POLICY

Trends in Public Perceptions of Electronic Health Records During Early Years of Meaningful Use

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ABSTRACT

Objectives: The proportion of US doctors using electronic health records (EHRs) has risen sharply in response to the federal Meaningful Use (MU) program, which incentivizes EHR adoption. To track consumer perceptions of EHRs during this period, we conducted a national telephone survey annually for 3 consecutive years, from 2011 to 2013, corresponding with the early years of MU.

Study Design: Nationwide random digit-dial survey.

Methods: The survey used random digit-dial sampling on a dual frame of landline and cell phone numbers in the continental United States, but was not otherwise stratified by geographic region, race, or other variables. Because our primary goal was to identify relationships between variables and EHR attitudes, we constructed post hoc survey weights to align all 3 samples with each other. Relationships between sociodemographics and EHR questions were assessed with logistic regression models using the survey weights. Cross-year comparisons were conducted with χ^2 tests and Cochran-Armitage tests for linear trend.

Results: Between 2011 and 2013, the proportion of respondents with a doctor who used an EHR rose from 64% to 71%. In 2011, 64% endorsed the belief that EHRs would improve healthcare quality, dropping to 62% by 2013. Simultaneously, the proportion concerned about the effects of EHRs on privacy dropped from 48% to 41%. Consumers whose doctors used EHRs were generally more likely to believe EHRs would improve healthcare quality and less concerned about privacy risks than those whose doctors did not use EHRs.

Conclusions: Overall, we conclude that during the early years of the MU program, exposure to EHRs increased while confidence in the benefits of EHRs and concerns about privacy risks became less marked. The subset of people exposed to EHRs via their physicians continued to have more positive attitudes toward them than those without that exposure. These attitudinal trends may be linked to increased familiarity with health information technology.

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Since the passage of the Health Information Technology for Economic and Clinical Health Act (HITECH) in 2009, the federal government has invested billions of dollars to promote the adoption of the electronic health record (EHR) through the Meaningful Use program (MU).[1] The long-term goal of this program is to improve the quality and safety of healthcare.[1] Since the launch of MU, the prevalence of EHRs has increased dramatically, with about 72% of ambulatory physicians and 44% of acute care hospitals using some form of EHR as of 2012.[2-4]

National and regional surveys conducted before and in the early years of MU generally suggest that consumers believe EHRs are likely to improve healthcare.[5-8] We recently found that most consumers think that EHRs will improve healthcare, and positive opinions were even more common among those who said their doctors use EHRs.[6] However, a relatively large percentage of respondents (18%) did not know whether their physicians used EHRs.[6]

Despite this overall positive perception of EHRs, consumers express strong concerns about the security of their electronic medical data.[6,8] Privacy concerns are generally associated with lower confidence that EHRs will improve healthcare[6,8] and with an increased level of concern about personal medical data breaches.[8] Agaku and colleagues recently reported that about 12% of patients have withheld health information from doctors out of concern about the privacy of electronic data.[9] Privacy concerns are also common with regard to health information technologies (ITs) that support the electronic exchange of medical records between healthcare providers (ie, health information exchange).[5,8,10,11] Our objective was to track national consumer perceptions of quality effects and privacy risks associated with EHRs over a 3-year period (2011-2013), corresponding with the early years of MU.

Take-Away Points

- Between 2011 and 2013—the early years of the Meaningful Use electronic health record (EHR) incentive program—surveys found a drop in the number of consumers who believed that EHRs would improve healthcare quality, as well as in the number who expressed concern about the effects of EHRs on privacy.
- Consumers whose doctors used EHRs were generally more likely to believe EHRs would improve healthcare and less concerned about privacy risks than those whose doctors did not use EHRs.

METHODS

The Cornell National Social Survey is an annual random digit-dial telephone survey conducted by the Cornell Survey Research Institute. Every year, the sample size of 1000 provides a margin of error of ± 3.1 percentage points. The Cornell University Institutional Review Board approved the study and respondents provided oral consent.

