of physicians not using EMRs reported having a system for viewing lab results, and 23.6 percent reported having a system for viewing imaging results. That some physicians reported not using EMRs, but had systems with certain features, may reflect differences in interpretation of what constitutes an EMR system.
- Similar to findings in 2006, Table 2 indicates that some computerized system features were either turned off or not used. The percentage of

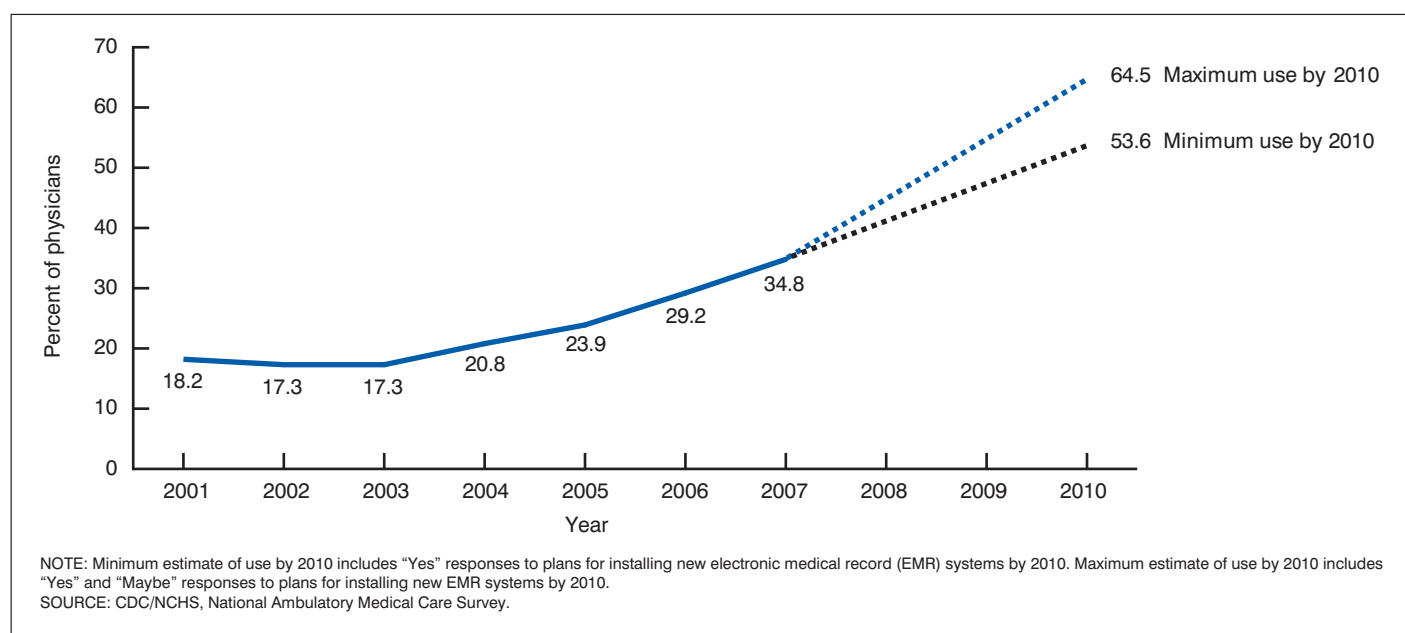
physicians reporting that any computerized system feature was available but turned off doubled in 2007, though the percentages remained small (4.7 percent compared with 2.3 percent in 2006) (6). Overall, 29.6 percent of all physicians reported having computerized systems for ordering prescriptions, but only 18.8 percent of all physicians reported having warnings for drug interactions or contraindications, and 16.0 percent of all physicians reported that prescriptions were sent to the pharmacy electronically.

## Practice-level estimates

- The percentage of medical practices that reported using any EMR system (25.0 percent) was similar to the 2006 estimate (25.9 percent) (Figure 3). The percentage of practices with systems meeting the criteria for a basic or fully functional system changed little during the same period (Figure 3).

