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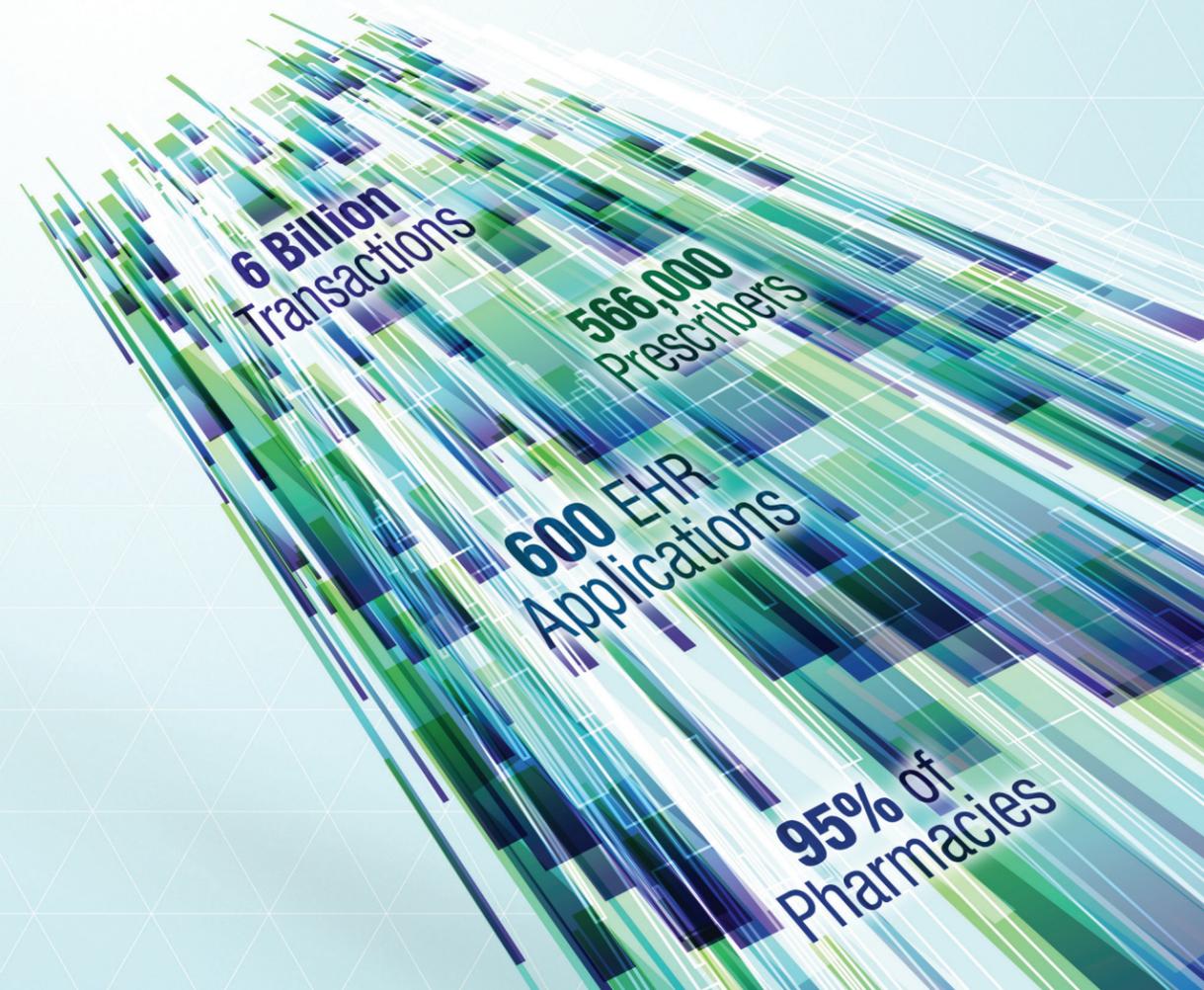
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2013 NATIONAL PROGRESS REPORT AND SAFE-Rx RANKINGS



Surescripts was founded in 2001 with a mission to eliminate paper prescriptions and deliver important medical information electronically. Just as we've witnessed continued growth in e-prescribing, so too have we seen the complexity of the healthcare system multiply, while patients and providers demand easier access to health information. Today, we have the assets and the experience that are needed to enable the electronic exchange of a diverse range of health information.

- We operate the network and build the relationships that enable vital information to flow freely and securely to the right place at the right time.
- We see American healthcare as a collection of disparate parts, each powerful in its own way, but whose collective potential has yet to be tapped.

- We know that people and organizations working together, across silos, will make healthcare more efficient, more effective and easier to navigate.
- We believe that healthcare is inextricably linked to technology, and if technology improves, healthcare will improve with it.

AS OF THE END OF 2013, SURESCRIPTS CONNECTS:

- 566,000 prescribers
- 95% of community pharmacies
- More than 400 hospitals and IDNs
- More than 70% of physicians
- More than 600 EHR applications
- 43 state immunization registries
- 21 health information exchanges (HIEs) and health information service providers (HISPs)

Our purpose is to connect fragmented healthcare into a coherent whole to enable more efficient and effective healthcare. Each day, our work touches upon a wide range of people, processes and products rooted in our three core capabilities:

CONNECT: We connect to the broadest community of care partners. Surescripts helps improve care collaboration, saving time and resources, by integrating disparate IT systems between hospitals, physicians, payers, pharmacies, labs and other healthcare stakeholders.

EXCHANGE: We exchange a wide range of information across networks from a single point of connectivity, facilitating timely and secure access to the data that is needed in today's quality-driven and evidenced-based care environment.

PROTECT: We protect data with rigorous security measures and industry-leading standards to improve security, quality and privacy.

6 Billi

TRANSACTIONS ANNUALLY

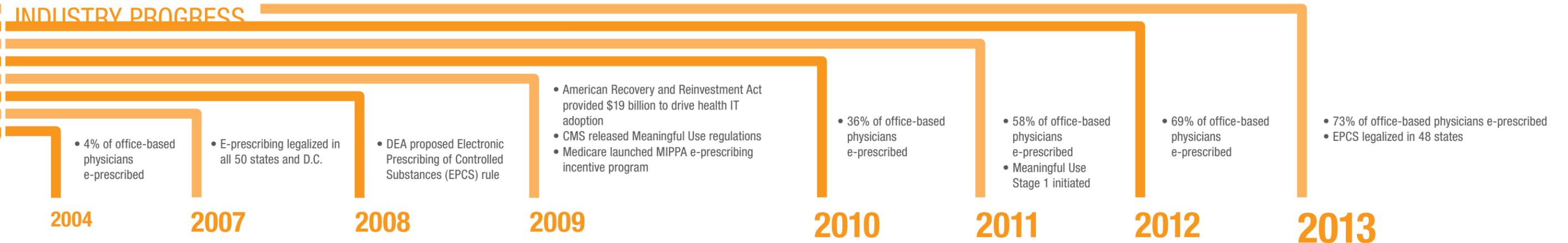
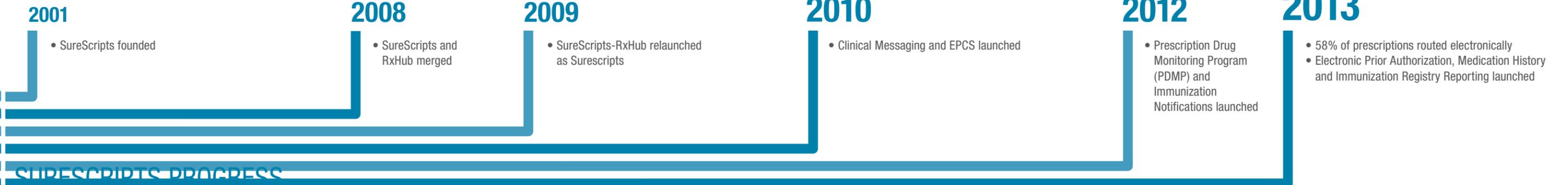
600

EHR APPLICATIONS

95%

OF PHARMACIES

THE EVOLUTION OF SURESCRIPTS

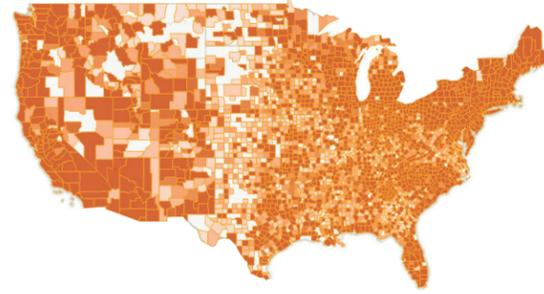


ELECTRONIC PRESCRIBING USE

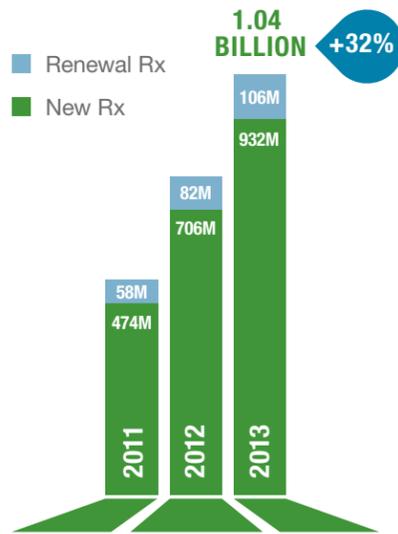
73% of Active Office-based Physicians E-Prescribed¹

7 out of 10 office-based physicians e-prescribed in 2013, a 4% increase in e-prescribing use over 2012.

Note: The darker the area, the greater the concentration of active e-prescribers.

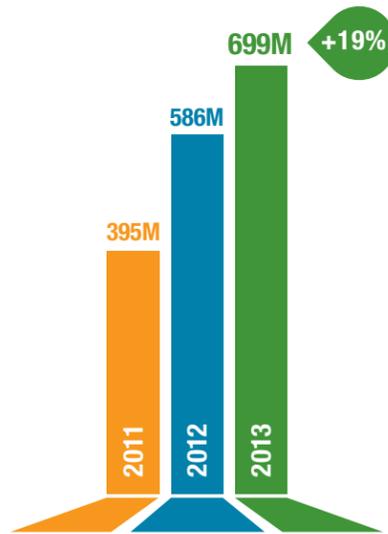


More than Half of All Prescriptions Routed Electronically²



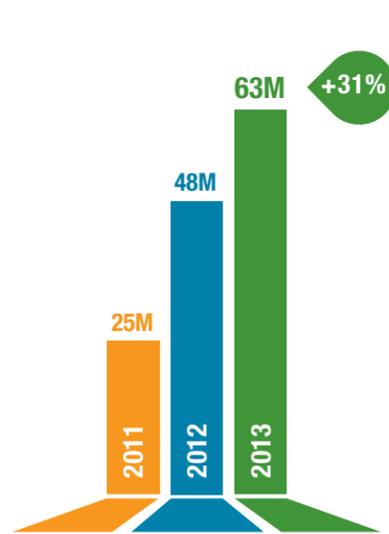
The Surescripts network routed more than one billion e-prescriptions in 2013, representing 58% of all eligible prescriptions. This shows a 32% increase in volume over 2012 and almost double the total in 2011.

19% Continued Growth in Medication Histories Delivered



Surescripts exchanged nearly 700 million Medication History transactions in 2013, up from nearly 400 million in 2011.

Mail-Order Pharmacies Routed 31% More E-Prescriptions



In 2013, Surescripts saw a 31% increase in the number of e-prescriptions routed from mail-order pharmacies. The volume of e-prescriptions routed from mail-order pharmacies has increased significantly in the past five years, from just below 4 million in 2009 to more than 63 million in 2013.

¹ Based on a total count of 522,000 office-based physicians in the U.S. per SK&A data. Surescripts' count of active physicians represents those ambulatory-care physicians who used electronic prescription routing services within the last 30 days of 2013. For the calculation of active office-based physicians in 2013, Surescripts made a 15% adjustment to remove acute physicians that are e-prescribing.

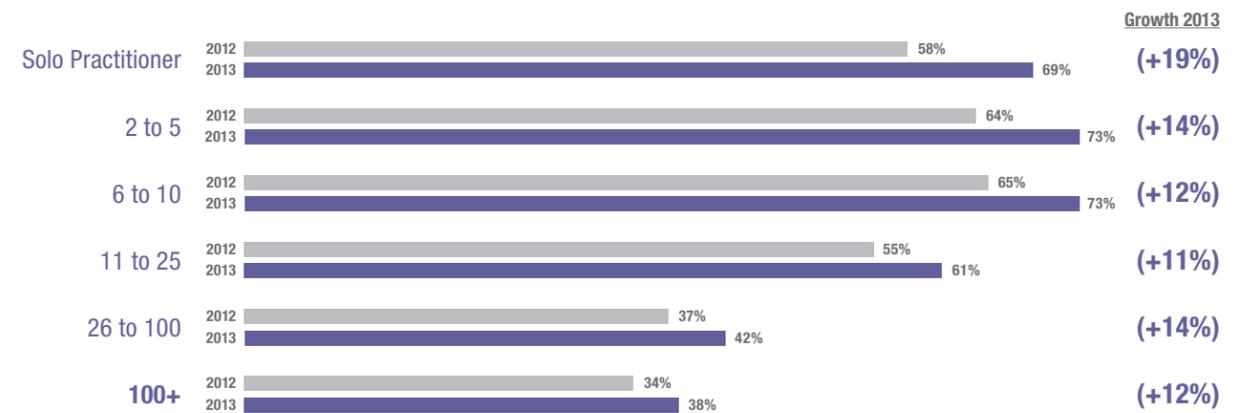
² Electronic prescriptions of controlled substances are not included.