Sampling Strategy

Each year's sample is a random digit-dial sampling conducted on a dual frame of landline and cell phone numbers in the continental United States, but not otherwise stratified by geographic region, race, or other variables. The proportion of cell phone numbers is calculated from county-level data on prevalence of cell phone-only households. Listed and unlisted numbers are included in the sample list, but known business, disconnected, and nonhousehold numbers are excluded. When the telephone is answered, the adult with the most recent birthday is interviewed—a technique that ensures each adult has an equal chance of selection.[12]

Survey Development and Administration

Researchers may submit potential questions for inclusion in the survey, which are competitively reviewed by the Cornell Survey Research Institute. Three questions about EHRs were included for 3 consecutive years: 2011, 2012, and 2013. The questions, adapted from previous surveys[7,11,13] were:

1. An electronic medical record is a computer-based version of the patient's medical record. Does your doctor use an electronic medical record for you? (Answer options: yes/no/not sure/have no doctor.)

2. If doctors used electronic medical records instead of paper records, how do you think that would affect the quality of medical care? (Answers were based on a 5-point Likert scale from "greatly improve it" to "greatly worsen it"; midpoint at "no effect.")

3. If doctors used electronic medical records instead of paper records, how do you think that would affect the privacy and security of medical information? (Answers were based on a 5-point Likert scale from "greatly improve it" to "greatly worsen it"; midpoint at "no effect.")

No additional explanation was provided for the questions.

For the definition of an EHR, we deliberately used the label "electronic medical record" and wording similarly used by the California Healthcare Foundation so that our findings would be comparable with their 2010 survey, which reported that about 26% of consumers had physicians using an EHR.[14]

The survey was conducted in English only, and data collection closed in November or December of each year. Survey administration took approximately 20 to 25 minutes.

Analysis

Exploratory comparisons of our samples with national census data suggested that respondents were representative in terms of gender distribution, age, and employment status, but were somewhat more educated, affluent, white, and non-Hispanic, most likely due to differential response rates in different populations. Because our primary goal was not to estimate strength of support for EHRs nationally, but rather to identify relationships between variables and EHR attitudes, we opted not to construct post hoc survey weights to bring the sample closer to national distributions on all demographics. Instead, we constructed post hoc survey weights to align all 3 samples with each other. This ensures that year-to-year differences cannot be attributed to random variation in demographics from sample to sample. The normalized survey weights corrected for slight differences in the distribution of education and income from year to year. Two individuals were excluded for missing demographics, leaving a total sample size of 2998 over the 3 years. We report the weighted frequencies and percents. Relationships between sociodemographics and EHR questions were assessed with logistic regression models using the survey weights. Cross-year comparisons were conducted with χ^2 tests and Cochran-Armitage tests for linear trend. Analyses were conducted in SAS version 9.3 (SAS Institute, Cary, North Carolina).

RESULTS

Each year, 67.1% to 71.4% of eligible respondents reached by telephone consented to participate (the "cooperation rate" according to American Association of Public Opinion Research definitions[15]). The samples were repre-

Table 1. Characteristics of Survey Respondents

Characteristics	Frequency, All Years	
	Weighted n	%
Age, years		
<40	991	33.4
40-65	1435	48.4
≥65	536	18.1
Gender, female	1514	50.5
Married	1736	58.1
Child in house	1053	35.2
Education		
≤High school graduate	727	24.3
Some college	836	27.9
≥College graduate	1427	47.7
Hispanic/Latino	222	7.4
Race		
White	2510	84.2
Black	357	12.0
Household income		
<$50,000	1121	38.4
$50,000 to <$100,000	978	32.6
≥$100,000	793	26.5
Employment status		
Employed	1854	61.9
Unemployed	456	15.2
Disabled/unable to work	164	5.5
Retired	521	17.4
Political orientation		
Moderate	1073	36.5
Liberal	878	29.9
Conservative	989	33.6
Use Internet/e-mail daily	2295	77.1
Self-rated health		
Good to excellent	2596	86.6
Fair to poor	400	13.4