## EMR systems plans for the future

- In 2007, 25.2 percent of all office-based physicians reported that they planned to install a new EMR system or replace their current system within the next 3 years, and 13.7 percent reported that they might do so (data not shown). Figure 4 presents projected percentages of physicians who may have an EMR system in 2010. These projections were derived by adding the number of physicians without EMR systems who planned to install systems within 3 years to 2007 EMR users. If physicians without an EMR system in 2007 install an EMR system by 2010 (18.8 percent of all physicians), 53.6 percent of all office-based physicians will be using some form of EMR system by 2010 (minimum estimate). In addition, if physicians without an EMR system who indicated that they might install an EMR system by 2010 actually do so (10.9 percent of all physicians), 64.5 percent of physicians will be



**Figure 4. Percentage of office-based physicians using any EMR system and projected 2010 use**

using EMR systems by 2010 (maximum estimate). These projected EMR adoption rates of 53.6 percent to 64.5 percent for 2010 based on 2007 data appear to be consistent with similar calculations for 2009 (47.0 percent to 59.5 percent) based on 2006 data (15).

## Discussion

Physicians who reported using any EMR (all electronic or partially electronic) system in 2007 increased by 19.2 percent from 2006, from 29.2 percent to 34.8 percent (Figure 1). Most of the increased use of EMR systems occurred among physicians using all electronic systems. From 2006 to 2007, the percentage of physicians who reported using all electronic medical record systems increased by 35.2 percent, from 14.5 percent to 19.6 percent. The percentage of medical practices using any EMR system from 2006 to 2007 did not change.

In 2007, nearly one of four physicians reported plans to install a new EMR system or replace an existing one within the next 3 years. If physicians without EMR systems with plans to install a new system by 2010

(18.8 percent of all physicians) actually do so, 53.6 percent to 64.5 percent of all office-based physicians will have EMR systems by 2010. The projected EMR adoption rates for 2010 based on 2007 data appear to be consistent with the 47.0 percent to 59.5 percent of all office-based physicians estimated to have EMR systems by 2009 based on 2006 data and similar assumptions (15).

Room for improvement in adoption and use of EMR systems continues. Only 20.6 percent of physicians in solo practice used any EMR system, a category that includes 30.7 percent of all office-based physicians. Use of any EMR system by physicians in the Northeast (24.2 percent) lagged behind physician use in other regions of the country (35.1 percent to 43.1 percent) (Table 1). The study confirmed previous research showing that not all computerized components available to physicians are used (11,16).

From 2006 to 2007, the percentage of physicians reporting that they do not use or turn off some available features doubled from 2.3 percent to 4.7 percent. Among physicians using all electronic medical record systems, the percentage who reported having warnings for drug interactions or contraindications

decreased by 30.8 percent from 2006 to 2007. This decrease may reflect a greater number of physicians using commercial software systems that lack these features.

This report also presents estimates of physician adoption of basic and fully functional EHRs (7,8). Using definitions similar to those developed by the expert panel, this study found that in 2007, 11.8 percent of physicians had systems with features that met the definition of a basic system, but only a subset of those with a basic system met the criteria of a fully functional system (3.8 percent of all physicians). These percentages did not differ significantly from those for 2006 (Figure 1). The 2007 estimates of physicians with basic and fully functional systems, however, may be more accurate than the 2006 estimates because the 2007 estimates include one additional item (patient problem list) that was not available in the 2006 NAMCS. The 2007 estimates also reflect more complete reporting by physicians with basic and fully functional systems, since 7.2 percent of physicians with basic systems reported that they did not use an EMR system, and 4.2 percent of physicians who had fully functional systems reported not

using EMRs. Further research is needed to understand these reporting differences.