ELECTRONIC PRESCRIBING ADOPTION

Pediatricians Lead Growth in E-Prescribing Adoption with 24% Increase

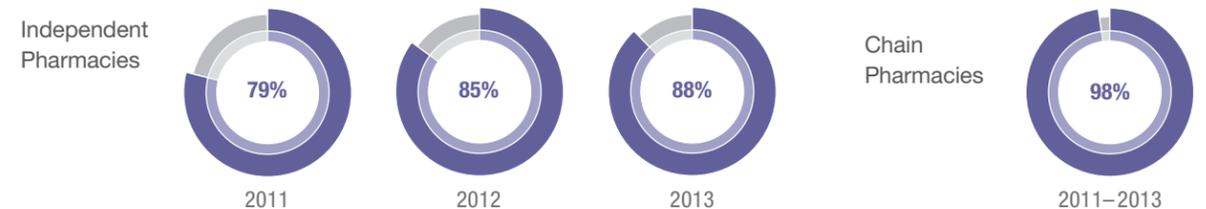
SPECIALTY	E PRESCRIBING IN 2012	E PRESCRIBING IN 2013	YEAR TO YEAR GROWTH
1 Internist	79%	96%	+22%
2 Family Practitioner	71%	85%	+20%
3 Endocrinology & Metabolism	71%	81%	+14%
4 Cardiovascular Disease	72%	80%	+11%
5 Pediatrician	63%	78%	+24%

Solo Practitioners Drive Growth in E-Prescribing Adoption



Small practices of 25 or fewer physicians continue to lead in e-prescribing adoption and use. All practice sizes except those of 100 or more physicians exceeded 40% adoption.

95% of Pharmacies Adopted E-Prescribing



Independent pharmacies increased adoption of e-prescribing by 11% since 2011.

Chain pharmacies remained constant at 98% adoption during the same period.

A Community View*

In a typical metropolitan area with a population of 2 million, such as Cleveland, Ohio or Kansas City, Missouri, a web of providers and payers navigates this complex system to provide quality care to an increasingly informed and digitally connected patient.

The complexity of the health system multiplies with the added communications needs among nursing homes, retail clinics, and long-term care facilities or when a patient needs care while traveling outside their local community.

Data is the life blood of healthcare, but the benefits of improving patient care, increasing efficiency and decreasing costs, cannot be realized if health information exists in isolation.

Health information technology offers significant promise. The ability to share clinical information, quickly and securely, will transform the healthcare system. The electronic exchange of health information can help improve quality and control costs, but this simple idea is a difficult task given the complexity of the U.S. healthcare system.

Surescripts has the infrastructure, data network, provider and supplier directories, and experience in developing standards to ensure that the healthcare system is connected and interoperable.

+ 36 Hospitals^{3, 4, 5}

- 817,205 ER Visits⁶
- 5,797 Beds⁷
- 13 EHRs⁸

4,451 Primary Care Physicians¹²

- 6.3 Million Patient Visits¹³
- 1 Million Referrals¹⁴
- 58 EHRs⁸

Rx 400 Pharmacies⁹

- 12.7 Million Prescriptions¹⁰
- 16 Software Systems¹¹

784 Ambulatory Labs¹⁵

- 8.9 Million Ambulatory Lab Tests¹⁴

POPULATION: 2 MILLION

MESSAGES: 68 MILLION

CONNECTIONS: 6,838

³Surescripts analysis of American Hospital Association data and US Census Live Tracker Data.

⁴American Hospital Association. Fast Facts on US Hospitals. Available at <http://www.aha.org/research/rc/stat-studies/fast-facts.shtml>

⁵Source: <https://www.census.gov/popclock/> Accessed 3/10/2014 at 11:12am et.

⁶Surescripts analysis of NHAMCS data: National Hospital Ambulatory Medical Care Survey: 2010 Emergency Department Summary Tables, tables 1, 4, 14, 24.

Available at <http://www.cdc.gov/nchs/fastats/er-visits.htm>

⁷Surescripts analysis of American Hospital Association data.

⁸Surescripts analysis of 'CMS Medicare and Medicaid EHR Incentive Program, electronic health record products used for attestation.' Data available at <http://catalog.data.gov/dataset/cms-medicare-and-medicaid-ehr-incentive-program-electronic-health-record-products-used-for>

⁹Surescripts analysis of National Council for Prescription Drug Plan pharmacy data.

¹⁰Surescripts analysis of 'Total Number of Retail Prescription Drugs Filled at Pharmacies.' Kaiser Family Foundation. Available at: <http://kff.org/other/state-indicator/total-retail-rx-drugs/>

¹¹Surescripts estimate.

¹²Surescripts analysis of SK&A data.

¹³Surescripts analysis of National Ambulatory Medical Survey: 2010 Summary Tables. Available at http://www.cdc.gov/nchs/data/ahcd/namcs_summary/2010_namcs_web_tables.pdf

¹⁴Ibid.

¹⁵Surescripts analysis of Laboratory Corporation of America Holdings. Form 10-K, December 31, 2013.

* This infographic is for illustrative purposes and represents the complexity of health information in a typical metropolitan area with a population of 2 million people based on publicly available data and other sources as cited. It is not representative of actual Surescripts network connections or transactions.

Connecting healthcare is a monumental task. Surescripts has grappled with extraordinary complexity and mastered it. We have been connecting, exchanging, and protecting healthcare information for over a decade, starting with e-prescribing and broadening across all areas of healthcare. Real progress is occurring and the impact is tangible.

The vast majority of e-prescription data in America flows through our network, including prescription, medication history, formulary and benefits information. The range of information that we exchange is expanding and we continually develop services to help people identify and access it.

Medication History: Improving Patient Safety and Driving More Accountable Care

Adverse drug interactions present significant risks to patient safety, especially in hospitals where a patient cannot communicate their medications because they are unconscious or in a compromised state. Surescripts provides access to a patient's comprehensive, real-time, electronic medication history, based on PBM claims and pharmacy fill data, prior to administering treatment. Electronic access to medication history improves patient safety and is leading the way to more accountable care by:

- Reducing the risk of adverse drug events (ADEs) by increasing the identification of medications most likely to cause them.
- Supporting more informed decisions across care transitions.
- Enabling more efficient medication reconciliation, which reduces patient readmissions.



40%

More than **40%** of medication errors result from inadequate medication reconciliation.¹⁶



770,000

More than **770,000** people die or are injured annually from ADEs.¹⁷



23%

23% of patients readmitted within 30 days of discharge had an ADE as either a primary or secondary diagnosis.¹⁸



66%

Surescripts can provide medication history for approximately **66%** (two-thirds) of the U.S. population.

30% IMPROVED COMPLETENESS OF MEDICATION HISTORY

20 Min. SAVINGS PER PATIENT

2 Billion+ PRESCRIPTION RECORDS

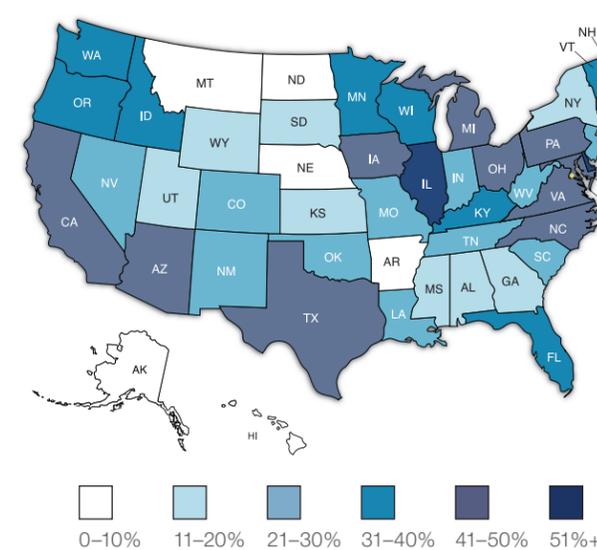
EPCS: Addressing Controlled Substance Fraud and Abuse

Controlled substance fraud and abuse is at an all-time high. Since 1995, drug overdoses have tripled and in 2009, there were **1.2 million** Emergency Department visits related to substance abuse. Today, between **3% and 9%** of drugs that are diverted for abuse are tied to fraud and forgery of paper prescriptions.¹⁹ The electronic prescribing of controlled substances can help combat this epidemic by replacing the fraud-prone paper prescription pad. The Drug Enforcement Agency found that e-prescribing could yield up to **\$700 million** in annual savings.²⁰

Surescripts' Electronic Prescribing of Controlled Substances (EPCS) provides one electronic workflow for all prescriptions, reduces fraud and abuse, and improves safety by reducing the diversion of controlled substances.

- EPCS is legal in **47 states and DC**.
- **98%** of providers who e-prescribe also prescribe controlled substances.²¹
- Controlled substances represent **13%** of all prescriptions.²²
- 40% of pharmacies are enabled for EPCS

Percent (%) of Pharmacies Enabled for EPCS



Immunization Services: Driving More Coordinated Care

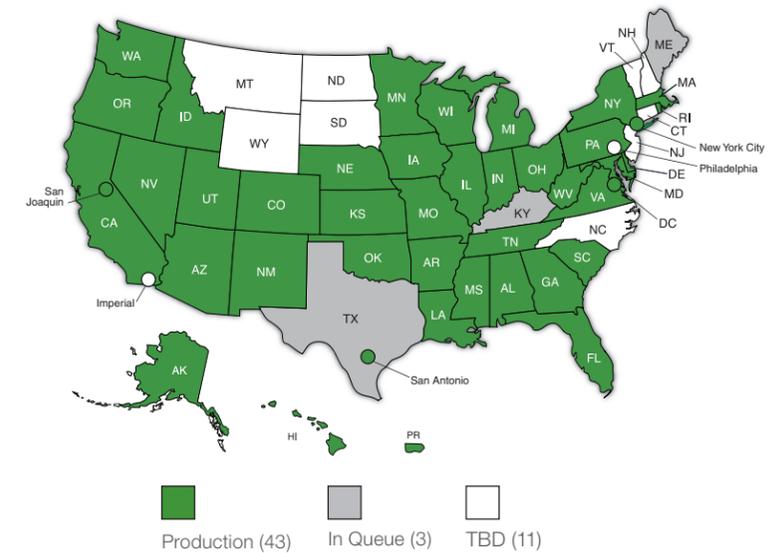
Over the past 50 years, the growth and effectiveness of vaccines have helped reduce preventable diseases such as polio, measles and rubella by **99%** according to the CDC. Today, care providers are looking to utilize immunizations to address more adaptable viral diseases, like influenza, that require serial vaccinations. Yet, in 2013, only **41.5%** of the U.S. population received the influenza vaccination.²³

Pharmacies and retail clinics are playing an increasingly important role in immunizations. Today, nearly **45%** of all adult influenza vaccinations occur in pharmacies and retail clinics.²³

Surescripts offers two Immunization Services to help improve the coordination of care.

- Immunization Notifications provide physicians a more complete view of a patient's medical history, so they can ensure the best course of treatment.
- Immunization Registry Reporting simplifies the process of providing immunization information to mandatory and voluntary state and regional registries, allowing pharmacies to save time and other resources.

Surescripts Connects to 43 Immunization Registries



Surescripts connects to **43 immunization registries** nationwide, covering more than **246 million** individuals (**80%** of the U.S. population in 2010).

¹⁶ Rozich JD, Howard RJ, Justeson JM, et al. Patient safety standardization as a mechanism to improve safety in healthcare. *Jt. Comm J Qual Saf* 2004; 30(1):5-14.

¹⁷ The Agency for Healthcare Research and Quality (AHRQ).

¹⁸ *FormularyWatch*.

¹⁹ Butler SF, Budman SH, Licari A, et al. National addictions vigilance intervention and prevention program (NAVIPPRO): a real-time, product-specific, public health surveillance system for monitoring prescription drug abuse. *Pharmacoepidemiol Drug Saf* 2008;17:1142-54. ALSO, Rosenblum A, Parrino M, Schnoll SH, et al. Prescription opioid abuse among enrollees into methadone maintenance treatment. *Drug Alcohol Depend* 2007; 90:64-71.

²⁰ DEA, U.S. Department of Justice, Economic Impact Analysis of the Interim Final Prescription Rule, March 2010.

²¹ 2010 Surescripts survey of 1,375 providers who e-prescribed.

²² National Association of Chain Drug Stores (NACDS 2013).

²³ U.S. Centers for Disease Control & Prevention.

2013 SAFE-Rx STATE RANKINGS

E-Prescribing Adoption and Use

Safe-Rx Rankings measure each state's progress in advancing healthcare safety, efficiency and quality through the adoption and use of e-prescribing. The rankings recognize the full utilization of e-prescribing based on volume of use of Surescripts' Prescription Benefit, Medication History and Prescription Routing services.

2013	STATE	2012	2013	STATE	2012
1	DELAWARE	1	27	FLORIDA	23
2	MINNESOTA	2	28	SOUTH CAROLINA	32
3	VERMONT	7	29	ILLINOIS	30
4	WISCONSIN	11	30	RHODE ISLAND	26
5	MASSACHUSETTS	5	31	MARYLAND	25
6	NORTH DAKOTA	15	32	HAWAII	34
7	CONNECTICUT	13	33	LOUISIANA	45
8	NORTH CAROLINA	6	34	MONTANA	42
9	NEW HAMPSHIRE	4	35	TENNESSEE	36
10	SOUTH DAKOTA	10	36	IDAHO	38
11	MICHIGAN	16	37	ARKANSAS	41
12	OREGON	20	38	NEW YORK	33
13	NEBRASKA	17	39	NEW MEXICO	21
14	KANSAS	22	40	TEXAS	40
15	VIRGINIA	19	41	GEORGIA	39
16	KENTUCKY	31	42	ARIZONA	29
17	OHIO	3	43	OKLAHOMA	43
18	INDIANA	24	44	MISSISSIPPI	44
19	MAINE	9	45	NEW JERSEY	37
20	PENNSYLVANIA	14	46	WYOMING	46
21	WEST VIRGINIA	18	47	COLORADO	47
22	WASHINGTON	28	48	CALIFORNIA	49
23	UTAH	27	49	NEVADA	48
24	IOWA	12	50	DISTRICT OF COLUMBIA	51
25	ALABAMA	35	51	ALASKA	50
26	MISSOURI	8			

Safe-Rx Highlights*

- Wisconsin, North Dakota and Connecticut all moved into the top 10 for the first time.
- E-prescribing routing has increased to where the last place state in 2013 would have been the first place state in 2009, by a margin of 13 percentage points.
- All states routed at least 45% of eligible prescriptions electronically.