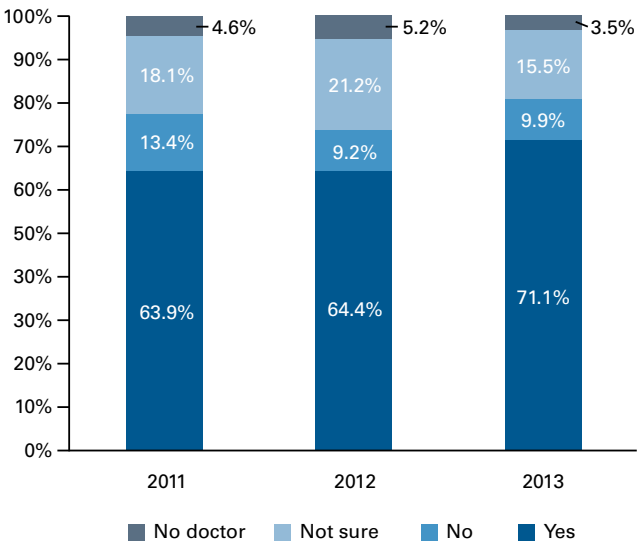
Percents may not total 100 due to rounding and missing data.

sentative of the US population in terms of age, sex, and employment, but whites, non-Hispanics, and well-educated respondents were somewhat overrepresented (Table 1).

Cross-Year Comparisons

The proportion reporting a doctor using an EHR rose over time (63.9% in 2011 to 71.1% in 2013; $P = .001$) (Figure 1). The proportion endorsing the belief that EHRs would improve healthcare quality decreased modestly from 64% in 2011 to 61.5% in 2013, while the percentage of those

Figure 1. Responses to: "Does your doctor use an electronic medical record for you?"



who believed EHRs would worsen healthcare quality rose from 7% to 8.7% (Figure 2). The proportion believing EHRs would have no effect on quality rose from 25.5% to 29.6% over the same time period (test for linear trend, $P = .009$). The proportion expressing concerns that EHRs would worsen privacy and security decreased from 47.5% in 2011 to 41.2% in 2013 (test for linear trend, $P = .02$) (Figure 3). More than one-fifth of respondents believed that EHRs would actually improve privacy and security.

Within-Year Comparisons

In every year, the belief that EHRs would improve healthcare quality was more common among wealthier individuals, those who were employed, and those who used the Internet daily (Table 2). In addition, this belief was significantly less common among individuals concerned that EHRs would worsen privacy and security. Respondents who reported having a doctor that uses an EHR were more likely to believe EHRs would improve healthcare quality, although the effect narrowly missed statistical significance in 2013. In the first 2 years of the survey, college graduates were less concerned about privacy and security, but in the final year they became more likely than other respondents to express concerns (Table 3).

In addition to college graduates, concerns about the effect of EHRs on privacy and security were consistently less common among individuals whose physician used an EHR. However, this concern was significantly more common among individuals who identified themselves as politically conservative.

Figure 2. Responses to: "If doctors used electronic medical records instead of paper records, how do you think that would affect the quality of medical care?"