The 2009 ARRA includes funding to promote the adoption and use of EHR systems by physicians and hospitals (2). Starting in 2011, physicians who can demonstrate meaningful use of interoperable “certified” EHRs may receive extra Medicare payments over a 5-year period (2). Alternatively, physicians with high volumes of Medicaid patients may apply for extra Medicaid payments. Although the definition of “meaningful use” is not yet finalized, it may include use of many of the EMR/EHR features examined here. “Interoperable” EHR systems are those that can exchange health information across provider settings (17). Although it is presently believed that few systems now include interoperability (18,19), ARRA includes funds to develop health information exchange capabilities at the regional and state levels (2). Given these incentives, changes in EHR adoption and use by physicians will continue to be an important research topic.

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**Table 1. Percent distribution of office-based physicians, and percentage with any electronic medical record (EMR) system, basic system, and fully functional system, by characteristics of physician or practice: United States, 2007**

| Physician or practice characteristic                                 | Percent distribution of all physicians (based on weighted responses from 1,743 sample physicians) | Percentage of physicians using any EMR system <sup>1</sup> (standard error) | Percentage of physicians having basic systems <sup>2</sup> (standard error) | Percentage of physicians having fully functional systems <sup>3</sup> (standard error) |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| All physicians <sup>4</sup>                                          | 100.0                                                                                             | 34.8 (1.6)                                                                  | 11.8 (1.1)                                                                  | 3.8 (0.6)                                                                              |
| Physician characteristic                                             |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Age of physician <sup>5,6</sup>                                      |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Under 35 years                                                       | 8.2                                                                                               | 47.9 (6.4)                                                                  | 18.8 (4.1)                                                                  | *5.8 (2.4)                                                                             |
| 35–44 years                                                          | 28.1                                                                                              | 41.1 (2.9)                                                                  | 17.9 (2.5)                                                                  | 6.2 (1.6)                                                                              |
| 45–54 years                                                          | 35.0                                                                                              | 34.0 (2.4)                                                                  | 9.0 (1.2)                                                                   | 3.5 (0.8)                                                                              |
| 55–64 years                                                          | 20.0                                                                                              | 28.7 (2.6)                                                                  | 8.1 (1.7)                                                                   | *1.3 (0.6)                                                                             |
| 65 years and over                                                    | 8.5                                                                                               | 19.3 (4.5)                                                                  | 5.2 (2.1)                                                                   | *0.6 (0.6)                                                                             |
| Unknown                                                              | *                                                                                                 | * ...                                                                       | — ...                                                                       | — ...                                                                                  |
| Physician specialty type <sup>7</sup>                                |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Primary care                                                         | 49.8                                                                                              | 34.7 (2.2)                                                                  | 14.5 (1.6)                                                                  | 4.7 (1.0)                                                                              |
| Surgical                                                             | 22.2                                                                                              | 36.5 (3.0)                                                                  | 10.7 (1.6)                                                                  | 3.9 (1.1)                                                                              |
| Medical                                                              | 28.1                                                                                              | 33.7 (2.9)                                                                  | 7.7 (1.4)                                                                   | *1.9 (0.6)                                                                             |
| Physician gender <sup>6</sup>                                        |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Male                                                                 | 74.7                                                                                              | 34.4 (1.8)                                                                  | 10.5 (1.1)                                                                  | 3.2 (0.7)                                                                              |
| Female                                                               | 25.3                                                                                              | 36.1 (2.7)                                                                  | 15.7 (2.1)                                                                  | 5.5 (1.5)                                                                              |
| Practice characteristic                                              |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Practice size (number of physicians) <sup>5,6</sup>                  |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Solo                                                                 | 30.7                                                                                              | 20.6 (2.3)                                                                  | 5.2 (1.0)                                                                   | *1.6 (0.6)                                                                             |
| 2                                                                    | 12.3                                                                                              | 27.4 (4.0)                                                                  | 10.3 (2.5)                                                                  | *4.0 (1.5)                                                                             |
| 3–5                                                                  | 29.9                                                                                              | 31.8 (3.1)                                                                  | 9.5 (1.7)                                                                   | *2.5 (0.8)                                                                             |
| 6–10                                                                 | 16.4                                                                                              | 47.0 (4.1)                                                                  | 15.3 (2.4)                                                                  | 4.5 (1.3)                                                                              |
| 11 or more                                                           | 10.6                                                                                              | 74.3 (4.2)                                                                  | 33.6 (5.8)                                                                  | *12.0 (4.1)                                                                            |
| Breadth of specialization <sup>5,6</sup>                             |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Solo and single-specialty                                            | 79.0                                                                                              | 30.3 (1.4)                                                                  | 9.7 (1.0)                                                                   | 3.0 (0.5)                                                                              |
| Multi-specialty                                                      | 20.6                                                                                              | 52.5 (4.0)                                                                  | 19.9 (3.7)                                                                  | *6.8 (2.3)                                                                             |
| Unknown                                                              | 0.4                                                                                               | * ...                                                                       | — ...                                                                       | — ...                                                                                  |