*Detailed state data is available at www.surescripts.com.

Delaware has ranked in the top 5 since the Safe-Rx rankings began in 2007.

81% OF PHYSICIANS IN DELAWARE ROUTED PRESCRIPTIONS ELECTRONICALLY

ELECTRONIC PRESCRIPTIONS ROUTED IN DELAWARE

84% OF PATIENTS IN DELAWARE WITH AVAILABLE PRESCRIPTION BENEFIT OR PRESCRIPTION HISTORY INFORMATION



ABOUT SURESCRIPTS

Surescripts is a nationwide health information network that connects and exchanges health information between pharmacies, payers, pharmacy benefit managers, physicians, hospitals, health information exchanges and health technology firms. By providing information for routine, recurring and emergency care, Surescripts is committed to saving lives, improving efficiency and reducing the cost of healthcare for all. For more information, go to www.surescripts.com and follow us at twitter.com/surescripts.

Emerging and Encouraging Trends in E-Prescribing Adoption Among Providers and Pharmacies

Meghan H. Gabriel, PhD; Michael F. Furukawa, PhD; and Varun Vaidya, PhD

Objective: The objective of this study is to describe the growth in provider (physician, nurse practitioner, and physician assistant) adoption of e-prescribing and the growth in pharmacies actively accepting e-prescriptions using nationally representative data from December 2008 to December 2012. Additionally, this study explored e-prescribing adoption variation by urban and rural counties.

Study Design: Descriptive analysis of nationally representative, transactional e-prescribing data.

Methods: Data for this analysis were from Surescripts. Surescripts is a leading e-prescription network utilized by a majority of all chain, franchise, or independently owned pharmacies in the United States routing prescriptions for more than 240 million patients through their network.

Results: The total number of prescribers, including physicians, nurse practitioners, and physician assistants e-prescribing via an electronic health record (EHR) on the Surescripts network has increased from 7% to 54%. Additionally, the number of pharmacies actively accepting e-prescriptions is 94%. These increases in pharmacies actively accepting e-prescriptions and the provider's e-prescribing mirror the increase in the volume of e-prescriptions sent on the Surescripts network.

Conclusions: This analysis shows that the vast majority of pharmacies in the United States are able to accept e-prescriptions and over half of providers are e-prescribing via an EHR.

Am J Manag Care. 2013;19(9):760-764

For author information and disclosures, see end of text.

Electronic prescribing (e-prescribing) is the electronic transmittal of a prescription to a pharmacy from the provider and is a tool used to send accurate, error-free, and legible prescriptions to pharmacies.^{1,2} Providers can e-prescribe via electronic health records (EHRs) or standalone e-prescribing systems. EHRs have advantages such as clinical notes, laboratory results and orders, and a broad range of clinical decision support that standalone systems do not offer.³ E-prescribing through EHRs improves the availability of pharmacy benefits information and patient medication histories, making potentially life-saving information available immediately.²

Evidence of the benefits of e-prescribing is mounting. E-prescribing has been found to significantly reduce prescription errors in community-based ambulatory practices and eliminate prescription errors due to illegibility.^{4,5} In 2000, the Institute of Medicine (IOM) detailed the rate of preventable medication errors associated with paper prescribing practices.³ In addition, the IOM called for the transformation of healthcare through the use of health information technology (Health IT) such as e-prescribing in "Crossing the Quality Chasm."⁶

E-prescribing has been encouraged by the Federal government for nearly 10 years. The first time was when the Medicare Modernization Act (MMA) was passed in 2003.¹ Federal regulations passed in 2006 and all states enacted laws to allow the electronic exchange of most types of prescriptions,⁷ thereby eliminating legal barriers to the adoption of e-prescribing. The Medicare Improvements for Patients and Providers Act of 2008 (MIPPA) authorized e-prescribing incentive payments for Medicare providers, starting in 2009.⁸ Most recently, The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 was passed.⁹

The goal of the HITECH act was to help meet the objectives of the "triple aim": to improve care, improve population health overall, and reduce the costs of healthcare.¹⁰ To help spur health information technology (IT) adoption, "meaningful use" incentive payments were designed to help with the initial costs of EHRs for eligible providers. These payments are designed to encourage and facilitate the adoption of health IT including e-prescribing. Additionally, the State Health Information Exchange Cooperative Agreement Program (State HIE Program) in the Office

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of the National Coordinator for Health Information Technology (ONC) awarded grants to 56 states and eligible territories.¹¹ This program specifically focuses on pharmacy adoption of e-prescribing, and encourages grantees to employ various strategies to advance pharmacy e-prescribing. ONC has also funded 62 regional extension centers (RECs) to help more than 100,000 primary care providers from individual and small practice settings adopt and use EHRs.¹² Despite the potential benefits of implementing e-prescribing, due to the technical, cost, and/or regulatory barriers, studies have indicated that the adoption of e-prescribing has been slow.¹³ Additionally, studies have held that technical challenges such as availability of reliable high-speed network connections to operate e-prescribing systems especially in the rural areas may affect preparedness of the pharmacies to accept e-prescribing.¹⁴ Therefore, federal, state, and local governments have devoted significant efforts to the adoption of e-prescribing.

The objective of this study is to describe the growth in provider (physician, nurse practitioner, and physician assistant) adoption of e-prescribing and the growth in pharmacies actively accepting e-prescriptions using nationally representative data.

METHODS

Data

Surescripts is a leading e-prescription network utilized by a majority of all chain, franchise, or independently owned pharmacies in the United States routing prescriptions for more than 240 million patients through their network, excluding closed systems such as Kaiser Permanente.¹⁵ For national results, data from all 50 states and the District of Columbia were included in the analysis. The data represent transactions from December 2008 to December 2012. The area resource file was used to determine county level urban and rural characteristics.¹⁶

Surescripts pharmacy data include all pharmacies registered with the National Council for Prescription Drug Programs (NCPDP). The NCPDP files include indicators of whether each pharmacy is connected to the Surescripts network and whether each pharmacy processed a prescription on the Surescripts network in the given month. In this analysis, an active pharmacy is a pharmacy that has processed at least 1 electronic prescription in the given month. To support a realistic denominator of pharmacies that have the ability to e-prescribe on the Surescripts network, this analysis included

Take-Away Points

Electronic prescribing among pharmacies and providers (including nurse practitioners, physician assistants, and physicians) has increased.

- Providers e-prescribing via an electronic health record has increased from 7% in December 2008 to 54% in December 2012.
- Pharmacies actively e-prescribing has increased from 70% in December 2008 to 94% in December 2012.
- No significant differences currently exist among provider or pharmacy adoption in rural and urban areas.

chain, franchise, and independent pharmacies. Medical device manufacturers, nuclear, intravenous infusion, and government/military pharmacies were excluded.

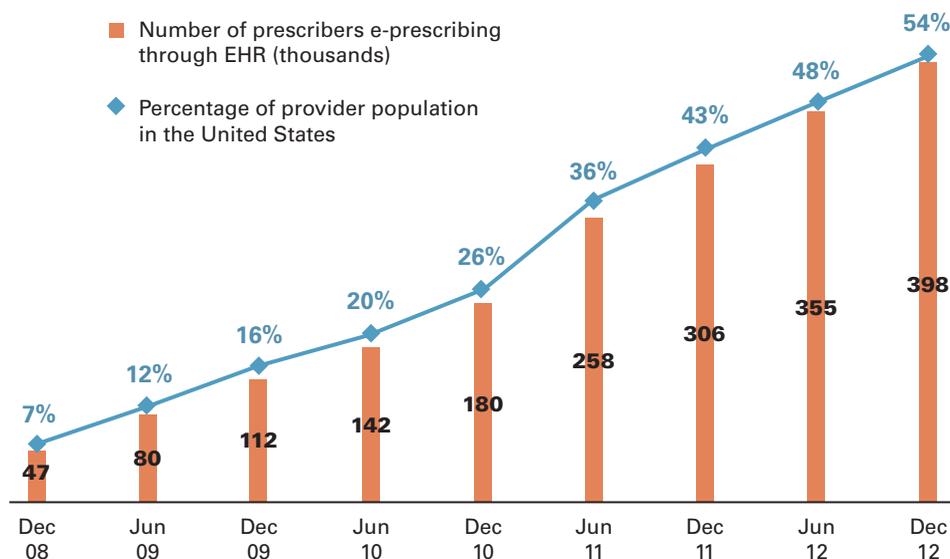
For providers, including physicians, nurse practitioners, and physician assistants, Surescripts data provide an e-prescribing method. For penetration rates of providers e-prescribing via an EHR, a method of identifying provider denominators was developed with SK&A, a proprietary data set using a combination of the title and specialty variables.¹⁷ The database is designed to comprise a census of ambulatory healthcare sites with at least 1 provider with prescribing authority. All sites are contacted twice a year and asked to confirm information on practice location, the providers who work at the site, and other site characteristics. The counts were de-duplicated to correct for individual providers who are observed at multiple sites. Data for annual percentages of new and renewal prescriptions routed through the Surescripts network data exclude controlled substances.

RESULTS

The total number of prescribers, including physicians, nurse practitioners, and physician assistants e-prescribing via EHR on the Surescripts network has increased, as displayed in **Figure 1**. In December 2008 the total number of prescribers using an EHR on the Surescripts network was approximately 47,000, representing 7% of the provider population in the United States. As of December 2012, the total number increased to 398,000, representing 54% of providers in the United States. Among current prescribers on the Surescripts network, 86% use an EHR while 14% use standalone e-prescribing systems (data not shown).

In order for providers to successfully use their e-prescribing systems, they must have pharmacies with the ability to accept these e-prescriptions. The growth in pharmacies actively e-prescribing in the United States during this study period is displayed in **Figure 2**. The percent of retail pharmacies actively e-prescribing on the Surescripts network increased from 43,000 pharmacies, representing 70% of all chain, franchise, and independent pharmacies in December 2008 to over

■ **Figure 1.** Growth in Prescribers Electronically Prescribing (E-prescribing) Through an Electronic Health Record



EHR indicates electronic health record.

Denominators for prescribers derived from SK&A and range from 668,395 to 733,499 in 2012.

59,000 pharmacies, representing 94%, in December 2012, therefore showing a 24% increase in the past 4 years.

These increases in pharmacies actively accepting e-prescriptions and in providers' e-prescribing mirror the increase in the volume of e-prescriptions sent on the Surescripts network. In 2008, 4% of all new and renewal prescriptions were sent electronically in the United States. It is forecasted that 45% of new and renewal prescriptions will be sent electronically in 2012. In December 2008, 61% of pharmacies in rural counties were actively accepting e-prescriptions, compared with 75% of urban pharmacies ($P < .001$). This 14% gap has closed during the study period. In December 2012, 94% of urban pharmacies and 93% of rural pharmacies were actively accepting e-prescriptions. For providers, adoption has remained consistent between urban and rural providers (data shown in [eAppendix](#); available at www.ajmc.com). Additional results regarding new and renewal prescriptions and variations in e-prescribing among pharmacies and providers in rural and urban counties are also given in the [eAppendix](#).

DISCUSSION

The majority of pharmacies in the United States have been able to accept e-prescriptions since 2008. This suggests that e-prescribing among physicians was not hindered by the lack of pharmacies able to receive e-prescriptions. In order to implement health information technologies, providers need to be able to afford the technologies, have access to those

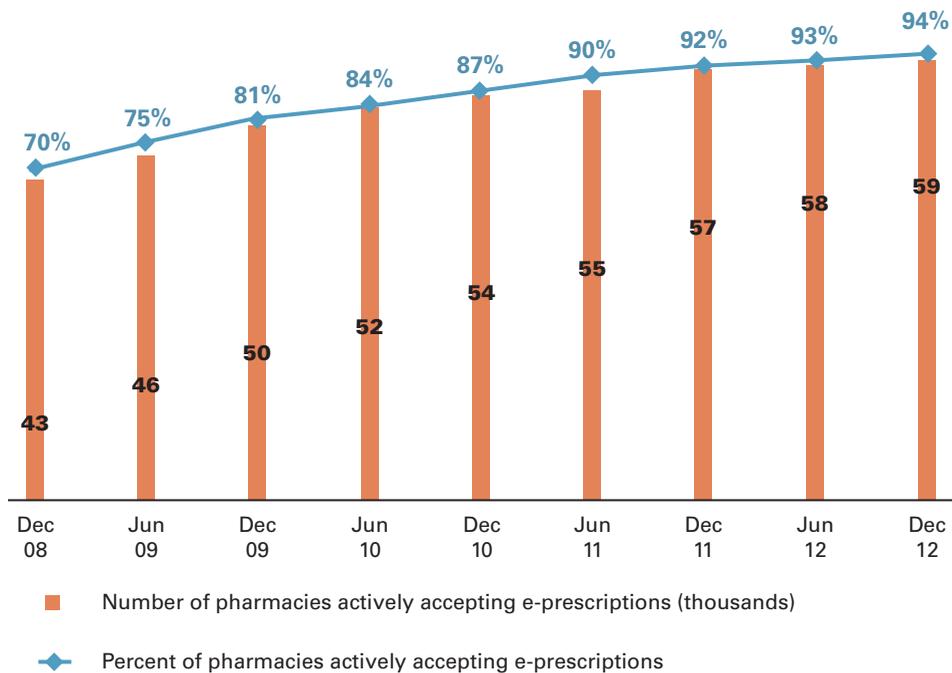
technologies in the marketplace, be able to implement the technology in practice, and perceive that the technologies are worthwhile.¹⁸ The HITECH act and resulting programs such as the State HIE and REC have assisted with the first 3 points. However, provider perceptions are less influenced by governmental policies and programs than by their practice experience. The large increase in e-prescribers (7%-54%) suggests accumulating positive perceptions as experience grows. Over half of providers have implemented EHRs and e-prescribe via those systems. This is consistent with current literature.¹⁹

Cost and work flow concerns are most commonly cited as the primary challenges to health IT adoption.¹⁸ Studies have noted that e-prescribing has doubled prescribing time for office-based physicians. This time is partially offset by reducing other record-keeping tasks.²⁰ The IOM reported that although ubiquitous in other major industries, the diffusion of relevant technologies in healthcare is still in its very early stages. The report states that EHRs have the potential to improve patient outcomes and also improve adherence to medications.²¹ Federal incentives, meaningful use requirements, and the federal programs detailed above may have helped lead toward increased positive experience, and thus driven this remarkable increase in adoption of e-prescribing.