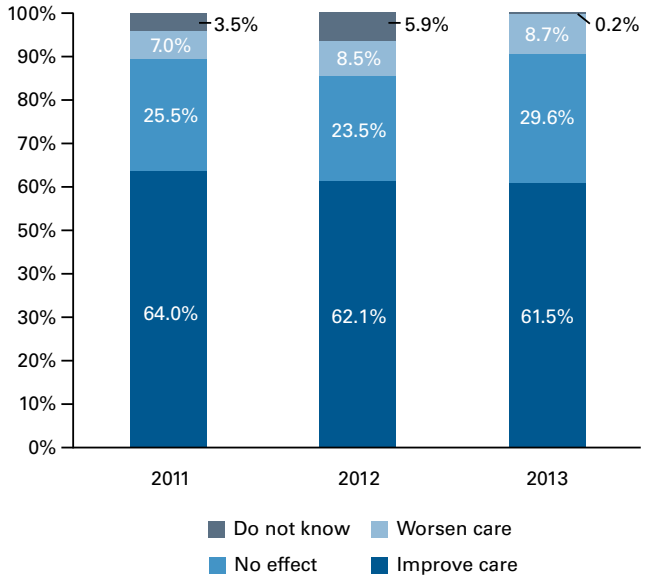
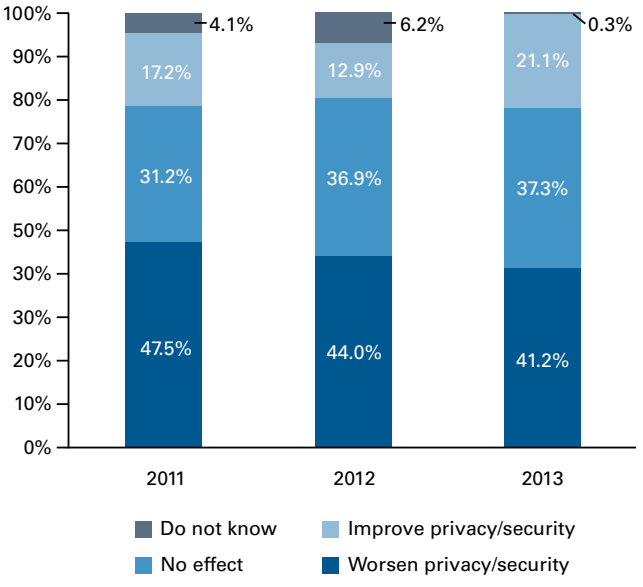


Figure 3. Responses to: "If doctors used electronic medical records instead of paper records, how do you think that would affect the privacy and security of medical information?"



DISCUSSION

During a 3-year period in which Americans became more likely to report seeing doctors who use EHRs, there were modest but statistically significant decreases in both optimism about EHR effects on quality and concerns about EHR-related privacy and security risks. Familiarity with a doctor using an EHR was generally positively associated with the belief that EHRs would improve healthcare quality as well as with less concern about EHR risks to privacy. Our 3-year trend results show an association between EHR exposure and perception of quality benefits that is consistent with prior national surveys over shorter timelines.[6,8]

As national discourse about the positive and negative aspects of EHRs continues, consumers may be forming their opinions on the basis of a variety of sources of information. Both positive and negative perspectives have been publicized in the media; in addition, physicians may talk to their patients about their enthusiasm for or frustration with EHRs. Finally, more consumers have had a personal experience with a doctor using an EHR—some of whom may have felt that the computer made the visit more impersonal (as shown in a Veterans Administration patient survey[16]), whereas others may have noticed improvements in physician communication skills (demonstrated in a small study of young physicians[17]).

Despite significant overall decreases in concerns about privacy and security, the perceived risks in these areas were negatively associated with the perceived benefits of EHRs. Thus, consumers who were more concerned with EHR-related privacy and security risks were less likely to perceive EHRs as likely to benefit quality of care. It is logically possible for quality benefits to be independent of privacy risks—for example, an EHR could support more personalized care, and yet it could also be hacked—but it is well-established that perceived benefits of almost any activity tend to decrease as its perceived risks grow.[18-20] As a result, it is likely that privacy concerns may be one of the causes of lower perceived benefits and, therefore, explicitly addressing consumer privacy concerns would lead to a more positive view of EHRs overall.

Awareness of medical data breaches has likely risen since 2009 when federal regulations first mandated that large breaches be reported to news media and to the HHS.[21] The number of data breaches publicly reported recently reached 1000, affecting nearly 32 million Americans.[22] Contact from healthcare organizations or news stories about these breaches (eg, the *Wall Street Journal*'s summary of multiple data breaches[23]) could be raising public awareness of threats to privacy and security. It is also noteworthy that Edward Snowden's revelations about National Security Agency (NSA) surveillance of electronic communication[24] occurred in June 2013, several months before the third year of data