| Practice ownership <sup>5,6</sup>                                    |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Physician or physician group                                         | 80.6                                                                                              | 31.4 (1.8)                                                                  | 8.8 (1.0)                                                                   | 2.7 (0.6)                                                                              |
| Health maintenance organization (HMO)                                | 2.9                                                                                               | 86.1 (6.6)                                                                  | 49.0 (9.1)                                                                  | *27.1 (8.4)                                                                            |
| Community health center                                              | 3.5                                                                                               | 40.0 (8.3)                                                                  | *21.6 (8.7)                                                                 | *1.9 (1.7)                                                                             |
| Other <sup>8</sup>                                                   | 12.1                                                                                              | 46.3 (4.5)                                                                  | 20.6 (4.2)                                                                  | *5.9 (2.0)                                                                             |
| Unknown                                                              | *                                                                                                 | — ...                                                                       | — ...                                                                       | — ...                                                                                  |
| Number of managed care contracts <sup>5</sup>                        |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| None                                                                 | 11.7                                                                                              | 21.7 (3.8)                                                                  | *6.6 (1.9)                                                                  | *1.7 (1.1)                                                                             |
| 1–2                                                                  | 10.1                                                                                              | 47.6 (5.8)                                                                  | 18.3 (3.7)                                                                  | *10.0 (3.1)                                                                            |
| 3–10                                                                 | 31.4                                                                                              | 29.3 (2.6)                                                                  | 8.6 (1.6)                                                                   | *1.8 (0.7)                                                                             |
| 11 or more                                                           | 41.4                                                                                              | 39.0 (2.4)                                                                  | 13.8 (2.1)                                                                  | 3.6 (1.1)                                                                              |
| Unknown                                                              | 5.4                                                                                               | 39.0 (6.2)                                                                  | 14.4 (3.9)                                                                  | *8.6 (3.0)                                                                             |
| Percentage revenue from Medicaid                                     |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Under 5%                                                             | 36.8                                                                                              | 32.6 (3.1)                                                                  | 11.5 (1.6)                                                                  | *4.3 (1.3)                                                                             |
| 5%–19%                                                               | 29.7                                                                                              | 34.3 (3.0)                                                                  | 11.8 (1.6)                                                                  | 3.2 (0.8)                                                                              |
| 20% or more                                                          | 22.1                                                                                              | 34.7 (3.4)                                                                  | 10.6 (2.8)                                                                  | *1.6 (0.7)                                                                             |
| Unknown                                                              | 11.3                                                                                              | 43.4 (4.3)                                                                  | 15.0 (3.0)                                                                  | 7.8 (1.9)                                                                              |
| Geographic region <sup>5,6</sup>                                     |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Northeast                                                            | 20.1                                                                                              | 24.2 (3.3)                                                                  | 5.6 (1.5)                                                                   | 1.6 (0.5)                                                                              |
| Midwest                                                              | 21.2                                                                                              | 35.6 (3.2)                                                                  | 14.0 (2.6)                                                                  | *3.2 (1.0)                                                                             |
| South                                                                | 36.4                                                                                              | 35.1 (2.5)                                                                  | 11.2 (1.9)                                                                  | *3.3 (1.1)                                                                             |
| West                                                                 | 22.3                                                                                              | 43.1 (3.9)                                                                  | 16.1 (2.6)                                                                  | 7.0 (2.0)                                                                              |
| Metropolitan status                                                  |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Metropolitan statistical area                                        | 87.8                                                                                              | 35.0 (1.9)                                                                  | 11.9 (1.1)                                                                  | 4.2 (0.7)                                                                              |
| Not a metropolitan statistical area                                  | 12.2                                                                                              | 33.5 (5.8)                                                                  | *11.1 (5.0)                                                                 | *0.8 (0.6)                                                                             |
| Percent of county population that is non-Hispanic white <sup>9</sup> |                                                                                                   |                                                                             |                                                                             |                                                                                        |
| Over 75%                                                             | 37.7                                                                                              | 37.8 (2.9)                                                                  | 15.1 (2.1)                                                                  | 4.4 (1.2)                                                                              |
| 50%–75%                                                              | 35.2                                                                                              | 33.4 (2.5)                                                                  | 8.2 (1.5)                                                                   | *2.2 (0.6)                                                                             |
| Under 50%                                                            | 27.1                                                                                              | 32.5 (2.7)                                                                  | 11.9 (1.9)                                                                  | 4.9 (1.4)                                                                              |