E-prescribing is an essential component of meaningful use, an important milestone for health information exchange (HIE), and is important to meeting the triple aim.¹⁰ Tracking the distribution of new prescriptions and renewal requests on the Surescripts network is a useful way to assess the robustness

Emerging and Encouraging Trends in E-Prescribing Adoption

■ **Figure 2.** Growth in Pharmacies Actively E-Prescribing



An active pharmacy indicates a pharmacy that has processed at least 1 electronic prescription in the given month.

of HIE, as renewal requests require bidirectional exchange between pharmacist and prescriber. Additionally, patient adherence to medications is better with e-prescribing.²² A recent review article found that 92% of health IT studies during that time showed either positive or mixed positive outcomes.²³ Complete EHR use may add additional quality and outcome benefits. Payers and prescribers are enabled to communicate information that will lead to improved quality care for patients. Formulary benefit alerts, safety alerts, adherence reminders, and gaps in care alerts are some of the initial innovations that HIE via EHRs makes possible.

In addition to the challenges faced by urban providers, rural providers and pharmacies face unique issues with access, resources, and connection. With this in mind, the RECs have worked with over 50% of eligible providers in rural areas to provide assistance regarding e-prescribing and other requirements of meaningful use. Additionally, the State HIE Program has reached out to rural pharmacies to help facilitate e-prescribing. Our study found no current major differences in provider adoption by rurality. This is in agreement with 2 early studies of physician offices which showed that Health IT adoption and use in rural offices was not lower than in urban offices.^{24,25}

Despite the progress made in the use of e-prescribing, there is also a concern of lack of ability to receive and process e-prescriptions by independent or rural pharmacies for reasons such

as availability of broadband Internet and concern over transaction fees. Studies have suggested that incentive programs or grants to help with infrastructure would help to overcome that issue.²⁶ It is important to note that our study reports no difference in ability of pharmacies in rural and urban counties which are actively e-prescribing. This indicates the potential success of incentives, grants, and technical assistance provided to such pharmacies.

With the increase of health IT use among providers and pharmacies, concerns have been raised regarding patient privacy and increased third-party access to health information. It is of note that in the period of this study, those issues do not appear to impede rapid growth in utilization and adoption. However, questions regarding the cost and health benefits of health information technologies such as e-prescribing and EHR use continue to be voiced. This analysis suggests that increasing experience with various HIE technologies such as e-prescribing results in their rapid growth. This is a trend encouraging continued exploration of the clinical and economic benefits of HIE.

Limitations

Data used for this analysis were generated from prescribers and pharmacies connected to the Surescripts Network and e-prescribing transactions that flow through the network. Due to the strength of market share, Surescripts can serve as

a proxy for national trends analysis. While Surescripts captures the vast majority of outpatient transactions, it may not include transactions from a number of sources such as inpatient e-prescribing where the prescription goes directly to the hospital pharmacy, e-prescribing that occurs within a closed integrated delivery network (eg, Kaiser Permanente), and transactions that occur solely on competing networks.

CONCLUSIONS

E-prescribing is proving its potential to create a gateway to the improved patient care that health IT promises. The majority of pharmacies in the United States are able to accept e-prescriptions and nearly half of providers are e-prescribing via an EHR. These percentages have increased significantly as pharmacy and prescribing practitioner experience have grown. This study shows positive emerging trends in electronic prescribing by demonstrating accelerated growth in adoption of electronic prescribing at both provider and pharmacy level. Continuous efforts and focused investments can be expected to diminish most of the barriers to implementation in the future.

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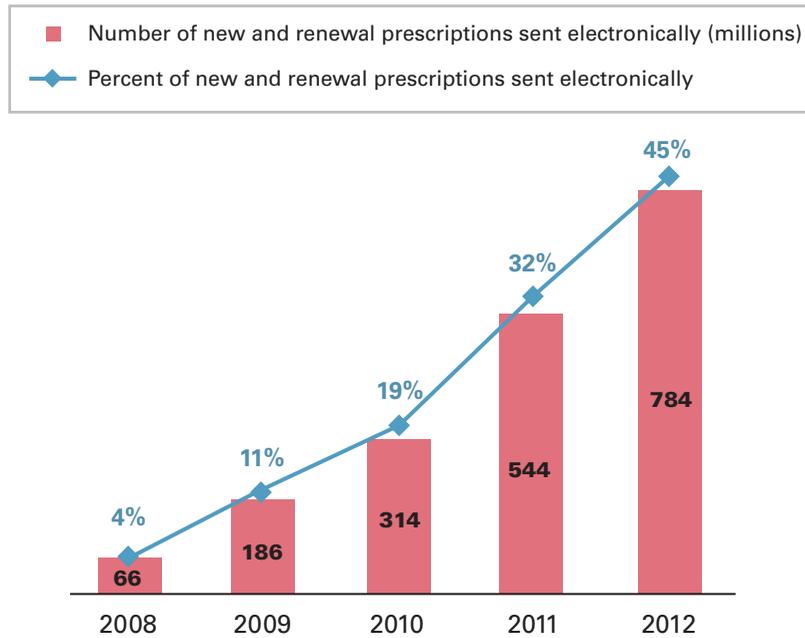
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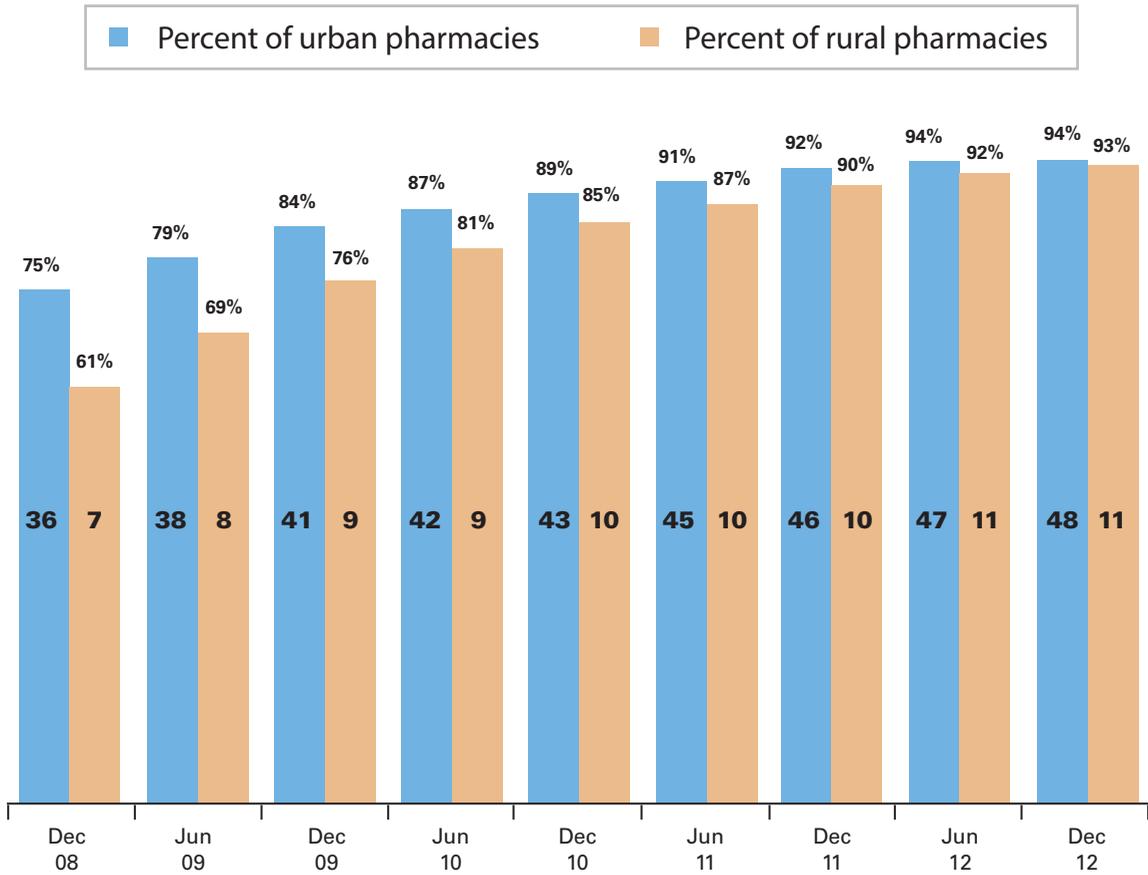
■ **eAppendix A. Annual Growth in New and Renewal Prescriptions Sent Electronically**



New prescription indicates a new prescription routed from prescriber to pharmacies; renewal prescription, a renewal response that is routed between prescribers and pharmacies.

These increases in pharmacies actively accepting e-prescriptions and in providers' e-prescribing mirror the increase in the volume of e-prescriptions sent on the Surescripts network. The annual increase is displayed above. In 2008, over 66 million new and renewal prescriptions were sent electronically, representing 4% of all new and renewal prescriptions sent in the United States, both electronically and via paper. In 2011, this number was 544 million, representing 32% of all new and renewal prescriptions. It is forecasted that the annual number of new and renewal e-prescriptions in 2012 will be 784 million, representing 45% of all new and renewal prescriptions in the United States. This shows a projected 13% increase in all new and renewal prescriptions sent electronically from 2011 to 2012.

■ **eAppendix B. Growth in Urban and Rural Pharmacies Actively Accepting E-Prescriptions**

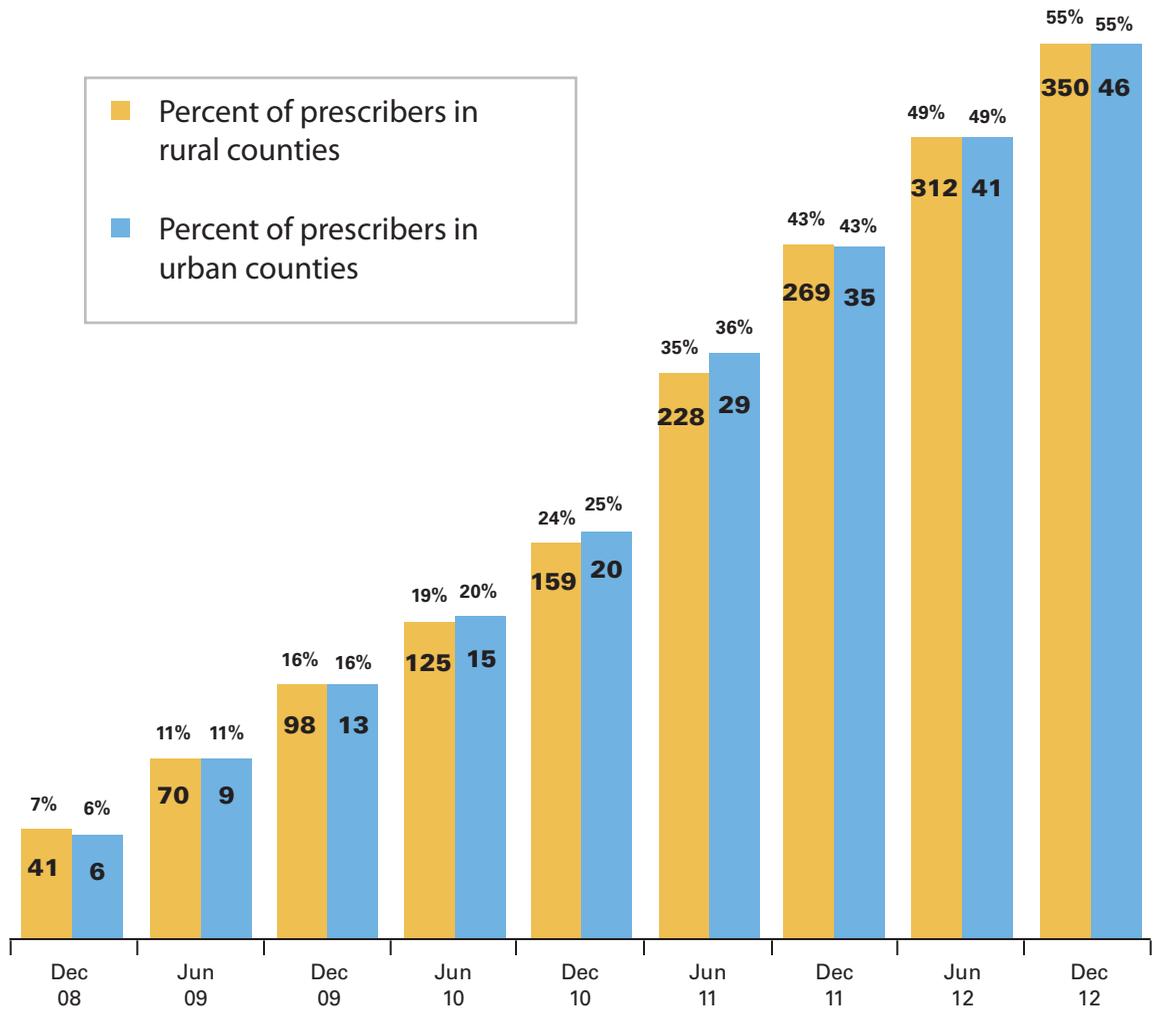


Numbers in bars represent the number of pharmacies (thousands).