Table 2. Factors Associated With Perceived Effect of EHRs on Healthcare Quality

Characteristic	Association With Belief EHRs Will Improve Healthcare Quality: OR (95% CI)		
	2011	2012	2013
Age, years			
<40	Reference	Reference	Reference
40-64	0.82 (0.60-1.13)	0.75 (0.55-1.03)	0.78 (0.58-1.05)
≥65	**0.47 (0.31-0.70)**	0.76 (0.50-1.15)	**0.60 (0.42-0.88)**
Gender, female	0.95 (0.72-1.24)	0.94 (0.72-1.24)	0.99 (0.76-1.30)
Married	1.20 (0.91-1.58)	1.06 (0.80-1.40)	1.07 (0.82-1.40)
Child in house	1.05 (0.79-1.40)	1.18 (0.88-1.58)	1.01 (0.77-1.33)
Education			
≤High school graduate	Reference	Reference	Reference
Some college	**1.47 (1.02-2.11)**	1.36 (0.94-1.98)	1.22 (0.85-1.74)
≥College graduate	**2.21 (1.59-3.08)**	**2.58 (1.82-3.65)**	**1.86 (1.34-2.57)**
Hispanic/Latino	0.65 (0.39-1.10)	1.11 (0.65-1.91)	1.31 (0.80-2.13)
Race, black	1.08 (0.73-1.60)	1.24 (0.81-1.89)	0.86 (0.58-1.29)
Household income			
<$50,000	Reference	Reference	Reference
$50,000 to <$100,000	1.31 (0.59-1.80)	**1.67 (1.22-2.28)**	1.17 (0.86-1.58)
≥$100,000	**1.76 (1.24-2.50)**	**2.09 (1.43-3.05)**	**1.46 (1.04-2.02)**
Employment			
Employed	Reference	Reference	Reference
Unemployed	0.82 (0.55-1.23)	0.90 (0.62-1.32)	0.90 (0.60-1.35)
Disabled	0.57 (0.30-1.10)	**0.37 (0.21-0.64)**	1.74 (0.94-3.22)
Retired	**0.63 (0.45-0.88)**	0.76 (0.52-1.10)	**0.65 (0.44-0.96)**
Political orientation			
Moderate	Reference	Reference	Reference
Liberal	1.07 (0.76-1.51)	**1.73 (1.20-2.48)**	**1.49 (1.07-2.07)**
Conservative	0.76 (0.56-1.05)	1.08 (0.77-1.50)	0.96 (0.69-1.32)
Uses Internet daily	**2.18 (1.61-2.96)**	**3.16 (2.29-4.38)**	**1.73 (1.66-2.36)**
Good/excellent health	**1.52 (1.03-2.24)**	1.22 (0.82-1.83)	1.23 (0.83-1.83)
Doctor uses EHR	**1.91 (1.45-2.52)**	**1.67 (1.26-2.22)**	1.31 (0.98-1.74)
Believes EHRs will worsen privacy	**0.47 (0.35-0.62)**	**0.52 (0.39-0.68)**	**0.50 (0.38-0.66)**

EHR indicates electronic health record; OR, odds ratio.
Bolding indicates statistically significant ORs (those in which the CI did not cross 1).

collection. It is possible that prominent news stories such as these could be linked to the change we observed in the opinions of college graduates, who were less likely to be concerned about EHR privacy threats in 2011 and 2012, but became significantly more likely to be concerned the following year. Additionally, a 2014 Harris poll has linked increased caution online to awareness of NSA digital surveillance.[25]

Nevertheless, in spite of these privacy concerns by many consumers, a substantial minority of respondents (up to 21% in our data) perceived health IT as a way to improve privacy and security.[11] These consumers may believe electronic protections to be stronger than the protections for paper records or they may have had negative experiences with paper records.