\* Figure does not meet standards of reliability and precision.

... Category not applicable.

— Quantity zero.

<sup>1</sup>Refers to physicians reporting that their medical records are either all or partially electronic (excluding systems solely for billing). Percentages may be underestimates because physicians missing information on EMR use (2.1 percent) are assumed to not have an EMR system.<sup>2</sup>Features include patient demographic information, patient problem lists, clinical notes, orders for prescriptions, viewing lab results, and view imaging results; features that were available but

turned off were included.

<sup>3</sup>Features include patient demographic information, patient problem lists, clinical notes, medical history and follow-up notes, orders for prescriptions, warnings of drug interactions or contraindications, prescriptions sent electronically, orders for tests, tests sent electronically, viewing lab and imaging results, out-of-range test levels, electronic images returned, and reminders for guideline-based interventions. Fully functional systems are a subset of basic systems.

<sup>4</sup>Includes nonfederal, office-based physicians who see patients in an office setting. Excludes radiologists, anesthesiologists, and pathologists.

<sup>5</sup>Significant relationship between use of any EMR system and physician or practice characteristic based on chi-square test ( $p < 0.05$ ).

<sup>6</sup>Significant relationship between use of basic system and physician or practice characteristic based on chi-square test ( $p < 0.05$ ).

<sup>7</sup>Based on categorization of physician subspecialties obtained from the American Medical Association (see text reference 9).

<sup>8</sup>Includes medical or academic health center, other hospital, other health care corporation, and other.

<sup>9</sup>Based on U.S. Census Bureau data from the Area Resource File (see text reference 14).

**Table 2. Percentage of office-based physicians reporting selected computerized system features (and corresponding standard errors), and percentage reporting selected computerized system features by type of electronic medical record (EMR) system: United States, 2007**