E-prescribing trends in pharmacy and providers in urban and rural counties are displayed in Appendices B and C. In December 2008, 61% of pharmacies in rural counties were actively accepting e-prescriptions, compared with 75% of urban pharmacies ($P < .001$). This 14% gap closed during the study period. As of December 2012, 93% of rural pharmacies are actively accepting e-prescriptions compared with 94% of urban pharmacies, with no significant differences in proportions ($P = .1524$). For providers, adoption has remained consistent between urban and rural providers. In December 2008, the percentages of urban and rural providers e-prescribing via electronic health record (EHR) were 6% and 7%, respectively ($P = .9087$). As of December 2012, 55% of rural and 55% of urban providers were e-prescribing via EHR.

Emerging and Encouraging Trends in E-Prescribing Adoption

■ eAppendix C. Growth in Rural and Urban Providers E-Prescribing via an Electronic Health Record



Numbers in bars represent the number of e-prescribers (thousands).

Evolving Vendor Market for HITECH-Certified Ambulatory EHR Products

Marsha Gold, ScD; Mynti Hossain, MPP; Dustin R. Charles, MPH;
and Michael F. Furukawa, PhD

The Health Information Technology for Economic and Clinical Health (HITECH) provisions of the American Recovery and Reinvestment Act of 2009 set ambitious goals for using health information technology (HIT) to improve healthcare delivery. Critical first steps for success involve rapid nationwide adoption of electronic health records (EHRs) and electronic health information exchange to support delivery improvements. In previous work, we examined critical drivers of adoption and exchange, finding that some of these drivers were not directly under HITECH or government control.¹ In this study, we examine in more depth the evolution of one such driver: the availability of vendor products offering EHRs to eligible professionals, especially in office-based practice. (Other drivers of adoption are affordability, practice integration, and provider attitudes.)

Availability is particularly relevant to ambulatory care. Before HITECH, use of EHRs in office-based practice was much less developed than in the inpatient environment; products serving smaller office-based practices were particularly limited in both number and functionality.^{2,3} While the percentage of office-based physicians making any use of an EHR has risen over time,⁴ adoption rates are uneven, with uptake substantially lower for certified products that meet uniform nationwide standards. The HITECH objective was to combine such standards with meaningful use incentives and regional extension center support for high-priority providers to accelerate development of a strong vendor market with certified EHR products suitable to ambulatory and inpatient settings.

STUDY QUESTIONS AND METHODS

This study sought to further our understanding of the industry, which is evolving to meet the demand for HITECH-relevant ambulatory EHRs. It addressed 3 questions:

1. How has the vendor market for ambulatory products evolved with the implementation of HITECH?
2. What role do vendors play in the market, and how do they function currently?
3. How will the market evolve in the future, and what tools do policy makers have to shape it?

Because the vendor market is relatively new, there is not a well-developed, peer-reviewed literature on the industry and many available sources are proprietary. To begin

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Background: The ambitious goals of the Health Information Technology for Economic and Clinical Health (HITECH) Act require rapid development and certification of new ambulatory electronic health record (EHR) products.

Objectives: To examine where the vendor market for EHR products stands now and the policy issues emerging from the market's evolution.

Study Design: Descriptive study with policy analysis.

Methods: We had 3 main sources of information: (1) documents describing this evolving market, which is not well represented in peer-reviewed literature; (2) operational data on certified ambulatory EHR products and their use by Medicare-eligible professionals attesting for meaningful use payments from January 2011 to October 2012; and (3) telephone interviews with 10 vendors that account for 57% of the market.

Results: Those attesting for Medicare meaningful use payments used ambulatory EHRs from 353 different vendors, although 16 firms accounted for 75% of the market. The Herfindahl-Hirschman Index showed the ambulatory EHR market to be highly competitive, particularly for practices of 50 or fewer professionals. The interviewed vendors and the external analysts agreed that stage 1 requirements set a relatively low bar for market entry, but that likely will change as requirements get more demanding.

Conclusions: The HITECH Act met its initial goals to motivate growth of diverse ambulatory EHR products. A market shakeout may emerge, though current data reveal no signs of it. Policy makers can influence the shape and value of such a shakeout, and the extent of disruption, through their approach to certification and "usability" and "interoperability" strategies and requirements.

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**For author information and disclosures,
see end of text.**

Take-Away Points

This study examines the evolving vendor market for ambulatory electronic health records (EHRs) as implementation of the Health Information Technology for Economic and Clinical Health Act proceeds. It analyzes:

- The market share of Medicare-eligible attesting providers and the extent of competition across the 353 ambulatory EHR vendors.
- How ambulatory EHR vendors handle product distribution and pricing, implementation and maintenance support, and support for a meaningful use attestation.
- The policy issues that arise with the rapid growth of ambulatory EHR products.

filling this gap, we used available information to answer these 3 questions. Three main sources of information were used:

- Documents, including available industry reports and information on company websites (the “grey literature”).
- Operational data that federal agencies have developed in the context of certifying vendor products and reviewing applications from eligible professionals for meaningful use payments.
- Telephone interviews with 10 diverse vendors in the ambulatory EHR market in March and April 2012.

Lacking an established sample frame, we used information in the trade press to identify a mix of vendors active in the ambulatory market that were diverse in company origins (hospital industry versus others), age, target market, and product design features as reflected in trade publications. Before finalizing our recommendations, we discussed them with Office of the National Coordinator staff, including high-level leadership familiar with the industry. Interviews were guided by a semistructured protocol covering topics relating to market position, marketing and provider support, certification, meaningful use requirements, interaction with federal programs, and future directions and issues. We asked to speak for 45 minutes with each firm’s most senior executive(s) who had strategic and operational oversight of product development, sales, and provider support of certified electronic medical record product(s). To encourage cooperation, we assured interviewees that their comments would be confidential and not reported by firm. We also elicited the cooperation of the Healthcare Information and Management Systems Society Electronic Health Record Association, which then encouraged its members to respond. (The Electronic Health Record Association had no role in choosing interviewees or topics covered and played no role in the analysis.) Interviews were conducted in March and April 2012; 10 of 11 solicited vendors responded. Our lead author conducted each interview, and

a research associate participated in the call, taking detailed notes to support analysis.

Table 1 shows selected characteristics of the vendors we interviewed. While most were relatively large, their gross revenues ranged from the low millions to billions, sometimes including revenue from a parent company. Most currently are publicly traded, sometimes as subsidiaries of larger parent companies such as General Electric and Quest

Diagnostics. Epic, founded in 1979, remains a private, employee-held company. e-MDs is privately held, as is Practice Fusion, a start-up firm founded with capital from Silicon Valley entrepreneurs. The origins of the 10 vendors also differ. Some were founded by clinicians for ambulatory uses (Greenway, e-MDs), and others added EHRs to existing product lines that tend to emphasize practice management products (athenahealth, NextGen, Cerner) or HIT in support of laboratory testing (MedPlus). Vendors also differed in the emphases of their marketing (see the Company Public Tag Line column, Table 1).

Given their small number, interviewees obviously did not represent all vendors; however, they did represent a sizable share of the market (57% of all eligible professionals receiving stage 1 payments by October 2012). Interviewee responses also reflected the vendor perspective and should be understood in this context. We relied on vendor reports to describe the way the industry functions but applied a critical eye in assessing the policy implications.

MARKET EVOLUTION AND CURRENT STRUCTURE

Market Scope

The market for ambulatory EHR products is potentially quite large. Frost and Sullivan estimated that the US market was likely to double, from \$1.3 billion to an estimated \$2.6 billion in revenue between 2009 and 2012, peaking at \$3 billion in 2013 before falling off as saturation occurred.⁵ These are large numbers. Customers for ambulatory products are diverse, including not only new practices but also those looking to replace existing systems with new certified options that better position them to meet increasingly stringent meaningful use requirements in HITECH stages 2 and 3.⁶ One analysis found that 35% of practices considering acquisitions were replacing their existing products (vs buying new ones), with replacement particularly likely in larger practices.⁷

Evolving Vendor Market for EHR Products

■ **Table 1.** Profile of Selected Vendors in the Electronic Health Record Market

Vendors	Type of Business	Origins	Company Public Tag Line	2011 HIT Revenue
Allscripts	Public (1999)	Incorporated in 1986	“Connected Community of Health” and “One Network, One Platform, One Patient”	\$1.4 billion
athenahealth, Inc	Publicly traded	Formed in 1977 after purchase of a birthing center led to the development of a medical billing product; in 2006, athenahealth developed an EMR and offered it for general purchase in 2010	“An EMR that gives you more money and more control with the industry’s only meaningful use incentive guarantee”	\$324 million
Cerner	Publicly traded	Founded in Kansas City in 1979 by several individuals formerly with Arthur Andersen; firm went public in 1986 with \$17 million in revenue	“Cerner’s mission is to contribute to the systematic improvement in healthcare delivery and the health of communities”	\$2.2 billion
e-MDs	Privately held	Physician- and programmer-led firm formed in 1996	“Rediscover the joy of practicing medicine” with “integrated affordable solutions”	Not posted by HCI or on company website
Epic	Private, employee owned	Founded in 1977	“Small Client Base, Huge Client Impact”	\$1.2 billion
GE Centricity	GE Centricity is part of GE Healthcare, a global publicly traded firm	GE was founded in 1878; GE Healthcare IT was founded in 2007 from heritage companies and later acquisitions	“Transformative Medical Technology and Services”	Not reported; company website indicates \$142 billion for parent and \$18 billion for GE Healthcare overall (2011)
Greenway	Publicly traded	Formed in 1998 in Georgia by providers	“Innovative Information Solutions that Improve Healthcare”	\$89.8 million
MedPlus	Subsidiary of publicly traded Quest Diagnostics, a company formed around diagnostic testing	Began the Health Information Technology Subsidiary of Quest Diagnostics in 1991	“Efficient systems designed for physicians” and “Health Information Technology Systems for Better Patient Care”	Not reported by HCI; company website shows \$7.5 billion in 2011 for parent Quest Diagnostics
NextGen	Wholly owned subsidiary of Quality Systems Inc, a publicly traded firm	ClinTec was formed in 1994 to convert paper to electronic records; Quality Systems Inc purchased ClinTec in 2006 and merged with Micromed (a practice management software firm) in 2007; NextGen was founded in 2000 as a merger of these 2 acquisitions	“Building Long Lasting Partners”	\$353 million (from NextGen website; figure appears to be for Quality Systems Inc, with NextGen accounting for 75% of the total)
Practice Fusion	Private, investor owned	Founded in 2005 with venture capital from multiple Silicon Valley firms	“Free, Web based, secure, Live in 5 ^o , Pocket \$44k”	Not posted by HCI or company

EMR indicates electronic medical record; GE, General Electric; HCI, Healthcare Informatics; HIT, health information technology.

Source: Author’s construction, based on information publicly available on each firm’s website as of April 2012. Unless otherwise noted, 2011 HIT revenue is from Healthcare Informatics (August 2012) and reflects figures self-reported by individual firms (<http://www.healthcare-informatics.com/hci100/about-hci-100>).

Market Growth

As intended, HITECH appears to have contributed to a rapid growth in the vendor market for certified ambulatory products. Almost 800 vendors had such products in late 2012, including 666 with ambulatory products only and 129 that also

had inpatient products.⁸ Some products predated HITECH and were adapted, as needed, to meet its requirements; others were new products from both new and established vendors.

Table 2 shows the vendors used by eligible professionals who attested by October 31, 2012, that they successfully met

Table 2. Distribution of Eligible Providers Attesting With Medicare for Meaningful Use Incentive Payments by Vendor Used, All and Primary Care, January 2011 to October 2012^a

Vendors	All Eligible Providers			Primary Care ^b		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Epic Systems Corporation	20,108	19.9	19.9	9494	22.2	22.2
Allscripts	11,635	11.5	31.4	5751	13.5	35.7
eClinicalWorks	8872	8.8	40.2	4936	11.6	47.3
NextGen Healthcare	7113	7.1	47.3	3202	7.5	54.8
GE Healthcare	6208	6.2	53.5	3092	7.2	62.0
Greenway Medical Technologies, Inc	2933	2.9	56.4	1453	3.4	65.4
athenahealth, Inc	2757	2.7	59.1	1424	3.3	68.7
Practice Fusion	2754	2.7	61.8	1217	2.8	71.5
McKesson	2084	2.1	63.9	1209	2.8	74.3
Community Computer Service, Inc	2050	2.0	65.9	993	2.3	76.6
e-MDs, Inc	1981	2.0	67.9	1467	3.4	80.0
Sage	1907	1.9	69.8	804	1.9	81.9
Eyefinity/OfficeMate	1817	1.8	71.6	0.0	0.0	81.9
AmazingCharts.com, Inc	1161	1.2	72.8	866	2.0	83.9
BioMedix Vascular Solutions	1160	1.1	73.9	0.0	0.0	83.9
Compulink	1155	1.1	75.0	0.0	0.0	83.9
All other (100-500 attestations)	19,627	19.5 (n = 66)	94.5	3705	8.7 (n = 16)	92.6
All other (under 100 attestations)	5565	5.5 (n = 271)	100.0	3102	7.3 (n = 227)	99.9
All vendors	100,887	100 (n = 353)		42,715	100 (n = 256)	

GE indicates General Electric.

^aPercentages are rounded to the tenth place, yielding a total percentage slightly below 100.

^bAs used here, primary care is defined to include general practice, family practice, geriatrics, internal medicine, pediatrics, obstetrics/gynecology, and adolescent medicine. (The last 3 specialties are less commonly used in Medicare.) Data are from all 50 states, the District of Columbia, and Puerto Rico.