Limitations

Random digit-dial surveys have limitations, including sampling coverage and nonresponse bias.[26] One advantage of dual-frame methodology is the inclusion of cell phone households, which is particularly more inclusive of younger demographics than a landline-only survey.[26] The sampling strategy was random, so we did not apply

Table 3. Factors Associated With Perceived Effect of EHRs on Privacy and Security

	Association With Belief EHRs Will Worsen Privacy/Security: OR (95% CI)		
Characteristic	**2011**	**2012**	**2013**
Age, years			
<40	Reference	Reference	Reference
40-64	1.21 (0.90-1.62)	1.22 (0.91-1.64)	1.16 (0.87-1.54)
≥65	1.26 (0.85-1.87)	0.76 (0.51-1.14)	0.82 (0.57-1.20)
Gender, female	0.84 (0.65-1.08)	0.83 (0.64-1.08)	0.92 (0.70-1.19)
Married	0.90 (0.69-1.17)	1.12 (0.86-1.47)	0.93 (0.71-1.22)
Child in house	1.00 (0.77-1.31)	**1.35 (1.02-1.77)**	0.94 (0.72-1.24)
Education			
≤High school graduate	Reference	Reference	Reference
Some college	1.14 (0.80-1.63)	0.83 (0.58-1.20)	1.43 (0.99-2.07)
≥College graduate	**0.72 (0.52-0.99)**	**0.66 (0.47-0.92)**	**1.52 (1.10-2.11)**
Hispanic/Latino	1.78 (1.05-3.01)	1.26 (0.76-2.10)	1.32 (0.83-2.13)
Race, black	1.29 (0.89-1.88)	0.69 (0.45-1.05)	0.65 (0.43-0.98)
Household income			
<$50,000	Reference	Reference	Reference
$50,000 to <$100,000	0.92 (0.68-1.25)	0.76 (0.56-1.02)	1.01 (0.74-1.36)
≥$100,000	0.85 (0.61-1.17)	**0.61 (0.43-0.87)**	1.04 (0.75-1.42)
Employment			
Employed	Reference	Reference	Reference
Unemployed	0.79 (0.54-1.16)	0.94 (0.65-1.34)	1.03 (0.69-1.52)
Disabled	0.94 (0.50-1.77)	1.41 (0.81-2.46)	0.75 (0.43-1.31)
Retired	1.01 (0.72-1.41)	0.86 (0.60-1.24)	**0.65 (0.44-0.97)**
Political orientation			
Moderate	Reference	Reference	Reference
Liberal	0.78 (0.57-1.08)	0.81 (0.58-1.13)	0.95 (0.69-1.32)
Conservative	**1.34 (0.99-1.82)**	**1.67 (1.21-2.30)**	**1.61 (1.16-2.24)**
Uses Internet daily	**0.55 (0.40-0.75)**	0.74 (0.54-1.02)	1.03 (0.75-1.41)
Good/excellent health	1.10 (0.75-1.61)	0.98 (0.67-1.15)	1.29 (0.87-1.91)
Doctor uses EHR	**0.70 (0.54-0.92)**	**0.70 (0.53-0.92)**	**0.69 (0.52-0.92)**

EHR indicates electronic health record; OR, odds ratio.
Bolding indicates statistically significant ORs (those in which the CI did not cross 1).

survey weights in order to match demographic characteristics of the country. As a result, although our sample was fairly representative in gender, age, and employment, our respondents were somewhat more educated and affluent, more likely to be white, and less likely to be Hispanic than the national population—most likely because of differential response rates. The questions in the survey have not been validated. The use of the term "electronic medical record" in the survey does not reflect the national consensus that "electronic health record" is the most accurate term for describing contemporary IT with certain capacities for interoperability. On the other hand, it is not clear that the general public makes a distinction between these terms, and we sought to minimize any confusion by providing a brief definition of the term—"an electronic medical record is a computer-based version of the patient's medical record"—in the question stem. Lastly, the study design was cross-sectional, so association does not imply causation.

CONCLUSIONS

During the launch and early years of the MU program, Americans became more likely to report having a physician who used an EHR. Individuals whose doctors used

EHRs tended to have more positive opinions of EHRs. Nevertheless, over the 3-year study time frame, both confidence in the benefits of EHRs and concerns about privacy risks became less marked overall, a pair of trends that might be attributed to increased familiarity with health IT. Opinions on electronic privacy threats remain split, with a plurality expressing privacy concerns about EHRs —a concern generally linked to lower perceived benefit— along with a substantial minority believing that EHRs will improve medical privacy and security.

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