| Features reported                                                   | All physicians <sup>1</sup><br>(standard error) | All electronic<br>medical records <sup>2</sup><br>(standard error) | Partially electronic<br>medical records <sup>3</sup><br>(standard error) | Does not use<br>EMRs or unknown <sup>4</sup><br>(standard error) |
|---------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------|
| Patient demographic information . . . . .                           | 73.9 (1.8)                                      | 94.0 (2.7)                                                         | 89.1 (2.0)                                                               | 64.3 (2.5)                                                       |
| Patient problem lists . . . . .                                     | 27.7 (1.5)                                      | 65.9 (4.0)                                                         | 43.7 (4.3)                                                               | 12.5 (1.3)                                                       |
| Clinical notes . . . . .                                            | 34.8 (1.4)                                      | 90.0 (3.2)                                                         | 62.5 (3.7)                                                               | 11.7 (1.3)                                                       |
| Medical history and follow-up notes . . . . .                       | 26.9 (1.4)                                      | 73.2 (4.1)                                                         | 51.7 (4.1)                                                               | 7.2 (1.0)                                                        |
| Guideline-based interventions or screening test reminders . . . . . | 25.9 (1.5)                                      | 66.6 (4.3)                                                         | 36.3 (3.7)                                                               | 11.2 (1.2)                                                       |
| View lab results. . . . .                                           | 44.8 (1.7)                                      | 82.3 (2.9)                                                         | 60.0 (4.0)                                                               | 30.0 (2.0)                                                       |
| Out-of-range values highlighted . . . . .                           | 29.9 (1.7)                                      | 54.0 (4.8)                                                         | 41.7 (3.8)                                                               | 19.8 (1.7)                                                       |
| View imaging results. . . . .                                       | 36.9 (1.6)                                      | 69.3 (3.3)                                                         | 52.6 (3.5)                                                               | 23.6 (1.8)                                                       |
| Electronic images returned . . . . .                                | 16.7 (1.0)                                      | 35.7 (4.3)                                                         | 24.2 (3.6)                                                               | 9.3 (1.2)                                                        |
| Orders for prescriptions . . . . .                                  | 29.6 (1.5)                                      | 77.9 (4.0)                                                         | 53.1 (3.3)                                                               | 9.6 (1.1)                                                        |
| Drug interactions or contraindications warned . . . . .             | 18.8 (1.3)                                      | 45.8 (3.6)                                                         | 34.8 (3.5)                                                               | 6.9 (1.0)                                                        |
| Prescriptions sent to pharmacy electronically . . . . .             | 16.0 (1.2)                                      | 41.9 (3.3)                                                         | 27.6 (3.5)                                                               | 5.5 (0.9)                                                        |
| Orders for tests. . . . .                                           | 28.5 (1.4)                                      | 69.6 (3.1)                                                         | 46.9 (3.8)                                                               | 11.9 (1.3)                                                       |
| Test orders sent electronically . . . . .                           | 16.7 (1.2)                                      | 42.1 (3.5)                                                         | 25.1 (3.2)                                                               | 7.1 (1.0)                                                        |
| Public health reporting . . . . .                                   | 13.8 (1.1)                                      | 32.4 (4.5)                                                         | 19.0 (2.7)                                                               | 7.0 (1.0)                                                        |
| Notifiable diseases sent electronically . . . . .                   | 6.1 (0.8)                                       | 14.2 (2.4)                                                         | 9.7 (2.0)                                                                | 2.8 (0.6)                                                        |

<sup>1</sup>Based on responses from 1,743 physicians. Includes nonfederal, office-based physicians who see patients in an office setting. Excludes radiologists, anesthesiologists, and pathologists.

<sup>2</sup>Based on 343 sampled physicians reporting use of all electronic medical records (19.6 percent of physicians, weighted by sample weight). See "Methods" section for description of sample weight.

<sup>3</sup>Based on 283 sampled physicians reporting use of partially electronic medical records (15.2 percent of physicians, weighted by sample weight). See "Methods" section for description of sample weight.

<sup>4</sup>Based on 1,117 physicians reporting no EMRs or missing information on EMRs.

NOTE: Specific features are reported as available even if they were turned off. Basic system features include patient demographic information, patient problem lists, clinical notes, orders for prescriptions, viewing lab results, and view imaging results. Fully functional system features include patient demographic information, patient problem lists, clinical notes, medical history and follow-up notes, orders for prescriptions, warnings of drug interactions or contraindications, prescriptions sent electronically, orders for tests, tests sent electronically, viewing lab and imaging results, out-of-range test levels, and reminders for guideline-based interventions. Fully functional systems are a subset of basic systems.