Source: Office of the National Coordinator and Mathematica analysis of Centers for Medicare & Medicaid Services attestation data provided by the Office of the National Coordinator. Attestation data are based on 100,887 of 107,907 professionals; the exclusions attested without using a complete electronic health record, or with multiple complete electronic health records.

stage 1 meaningful use requirements for Medicare. These data show a broad market, with 353 vendors selling certified complete products used by at least 1 eligible attesting provider. (The analysis was restricted to eligible professionals attesting for Medicare payments who used 1 vendor with 1 complete EHR. These included 93% of those attesting under Medicare [100,877 of 107,907 eligible professionals who qualify for Medicare and Medicaid must decide which program to use]. We cite Medicare figures because they are collected centrally and are more current and complete.) The number of vendors continues to grow, although at a slower rate than in 2011 (data not shown). Although there are many vendors, 16 firms account for 75% of the market. They include relatively established hospital vendors (Allscripts, CCS, and Sage) and newer vendors based mainly in the ambulatory market (eClinicalWorks, NextGen, and Greenway). Some (eg, athenahealth, Practice Fusion) offered products on a widespread basis only after HITECH was

enacted, reflective of significant market entry coinciding with HITECH. However, most vendors showed only a small reach to date (271 had fewer than 100 attestations; 127 of these had 10 or fewer attestations).

Market Concentration and Competitiveness

The Herfindahl-Hirschman Index is a commonly accepted measure of market concentration.⁹ (This index is calculated by summing the squares of the market share of each firm in an industry. The maximum score is 10,000. Markets with between 1500 and 2500 are considered to be moderately concentrated; those with higher scores are considered to be highly concentrated.) On this metric, the vendor market for ambulatory products was relatively competitive, with low concentration nationwide and across market sectors (Table 3). The main exception involved the largest practices (≥51 professionals). Other analyses also show greater diversity in vendor mix among

Table 3. Variation in Vendor Use, Medicare Attestations, and Market Concentration by Physician Specialty and Practice Size, January 2011 to October 2012

Characteristics	Vendors Used ^a	Medicare Attestations ^b	Herfindahl-Hirschman Index ^c
Overall	353	100,887	750
Specialty			
Primary care	256	42,715	988
Specialty care	281	46,932	820
Practice size			
Solo	254	6726	387
2-5 providers	261	11,861	377
6-10 providers	174	6534	598
11-50 providers	167	10,790	670
≥51 providers	101	22,161	2497
Multiple groups	292	38,152	892

^aUnique vendors with at least 1 successful meaningful use attestation. Because vendors can serve multiple specialties and practice sizes, the totals do not equal to the overall total.

^bThe total number of attestations exceed the totals by specialty or practice size because not all attesting professionals could be linked to the Medicare Provider Enrollment, Chain, and Ownership System data that were the source of specialty and practice size information.

^cMarket concentration as measured by the Herfindahl-Hirschman Index. Lower scores reflect more competitive markets. Markets between 1500 and 2500 are considered moderately concentrated, with higher scores considered highly concentrated.

Source: Office of the National Coordinator Analysis of Centers for Medicare & Medicaid Services attestation data linked to Medicare Provider Enrollment, Chain, and Ownership System, 2012.

the smallest practices (1-3 professionals) than among the largest (≥11 clinicians).¹⁰ Although the market may consolidate,¹¹ these data provide no evidence that this consolidation has begun, as the index reported here was relatively unchanged from that calculated at the end of 2011 (data not shown).

Specialization

Industry reviews highlight the relevance of particular vendors to different sized practices.¹² The attestation data show most large vendors used by practices across the size spectrum. Epic users are almost all professionals in the largest practices or multiple practice settings. Conversely, half or more of Practice Fusion, Eyefinity, Compulink, Biomedix, and Amazing Charts users are in the smallest settings (≤5 professionals; data not shown).

Studies show higher rates of attestation among primary care professionals than specialists.¹³ Our analysis showed somewhat more dispersion in vendors used by specialists than by primary care physicians (Tables 2 and 3). However, there were no striking differences in the vendor mix by individual specialty (data not presented). (Eyefinity/OfficeMate and Biomedix Vascular Solutions are exceptions.) Thus, both our analysis and industry sources suggest that most of the largest vendors aim to satisfy a wide audience.¹⁴

VENDOR ROLES AND FUNCTIONS

Product Distribution and Pricing

All of the vendors with whom we spoke were actively soliciting new business. They commonly used a variety of sales

channels, varying the emphasis with their target market. One vendor relied almost exclusively on online marketing and social media to attract large numbers of new but small practices. Another relied heavily on word of mouth to attract large-scale customers best positioned to take advantage of its product. Another vendor, part of a parent firm with other lines of health business, solicited new business from its existing clients using other firm products.

Most of the vendors had relationships with multiple regional extension centers funded by HITECH to assist high-priority providers.¹ Some of their clients also worked with a center. Vendors differed in the number of regional extension centers with which they worked and the conditions of the work, often reflecting differences in vendor marketing strategies. Some said they were motivated to pursue such arrangements as a possible source of new business. However, they generally were disappointed because extension centers produced limited new business.

Most vendors priced their products on a license or subscription basis, with monthly fees covering the specified services. One vendor linked payments to revenues generated, mirroring its pricing for existing practice management products. Another charged nothing, instead relying on advertising revenue, which a practice could remove for a monthly payment.

Some built incentives into the pricing. For example, one company ran demonstration projects in multiple states (now nationwide), offering vendor-financed grants/donations to reduce the product price. Two others offered some form of guarantee that practices would get their money back if they were

not successful in obtaining meaningful use payments. One of them limited such incentives to Medicaid practices, linking payments to initial adoption but not to meaningful use. The other included practices regardless of whether they were at-testing for Medicaid or Medicare.

Implementation and Maintenance Support

Implementation of EHRs requires practices to secure access to any hardware and complementary software the EHR product requires, train practice staff in product use, integrate EHR functionalities into practice work flow, and use the product to improve care for individual patients and the practice population overall. To access meaningful use payments, practices also must generate and submit metrics demonstrating compliance with requirements.

Vendors support practices in implementation in various ways. Self-designated full-service companies offer “high-touch, high-service support” for installation and ongoing maintenance, including considerable face-to-face training. Such vendors typically charge a fixed amount per month (usually several hundred dollars or more) that varies with the intensity of service and what it includes (eg, upgrades). In doing so, some vendors offer a relatively standardized product that builds on their experience. Others provide (for a price) more flexibility by tailoring the product. Vendors also may stretch out or shrink the implementation time frame to accommodate practices and minimize any disruption.

Some vendors structure their products with features they believe make them more operationally or financially feasible for small practices. An example is the design of products that maintain centralized back-end support “in the cloud.” This arrangement limits the amount of hardware individual practices must purchase and maintain, potentially lowering their fixed costs and avoiding the need to hire technical staff. Some vendors encourage a relatively standardized set of processes across practices to help practices convert to meaningful use and better learn from one another. To ease the demands further, a vendor may take on practice functions (such as faxing clinical orders or requests not yet possible to exchange through the EHR) to free up office staff. One particularly aggressive new vendor is marketing a fully online product as “free, Web-based, secure, live in 5[®] [minutes], pocket \$44K.”¹⁵ Practices desiring more support can hire vendor-trained third-party consultant networks.

In positioning their products, vendors appear to recognize affiliations that may exist among or between practices and larger health systems. Some vendors offer an “integrated solution,” in which a single product can be adapted to meet different needs. Others offer product lines that provide users with a choice of product sophistication and financial obligations

while supporting a shared infrastructure. If a vendor has a base product oriented toward large practices or systems, it also may offer simpler products that integrate with those of the base and allow connectivity with affiliates.

Support for Meaningful Use Attestation

All of the vendors we interviewed said they support providers seeking to meet meaningful use requirements. Such support includes training through workshops, practice-based trainings, conferences, and online classrooms. Some try to keep training costs down by relying more heavily on webinars versus face-to-face training, while others believe that this strategy is problematic in the long run because it may not generate necessary and fundamental changes in work flow. At least 1 vendor trains staff from its larger provider entities to help with implementation in smaller affiliates that have adopted a simplified version of its product that is interoperable with the larger entity. Some vendors embed meaningful use dashboards in their software, providing direct help with attestation, or set financial guarantees for a return of funds if attestation is unsuccessful. Others say they fear such strategies could detract from installing and using the EHR correctly. A recent survey of physicians found that satisfaction and reported usability of EHR functionalities were enhanced when the physicians were involved in vendor selection and received more training; however, 49% of physicians reported either no or only 1 to 3 days of training.¹⁶

Vendor Perceptions of Meaningful Use

Not surprisingly, the vendors with whom we spoke tended to tout their practices’ successes in adopting workable EHRs, meeting meaningful use requirements, and obtaining payments. They saw incentives as an impetus driving provider adoption, but not necessarily the most critical one, noting that the decision to adopt can be emotional for some providers. One interviewee characterized the decision to adopt EHRs as moving from a debate over “I do or don’t want to do it” to accepting the change and focusing on “how it will affect my work flow.” Practices’ decisions involve trade-offs between risks and rewards. Incentive payments are decisive in pushing some practices past the tipping point. From the vendors’ perspective, practices whose leaderships support adoption and engage clinicians in the effort are more likely to succeed.

Vendors said practices differed in how much weight they gave to healthcare delivery reform when deciding to adopt an electronic system. Vendors perceived that such reform generally was more important for larger systems that view it as a strategic essential. Smaller practices may be motivated more by defensive considerations and a desire to retain patients. Vendors stressed that data aggregation and other electronic-

enabled functionalities are tools for payment and delivery reform, but no substitute for awareness and control of the care being delivered. They said that there is still “an uphill march to value ... we’re not there yet.”

Vendors said that, among stage 1 requirements, newer functionalities not part of current practice pose the most difficult challenges in supporting products that meet meaningful use requirements. For example, linkage to public health registries is challenging because many agencies lack the interfaces to receive such data. Developing means for patient engagement (eg, patient portals, clinical summaries) also is an issue because appropriate tools still are being identified and developed. Such functionalities likely will be increasingly important in later stages of meaningful use. Vendors said some meaningful use requirements lacked specificity and noted inconsistencies in the technical specifications for electronic performance metrics used for attestation as an emerging issue as the number of providers seeking attestation grows.¹⁷

EMERGING ISSUES

Our analysis suggests that HITECH met its initial goals of motivating the growth of a vendor community with products geared to the ambulatory market. Indicators show a highly competitive market in which products appear diverse. Strategies varied even among the small subset of vendors interviewed; they are experimenting with innovative features such as hosted technologies or simplified systems that aim to make it more feasible for small practices to adopt EHRs and use them meaningfully. While it is too soon to judge the merits of particular innovations, they represent what policy makers hoped might emerge through HITECH.

The vendors we interviewed and the external analysts agreed that stage 1 requirements set a relatively low bar for market entry.¹⁸ Looking to the future, the fundamental questions relate to how this market will evolve as requirements for products become increasingly demanding under stages 2 and 3 meaningful use, what the emerging issues will be, and what levers policy makers will have available to encourage evolution of this market to meet policy goals. Stage 2, effective in 2014, emphasizes improving care as patients make transitions across the system. Products meeting stage 2 requirements must embed technology and tools to support exchange of information across providers, patient download of information, and other modifications that support the enhanced emphasis around transitions in care.¹⁹ Stage 3 requirements are expected to emphasize such features further.²⁰ Products certified for stage 1 still can be marketed, but professionals seeking to move from stage 1 to stage 2 must ensure that their systems support the expanded requirements in the latter.

Competition With Market Shakeout?

Some believe increasingly demanding product requirements under HITECH will mean a market shakeout, resulting in greater market concentration as entry costs rise. Vendors we interviewed agreed this was possible; they were less convinced that a shakeout would come through vendor consolidation to concentrate business because of the complexity in transitioning professionals from one system to another. While trade reports show new EHR adopters to be very price sensitive and interested in newer and smaller market competitors, performance and reputation weigh heavily on product selection in the replacement market.²¹ These contrasting dynamics are consistent with a future that includes both considerable competition from new entrants challenging established vendors and a shakeout among vendors that fail to deliver.

From a policy perspective, consolidation might not be bad and could even be desirable. There currently are many products but most have very little market share. There are regulatory costs to certifying so many products, and behavioral economics suggests that extensive choice could actually impede, not promote, choice.²²

But consolidation also could be highly disruptive for practices using products that are discontinued or not upgraded. Vendors we interviewed said switching products was likely to be as disruptive for a practice as initial adoption, even though some stage 2 requirements aim to make transitions easier by limiting the need to re-enter historical data.⁷ From the information available, we were not able to assess whether vendors were structuring products to make migration harder. If providers are dissatisfied with the products they select initially and cannot transition easily to a better product, their reactions could be damaging to HITECH’s goals. The extent of disruption obviously will vary with the number of providers affected by any change in the market.

Winners and Losers: Balancing Innovation With Oversight

If there is a shakeout in the market, federal requirements and the handling of regulatory oversight are likely to influence vendor survival. Our interviews suggest that the form of certification requirements, handling of efforts to regulate the “usability” of vendor products, and the approach to interoperability each have the potential to shape the market and affect the competitive position of products with different features.

Form of Certification Requirements. While vendors might not necessarily welcome a host of new competitors, those we interviewed were concerned about overly prescriptive requirements for product certification particularly, they implied, if the requirements impeded their ability to pursue designs that distinguish them in the marketplace. They distinguished between

setting public goals and specifying how they should achieve those goals. For example, one vendor said that its use of web-based products allows frequent product updates, which provides value to users. However, this policy might not continue if standards limit the frequency of updates and require each update to be approved. Another vendor perceived requiring providers to test for drug-drug interactions as different from requiring vendors to include that capacity within their certified EHR products. Because the form of the requirements is likely to create winners and losers, policy makers should be careful to establish requirements whose focus is on encouraging change that is supportive of policy goals (eg, improving care).