## Technical Notes

**Table. Percentage of office-based physicians having minimally functional electronic record systems, by characteristics of office-based physicians: United States, 2007**

| Physician or practice characteristic                                 | Percent of physicians having minimally functional systems <sup>1</sup> (standard error) |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| All physicians <sup>2</sup> . . . . .                                | 17.4 (1.2)                                                                              |
| Physician characteristic                                             |                                                                                         |
| Age of physician <sup>3</sup>                                        |                                                                                         |
| Under 35 years . . . . .                                             | 36.4 (5.0)                                                                              |
| 35–44 years . . . . .                                                | 22.1 (2.8)                                                                              |
| 45–54 years . . . . .                                                | 15.5 (1.7)                                                                              |
| 55–64 years . . . . .                                                | 12.0 (1.9)                                                                              |
| 65 years and over . . . . .                                          | 4.1 (1.5)                                                                               |
| Unknown . . . . .                                                    | — . . .                                                                                 |
| Physician specialty type <sup>3,4</sup>                              |                                                                                         |
| Primary care . . . . .                                               | 20.3 (1.8)                                                                              |
| Surgical . . . . .                                                   | 16.7 (2.1)                                                                              |
| Medical . . . . .                                                    | 12.8 (1.7)                                                                              |
| Physician gender <sup>3</sup>                                        |                                                                                         |
| Male . . . . .                                                       | 15.3 (1.2)                                                                              |
| Female . . . . .                                                     | 23.4 (2.5)                                                                              |
| Practice characteristic                                              |                                                                                         |
| Practice size (number of physicians) <sup>3</sup>                    |                                                                                         |
| Solo . . . . .                                                       | 7.9 (1.3)                                                                               |
| 2 . . . . .                                                          | 12.3 (2.8)                                                                              |
| 3–5 . . . . .                                                        | 17.1 (2.2)                                                                              |
| 6–10 . . . . .                                                       | 23.8 (2.8)                                                                              |
| 11 or more . . . . .                                                 | 41.8 (5.1)                                                                              |
| Breadth of specialization <sup>3</sup>                               |                                                                                         |
| Solo and single-specialty . . . . .                                  | 15.3 (1.2)                                                                              |
| Multi-specialty . . . . .                                            | 25.0 (2.9)                                                                              |
| Unknown . . . . .                                                    | * —                                                                                     |
| Practice ownership <sup>3</sup>                                      |                                                                                         |
| Physician or physician group . . . . .                               | 14.3 (1.2)                                                                              |
| Health maintenance organization (HMO) . . . . .                      | 83.2 (6.9)                                                                              |
| Community health center . . . . .                                    | *21.4 (8.4)                                                                             |
| Other <sup>5</sup> . . . . .                                         | 22.1 (3.6)                                                                              |
| Unknown . . . . .                                                    | — . . .                                                                                 |
| Number of managed care contracts <sup>3</sup>                        |                                                                                         |
| None . . . . .                                                       | 9.5 (2.3)                                                                               |
| 1–2 . . . . .                                                        | 31.6 (5.2)                                                                              |
| 3–10 . . . . .                                                       | 12.4 (1.8)                                                                              |
| 11 or more . . . . .                                                 | 19.4 (1.8)                                                                              |
| Unknown . . . . .                                                    | 22.1 (5.0)                                                                              |
| Percent revenue from Medicaid                                        |                                                                                         |
| Under 5% . . . . .                                                   | 17.1 (1.9)                                                                              |
| 5%–19% . . . . .                                                     | 17.4 (2.3)                                                                              |
| 20% or more . . . . .                                                | 16.1 (2.4)                                                                              |
| Unknown . . . . .                                                    | 20.8 (3.4)                                                                              |
| Geographic region <sup>3</sup>                                       |                                                                                         |
| Northeast . . . . .                                                  | 6.9 (1.5)                                                                               |
| Midwest . . . . .                                                    | 17.3 (2.3)                                                                              |
| South . . . . .                                                      | 17.5 (2.2)                                                                              |
| West . . . . .                                                       | 26.7 (3.0)                                                                              |
| Metropolitan status                                                  |                                                                                         |
| Metropolitan statistical area . . . . .                              | 18.0 (1.2)                                                                              |
| Not a metropolitan statistical area . . . . .                        | 13.2 (3.2)                                                                              |
| Percent of county population that is non-Hispanic white <sup>6</sup> |                                                                                         |
| Over 75% . . . . .                                                   | 18.9 (2.1)                                                                              |
| 50%–75% . . . . .                                                    | 14.3 (1.7)                                                                              |
| Under 50% . . . . .                                                  | 19.2 (2.6)                                                                              |

— Quantity zero. . . . . Category not applicable. \* Figure does not meet standards of reliability or precision.