Approach to Usability Concerns. Policy makers have been debating how far to regulate the usability of products and their potential effects on patient safety, as highlighted in a recent Institute of Medicine report on health information technology and patient safety that included a dissenting view calling for the regulation of health information technology products by the US Food and Drug Administration as Class III medical devices.²³ Many vendors we interviewed thought that the usability issue was a red herring raised by providers uncomfortable with the transition to health information technology. They argued that paper records have their own limitations, that physicians are highly educated and should be sufficiently well positioned to protect themselves, and that the usability issue is best left to the market. They said that, given a rapidly evolving set of technologies, government lacks the ability to look ahead to market needs. One interviewee noted that if the same policies had applied to communications, “We’d never have gotten the iPhone.” Vendors said they support a “culture of safety” but want a nonpunitive, multistakeholder approach.²⁴

However, regulation also has benefits in terms of encouraging well-tested and supported products, which must be weighed against a potential adverse impact on innovation. A new and permanent certification program has been established. Effective October 2012, the American National Standards Institute will oversee the process, and certification and testing will be considered separate functions. Policy makers likely want to understand how recent changes are affecting usability as they debate whether additional requirements are needed or how to structure them.

Interoperability Strategy. Given the pace of technological change, considerable debate exists over how best to envision ideal future systems.²⁵ There is interest in encouraging technology that challenges existing practices (so-called “disruptive technologies”). (For analysis of the distinction between sustaining and disruptive technologies, and their market effects, see *The Innovator’s Dilemma* by Christensen.²⁶) However, the ability to support such innovation could be lim-

ited without a common means of generating interoperability, allowing data to flow across diverse providers, the patients they serve, and organizations within their communities with a stake in either individual or population health. Interoperability is important to initiatives to reshape the healthcare system, whether through medical homes, accountable care organizations, bundled payment, integrated care, or other means to enhance patient-centered care and coordination across providers and settings to achieve better outcomes at lower costs. But many barriers exist.²⁷

HITECH originally envisioned exchange of information as a geographically based and open “public good,” but many states—like regional health information systems historically—have found it challenging to develop a sound business model to finance and support such exchange, which today remains highly limited and geographically specific.^{1,28} In the absence of strong geographically based systems for exchange, EHR vendors say they are being asked to develop client-specific solutions or work-arounds, particularly for providers common to a set of patients. Connectivity solutions are a new source of revenue, so vendors that can provide them may have an interest in promoting this strategy versus more public and open exchange platforms. However, vendor- and provider-specific solutions are expensive and inherently favor vendors with a large installed base upon which to spread fixed costs and a market share capable of enhancing the value of platform-limited exchange.

Allowing vendors and the private market to guide the form of exchange could create inequities, especially across markets that vary in concentration and for providers and patients with different characteristics. Such vendor exchange may also favor more established and larger vendors over relatively new and potentially innovative new entrants whose business models were not developed to support such exchange. If stage 2 requirements for common tools to support broad-based exchange do not support broad-based interoperability consistent with policy goals, policy makers may need to consider other means for making this feasible across the diversity of ambulatory products and practice settings.

CONCLUSIONS

Our analysis suggests that HITECH met its initial goals of motivating the growth of a vendor market offering products geared to the ambulatory market. Indicators show a highly competitive market with diverse products and some innovation. While it is too soon to judge the merits of particular innovations, a diverse and competitive market is what policy makers hoped might emerge through HITECH.

Looking to the future, the current size of the vendor market appears to leave room for market consolidation, especially if it

does not affect large numbers of providers. In a market environment, public policy is likely to influence the characteristics of vendors who win and lose. Vendor interviews suggest that the way policy makers approach balancing goals of innovation and regulatory oversight on certification, product usability, and interoperability will influence the future shape of the market.

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ABSTRACT E-prescribing, or the electronic generation of a prescription and its routing to a pharmacy, is generally believed to improve health care quality and reduce costs. However, physicians were slow to embrace this technology until 2008, when Congress authorized e-prescribing incentives as part of the Medicare Improvements for Patients and Providers Act. Using e-prescribing data from Surescripts, we determined that as of December 2010, close to 40 percent of active e-prescribers had adopted the technology in response to the federal incentive program. The data also suggest that among providers who were already e-prescribing, the federal incentive program was associated with a 9–11 percent increase in the use of e-prescribing—equivalent to an additional 6.8–8.2 e-prescriptions per provider per month. We believe that financial incentives can drive providers' adoption and use of health information technology such as e-prescribing, and that health information networks can be a powerful tool in tracking incentives' progress.

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Numerous studies have found that the use of health information technology (IT) generates clinical and public health benefits and facilitates improvements in the quality and coordination of care.¹⁻³ Two common examples of health IT in use today are e-prescribing, or the electronic generation of a prescription and its routing to a pharmacy, and electronic health record (EHR) systems. However, despite the benefits that apply to a wide range of health care stakeholders, adoption and use of health IT among the nation's health care providers remained low through the mid-2000s.⁴

Technology infrastructure to enable physicians to e-prescribe was limited before 2001. Thousands of individual pharmacies and millions of providers lacked the ability to communicate directly with each other. The National Association of Chain Drug Stores and the National Community Pharmacists Association

created Surescripts in 2001 to enable electronic prescription routing between providers and pharmacies. Early e-prescribing software was offered to providers either as a stand-alone technology or as part of an EHR system.

By 2004 roughly 0.4 percent of office-based providers, or 2,500 providers, had adopted e-prescribing.⁵ In 2005 the Centers for Medicare and Medicaid Services (CMS) published a final rule establishing standards for providers and pharmacies using e-prescribing.⁶ A year later CMS funded five pilot projects to test additional proposed Medicare Part D e-prescribing standards. By 2007 the boards of pharmacy in all fifty states had authorized e-prescribing as a legal method of prescription transmission. At that time, however, providers' adoption of the technology was still modest: just 6 percent of office-based providers, or 35,500 providers, were e-prescribing.⁷

Larger medical practices frequently had access to equipment financing and the operational

funds and capacity to manage the large-scale workflow changes associated with the adoption and use of EHR systems; as a result, these practices had a higher rate of EHR adoption than smaller practices.^{8,9} For example, clinics often leveraged existing IT staff to assist with selecting EHR vendors, installing an EHR system, training, and on-site support.

Faced with financial and operational constraints, many smaller practices abstained from adopting EHR systems or other forms of health IT. Others adopted less complex stand-alone e-prescribing systems (often sold as software to be used on a handheld device). The majority of office-based providers are employed by small practices; therefore, many experts concluded that in the absence of government intervention, market forces alone would not produce wide-scale adoption of e-prescribing.¹⁰⁻¹²

For this reason, in 2008 Congress authorized e-prescribing incentive payments as part of the Medicare Improvements for Patients and Providers Act. The act authorized the health and human services secretary to establish a program to encourage the adoption of e-prescribing technology. Implemented in 2009, the program offered financial incentives to “eligible professionals,” or health care providers who provide reimbursable services to Medicare beneficiaries. The act authorized a 2 percent bonus payment for e-prescribing beginning in 2009, established a schedule for decreasing incentive payments through 2011, and imposed penalties for non-participation in e-prescribing between 2012 and 2013.

The legislation authorizing e-prescribing incentive payments was followed by a broader push for the adoption and use of EHRs through the Health Information Technology for Economic and Clinical Health (HITECH) Act, passed in 2009 as part of the American Recovery and Reinvestment Act. The HITECH Act authorized an estimated \$30 billion in incentives to eligible professionals and hospitals that adopt and meet federal standards for the so-called meaningful use of certified EHR technology.¹³ *Meaningful use* includes functions such as e-prescribing, reporting clinical quality measures, clinical decision support, and electronic exchange of clinical messages between providers.

The HITECH Act authorized another \$2 billion to develop and support the nation’s health IT infrastructure and capacity to engage in the electronic exchange of health information. This included technical support for the adoption, maintenance, and meaningful use of EHR systems.¹⁴

Since the Medicare Improvements for Patients and Providers Act and HITECH programs were launched, Medicare and Medicaid have paid out

more than \$12 billion in incentives.¹⁵ For policy makers, it is important to understand whether the increased rate of e-prescribing adoption since 2009 would have occurred without federal financial incentives. Insights into this question could inform assessments of the impact of current EHR incentives under HITECH and plans to structure or adjust future incentive programs to maximize the return on investment.

In exploring the relationship between the Medicare Improvements for Patients and Providers Act incentives and the adoption and use of e-prescribing, this article addresses three questions. First, did these incentives accelerate the rate of e-prescribing adoption by providers? Second, was the impact of the incentives limited by certain factors, such as geographical location, or was it seen across practice settings? And third, did the incentives affect e-prescribing use among providers who had already adopted e-prescribing systems?

Study Data And Methods

DATA SOURCE The study data were obtained from the Surescripts e-prescribing network, which is used by pharmacies, payers, pharmacy benefit managers, physicians, hospitals, health information exchanges, and health technology firms. As of the end of 2012, the network was used for the purpose of exchanging prescription-related information in ambulatory settings by approximately 465,000 providers, 62,000 community pharmacies, six of the largest US mail-order pharmacies, and more than twenty-five of the nation’s largest pharmacy benefit managers. Approximately 93 percent of US community pharmacies use the network for prescription routing. More than 350 technology vendors’ e-prescribing systems have been certified as eligible to access the network.¹⁶

The use of network transaction data to measure e-prescribing adoption and use helps overcome the potential reporting bias of a survey-based approach or the delays associated with the use of payer claims data. Some of the data used in this study are available to the public online through Surescripts’ annual *National Progress Reports on E-Prescribing and Safe-Rx Rankings*. Two authors had full access to the Surescripts data as employees of the company. They shared the data with their coauthors, who are in the Office of the National Coordinator for Health Information Technology at the Department of Health and Human Services. Neither entity provided funding for this study.

OBSERVATION PERIODS The primary analysis period was from May 1, 2006, through December 31, 2010 (fifty-six months). The pre-

intervention period was May 1, 2006, through July 31, 2008, ending in the month when the Medicare Improvements for Patients and Providers Act became law. The post-intervention period was from August 1, 2008, through December 31, 2010.

We have noted below whenever granular-level data were not available as of May 2006 because of contractual and other data limitations. When the pre-intervention period data were insufficient to conduct some analyses, we identified a “peri-intervention” period of August 1, 2008, through February 28, 2009, as a basis of comparison.

STUDY VARIABLES We first measured the number of new e-prescribers by month, from May 2006 through December 2010. For the purposes of this study, *e-prescribing adoption* was defined as when a provider became “active” on the Surescripts network—that is, when a provider registered with a certified e-prescribing application and transmitted at least one e-prescription through the network. We calculated the number of new e-prescribers for a given month by subtracting the number of e-prescribers for the previous month from the number for the given month. As of December 31, 2010, there were 233,760 e-prescribers on the network, representing more than 90 percent of all e-prescribers in the United States and coming from all fifty states; Washington, D.C.; Puerto Rico; and seven additional territories.

To determine whether the federal incentives had a measurable impact on e-prescribing adoption across socioeconomic segments and geographic regions, we matched aggregated e-prescriber data at the ZIP code level to income data from the 2000 census. We also aggregated e-prescriber data at the ZIP code level and matched them to census data to track adoption data by geographic type, defined by Metropolitan Statistical Areas and non-Metropolitan Statistical Areas.

The secondary analysis used two measures of e-prescribing use to address the question of whether the Medicare Improvements for Patients and Providers Act incentives affected providers who had already adopted e-prescribing systems. The first measure was the percentage of providers who were active during a given month, and the second was the average number of e-prescriptions monthly per active provider.

We also analyzed whether the incentives had a discernible impact on use for existing e-prescribers. We compared rates of use in a cohort of providers ($n = 4,362$) who adopted e-prescribing systems between May 1 and June 30, 2006. We selected providers who adopted e-prescribing during this period to identify baseline patterns of use in the pre-intervention period.

MODELING ADOPTION AND USE OF E-PRESCRIBING For the primary analysis, we developed a linear regression model of providers’ adoption based on longitudinal e-prescribing adoption data during the pre-intervention period. We used the model to forecast the expected number of new e-prescribers by month through December 2010.

For our analysis of use, or the average number of e-prescriptions per month per provider, we developed a linear regression model for the cohort of providers who adopted e-prescribing during the pre-intervention period. The linear regression was constructed by calculating the cohort’s average number of e-prescriptions on a monthly basis during the pre-intervention period. For the cohort, this time period ranged from the period of adoption (May–June 2006) through July 2008. We also measured retention rates (the number of providers e-prescribing per month divided by the total number of providers in the cohort) during the pre- and post-intervention periods.

STATISTICAL ANALYSIS To analyze adoption of e-prescribing during the study period, we compared the actual number of new e-prescribers with the numbers predicted in our model, identified differences between actual and expected values during the pre-intervention period, and created a process-behavior chart (also known as a control chart, which is used frequently in Six Sigma management of manufacturing to determine if a process is in a stable, or “controlled,” state).¹⁷ We used the process-behavior chart to measure whether the adoption numbers fell within the expected range during the pre-, peri-, and post-intervention periods.

For more-granular analyses of adoption data across socioeconomic and geographic boundaries, the pre-intervention period did not always include sufficient data to construct a growth model. Where sufficient data did not exist, we used annualized growth rates during the pre- and peri-intervention periods to make directional comparisons.

For the analysis of existing e-prescribers, we determined whether use of e-prescribing changed noticeably in the post-intervention period. For the purpose of measuring *e-prescribing use*, defined here as the average number per month of e-prescriptions per provider in the cohort, we used the regression model and process-behavior chart to determine whether actual levels of use differed significantly from the expected levels. To evaluate the retention rates in the cohort, we used paired *t* tests comparing pre- and post-intervention rates of use. Because of the relatively small number of measurement periods in the pre-intervention period, we lim-

ited the number of post-intervention measurement months to conduct the paired *t* tests. All data were analyzed in Microsoft Excel, using the data analysis add-in.