<sup>1</sup>Include computerized prescription ordering, computerized test ordering, test results (lab or imaging), and clinical notes; features that were available but turned off were included.

<sup>2</sup>Includes nonfederal, office-based physicians who see patients in an office setting. Excludes radiologists, anesthesiologists, and pathologists.

<sup>3</sup>Significant relationship between use of minimally functional system and physician or practice characteristic based on chi-square test ( $p < 0.05$ ).

<sup>4</sup>Based on categorization of physician subspecialties obtained from the American Medical Association (see text reference 9).

<sup>5</sup>Includes medical or academic health center, other hospital, other health care corporation, and other.

<sup>6</sup>Based on U.S. Census Bureau data from the Area Resource File (see text reference 14).

|                                                                                                                     |  |  |  |  |                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>21a. Does your practice use electronic MEDICAL RECORDS (not including billing records)?</b>                      |  |  |  |  | 1 <input type="checkbox"/> Yes, all electronic<br>2 <input type="checkbox"/> Yes, part paper and part electronic<br>3 <input type="checkbox"/> No<br>4 <input type="checkbox"/> Don't know                                                                                                           |
| <b>b. Does your practice have a computerized system for –</b>                                                       |  |  |  |  | Yes      No      Unknown      Turned off                                                                                                                                                                                                                                                             |
| <b>(1) Patient demographic information? . . . . .</b>                                                               |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Does this include patient problem lists?</i>                                                   |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(2) Orders for prescriptions? . . . . .</b>                                                                      |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Are there warnings of drug interactions or contraindications provided?</i>                     |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(b) Are prescriptions set electronically to the pharmacy?</b>                                                    |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(3) Orders for tests? . . . . .</b>                                                                              |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Are orders sent electronically?</i>                                                            |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(4) Viewing Lab results? . . . . .</b>                                                                           |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Are out of range levels highlighted?</i>                                                       |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(5) Viewing Imaging results? . . . . .</b>                                                                       |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Are electronic images returned?</i>                                                            |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(6) Clinical notes? . . . . .</b>                                                                                |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Do they include medical history and follow up notes?</i>                                       |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(7) Reminders for guideline-based interventions and/or screening tests? . . . . .</b>                            |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>(8) Public health reporting? . . . . .</b>                                                                       |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <i>If Yes, ask – (a) Are notifiable diseases sent electronically?</i>                                               |  |  |  |  | 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/>                                                                                                                                                                                          |
| <b>22. Are there any of the above features of your system that you do NOT use or have turned off?</b>               |  |  |  |  | 1 <input type="checkbox"/> Yes – Please specify <br><br><b>FR NOTE</b> – Indicate in item 21b, last column, any component(s) turned off.<br>2 <input type="checkbox"/> No<br>3 <input type="checkbox"/> Unknown |
| <b>23. Are there plans for installing a new EMR system or replacing the current system within the next 3 years?</b> |  |  |  |  | 1 <input type="checkbox"/> Yes<br>2 <input type="checkbox"/> No<br>3 <input type="checkbox"/> Maybe<br>4 <input type="checkbox"/> Unknown                                                                                                                                                            |

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**National Center for Health Statistics**

Edward J. Sondik, Ph.D., *Director*  
Jennifer H. Madans, Ph.D., *Associate Director for Science*

**Division of Health Care Statistics**

Jane E. Sisk, Ph.D., *Director*

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**U.S. DEPARTMENT OF  
HEALTH & HUMAN SERVICES**

Centers for Disease Control and Prevention  
National Center for Health Statistics  
3311 Toledo Road  
Hyattsville, MD 20782

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