LIMITATIONS Our study had several limitations. First, because we aggregated the data at the network level and did not track individual providers' behavior, the number of new e-prescribers in any given month might include providers who had previously adopted e-prescribing, stopped using it, and then began e-prescribing again. However, our experience in operating an e-prescribing network suggests that the number of such providers is small and relatively consistent, and therefore it should distort the results modestly if at all.

Second, the adoption curve of any new technology is difficult to predict, and many factors can affect a provider's decision to adopt and use new technology. We conducted our analysis using network data on a longitudinal and nationwide basis, and we considered alternative analyses to account for relevant factors. Nonetheless, it is possible that we did not take all of the appropriate external factors into account.

Third, we were not able to make complete matches between our provider directory information and data from external sources such as the Census Bureau or commercial vendors with their own provider directories. As a result, we were not able to replicate all statistical tests for the analyses segmented by practice size, socioeconomic level, and geographical region.

Despite these limitations, we believe that our analysis offers strong and observable evidence across care settings that supports the overall study findings.

Study Results

E-PRESCRIBING ADOPTION During the study period, 58 percent of e-prescribers worked in small practices (those with five or fewer providers), consistent with broad practice demographics. Of the e-prescribers in the analysis, the largest group comprised family practitioners (22 percent), followed by internists (16 percent), pediatricians (8 percent), and cardiologists (7 percent). In the Surescripts network, 79 percent of providers used an e-prescribing system that was integrated into an EHR system instead of a stand-alone e-prescribing system, reflecting an upward trend in EHR adoption over the past several years.¹²

The number of new e-prescribers per month in the pre-intervention period ranged from a low of 141 (July 2006) to a high of 2,575 (November 2007), with an average of 1,437 (Exhibit 1). In the post-intervention period

the numbers ranged from a low of 3,207 (December 2009) to a high of 10,513 (February 2009), with an average of 6,346 per month.

During the pre-intervention period there was no month in which the difference between the actual number of new e-prescribers was more than three standard deviations from the mean predicted by our adoption model (Exhibit 2). And during that period there was only modest variability in the number of new e-prescribers per month. In contrast, we observed a significant increase in the number of new e-prescribers after July 2008, when the Medicare Improvements for Patients and Providers Act became law. And in twenty-two of the twenty-nine months in the post-intervention period, the actual values were more than three standard deviations above the expected mean.

We also analyzed new e-prescribers per month across three views: by geographic type (Metropolitan Statistical Areas and non-Metropolitan Statistical Areas), socioeconomic setting (as determined by income quintile at the ZIP code level of the practice), and provider practice size (Appendix Exhibit A).¹⁸ Similar to the trends seen at the national level, we observed a much higher growth rate of e-prescribers across socioeconomic and practice settings during the peri-intervention period than in the pre-intervention period.

E-PRESCRIBING USE Of the 4,362 providers in our cohort who adopted e-prescribing systems in May or June 2006, nearly half (2,119) were e-prescribing as of January 2007 (Exhibit 3), or roughly six months following adoption. This level of retention was consistent with Surescripts' internal analyses of new adopters at the time. During the pre-intervention period the number of providers in the cohort who continued e-prescribing ranged from a low of 2,000 in April 2007 to a high of 2,138 in January 2008. During the post-intervention period the number ranged from a low of 2,101 in August 2008 to a high of 2,416 in December 2010. The number of e-prescribers active each month was, on average, 4.4 percent ($p < 0.01$) higher in the post-intervention period than in the pre-intervention period.

Among active e-prescribers in the cohort, the average number of e-prescriptions per provider per month was 57.9, peaking at 65.4 in February 2008 (Appendix Exhibit B). During the post-intervention period, the average was 81.7, peaking at 97.4 in November 2010. We detected a significant shift in the rate of e-prescribing in the post-intervention period, with actual levels generally higher than predicted by our model. Actual levels of e-prescribing were more

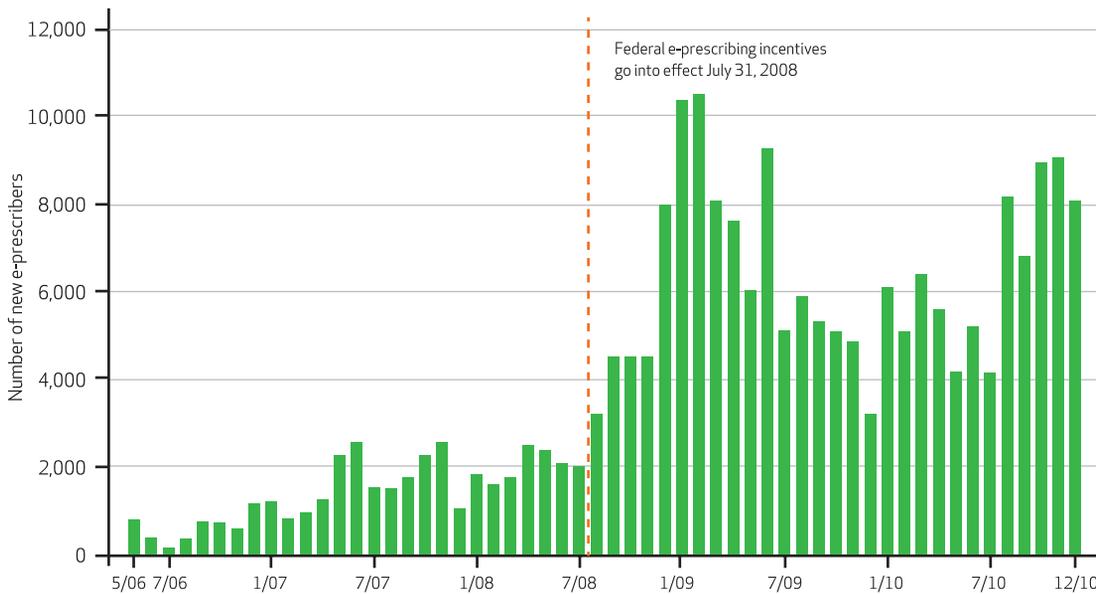
6,346

New e-prescribers

The number of new e-prescribers averaged 6,346 per month after the incentive program—up from an average of 1,437 per month.

EXHIBIT 1

Number Of New E-Prescribers In Surescripts Network Per Month, 2006-10



SOURCE Authors' analysis of Surescripts data.

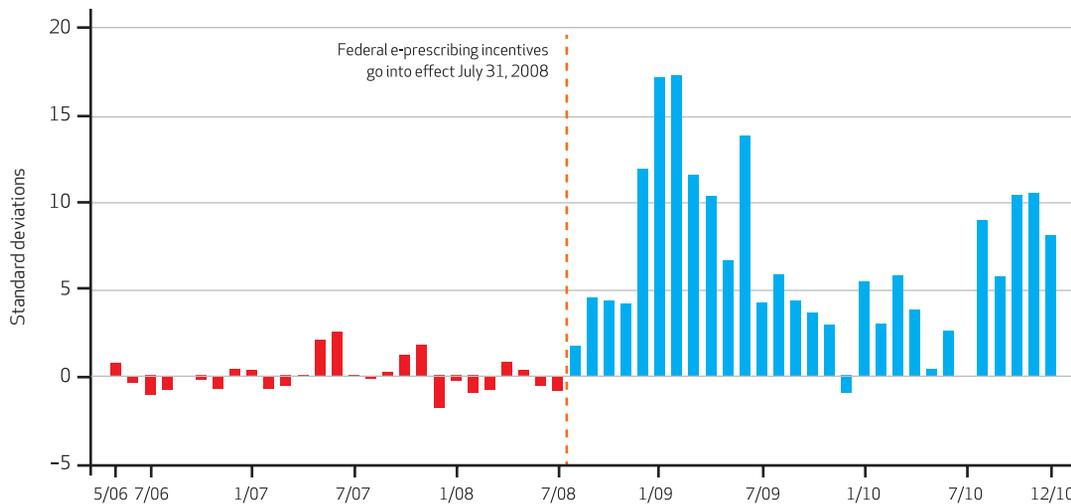
than three standard deviations above the expected value for eleven of the twenty-four post-intervention months (Appendix Exhibit C).¹⁸ Cumulatively, the actual number of e-prescriptions in the post-intervention period was 9–11 percent higher than the predicted number.

Discussion

Congress designed the Medicare Improvements for Patients and Providers Act incentives for e-prescribing to mirror the type of value-based incentive programs increasingly implemented by commercial health plans over the previous de-

EXHIBIT 2

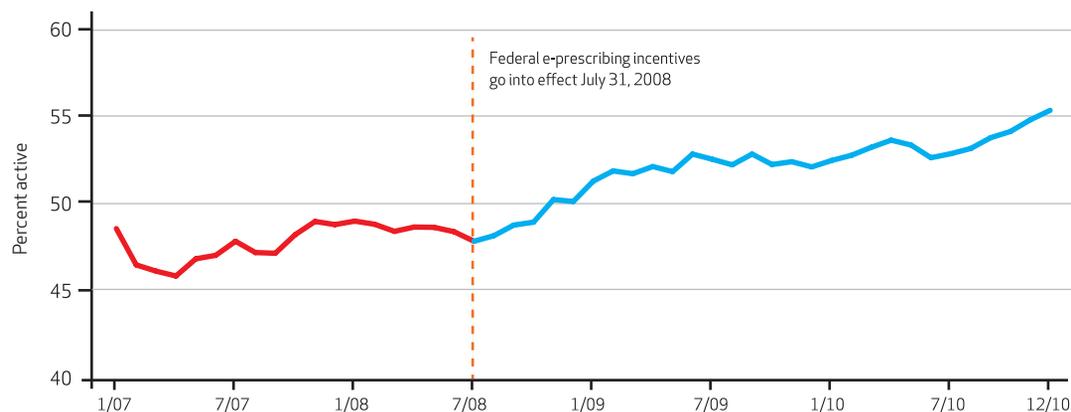
Number Of New E-Prescribers In Surescripts Network Per Month, Before And After The Introduction Of Federal Incentives, As Standard Deviations From Predicted Mean, 2006-10



SOURCE Authors' analysis of Surescripts data. **NOTES** The pre-intervention period, used for our model, was May 1, 2006, through July 31, 2008, ending in the month when the Medicare Improvements for Patients and Providers Act became law. The post-intervention period was from August 1, 2008, through December 31, 2010. "Intervention" refers to the introduction of federal incentives.

EXHIBIT 3

New E-Prescribers In Surescripts Network May–June 2006 Who Remained Active, 2007–10



SOURCE Authors' analysis of Surescripts data. NOTE N = 4,362 e-prescribers.

cade with varying degrees of success. The federal program offered a “carrots first, sticks second” approach over the period of 2009–13. To date, little attention has been paid to whether the program has achieved its intended effect: an increase in the adoption and use of e-prescribing.

Our analytical approach to that question is noteworthy because it used real-time electronic prescription data sent through an e-prescribing network, instead of claims or survey data, to measure adoption and use. We believe that using similar transaction data from electronic health information exchange networks could prove helpful to researchers interested in studying similar topics, such as meaningful use of EHRs.

Our analysis demonstrated a marked increase in e-prescribing adoption immediately following passage of the Medicare Improvements for Patients and Providers Act, which we believe suggests a causal relationship. However, we analyzed adoption rates across practice settings, socioeconomic levels, and locations to test whether instances of clustered adoption by hospitals or clinics, pharmacy adoption in densely populated areas, or other factors could explain the increased adoption rates that we observed. That analysis revealed that the timing of the adoption phenomenon was consistent, which suggests that none of the local, regional, or state-level factors could explain the rapid increase in adoption of e-prescribing that began in the second half of 2008.

Additionally, we tested whether the Medicare Improvements for Patients and Providers Act had an impact on the behavior of providers who had adopted e-prescribing systems before the act became law. Again, the data revealed a discernible increase after the law’s enactment in

the use of e-prescribing among providers who had already adopted e-prescribing systems.

Given these results, we believe that there is convincing evidence that the Medicare Improvements for Patients and Providers Act incentive program increased both the adoption and use of e-prescribing. Our analysis suggests that the incentives resulted in 89,000–94,000 more new e-prescribers between mid-2008 and the end of 2010 than there would have been otherwise, as well as an average of 9–11 percent more e-prescriptions per month (6.8–8.2 total e-prescriptions per month) from existing e-prescribers. These data suggest that as of December 2010, close to 40 percent of active e-prescribers had adopted the technology in response to the incentives.

We believe that the incentives were very effective for several reasons. First, the program included a sliding scale of financial incentives and penalties, which provided higher returns on investment to those who adopted earlier than to those who waited to adopt. Second, the incentives were tied to providers’ reimbursement for Medicare services, making the program relevant to a high proportion of providers. Third, the incentives were provided not just for adoption but also for the continued use of e-prescribing during each measurement period, so providers were motivated to invest in long-term workflow adjustments. Finally, eligibility for the incentives was based on clear and measurable results—numbers of e-prescriptions—instead of a demonstration of compliance with a process. This gave providers the flexibility to choose e-prescribing technology that was appropriate for their specific needs and to decide how they would adapt their workflow.

9–11%

More e-prescriptions

The incentive program resulted in 9–11 percent more e-prescriptions per month, on average, from those who were already e-prescribing.

Conclusion

With the program of federal incentives for e-prescribing in the Medicare Improvements for Patients and Providers Act now in its final year, it is important to evaluate whether or not the program achieved its intended effects of increased adoption and use of e-prescribing. We found strong evidence that the incentives did indeed succeed.

To our knowledge, this is the first case in which researchers used transactional data from a health information network to study the impact of a federal intervention on providers' adoption of health IT. The use of novel data sources can shed light on the effectiveness of incentives such as the ones in the Medicare Improvements for Patients and Providers Act and other programs that leverage health IT. ■

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- 18 To access the Appendix, click on the Appendix link in the box to the right of the article online.