Viewpoint:
Electronic Health Records: History in the Making
We live in a world of computers, tablets, smartphones, e-mail, and social media. Digital technology is so thoroughly woven into our everyday lives that being less connected is nearly unimaginable. But how exactly has this digital revolution affected the way we conduct health care?

The answer is we are in the midst of a nationwide integration of digital technology and health delivery via the electronic health record (EHR). Within the next decade, it is hoped that we will have a nationwide EHR system.1,2

This white paper is the first of a 3-part series examining EHR technology: How and when was the EHR born? How has it developed over time? We will trace the emergence of EHR technology in the 1960s through the present time, and end with a brief look at its potential future.

**What Is an EHR?**

An EHR is a longitudinal electronic version of a patient’s medical information. This includes patient demographics, progress notes, medications, vital signs, past medical history, immunizations, laboratory data, and radiology or other reports. The EHR streamlines provider access to patient information, and has the potential to help providers improve quality of care. Having readily accessible, centralized data about each patient can help providers reduce medical and prescribing errors by improving the accuracy and clarity of medical records and prescriptions. EHRs can increase efficiency by reducing redundant tests and services as well as delays in treatment. Additionally, EHRs may help make health records more accessible to patients, thus helping them become better informed and capable of advocating for themselves. Overall, the EHR can transform health care delivery to be more accurate, better coordinated, as well as more time- and cost-efficient.3-5

EHR systems can include many potential functional capabilities, but 3 functionalities (shown on the next page in Table 1) in particular are critical to improving quality of health care and reducing systemic costs.6
Table 1. Key EHR Functional Capabilities and Applications

<table>
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<tr>
<th>Functional Capabilities</th>
<th>Potential Application</th>
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| Clinical Decision Support (CDS) helps providers make better, safer patient care decisions | ● Provide information about drugs  
● Cross-reference patient allergy to specific medication  
● Provide alerts for potential drug interactions or other issues |
| Computerized Physician Order Entry (CPOE) allows providers to enter orders for drugs, lab tests, and other procedures electronically | ● Eliminate medical errors caused by poor penmanship  
● Provide clarity amongst health care team about drugs and procedures for a given patient |
| Health Information Exchange (HIE) is the process of sharing patient information between different organizations/practices | ● Allow real-time electronic access to patient health information across physician practices, pharmacies, specialist offices, and other locations, such as hospitals and emergency departments  
● Enable broader view of patient health information across locations and over time  
● Eliminate faxing or mailing patient health information, which is slow and inefficient |
Early History of EHR Technology

Today’s EHRs owe much to the groundbreaking work initiated in academic medical centers and industry and government clinical care organizations during the 1960s and 1970s. Many of the concepts that these early systems pioneered were influential and are in use today.7,8

In the mid-1960s, it is estimated that at least 73 hospitals had initiated some form of EHR project. The University of Utah together with 3M Corporation developed one of the first EHRs—the Health Evaluation through Logical Processing (HELP) system, which had CDS features. Around the same time, Lockheed developed an EHR, since handed down to Technicon, then TDS Healthcare, and now Allscripts. This system was notable for its processing speed and flexibility, which allowed many users simultaneous access to the system. Then, in 1968, Harvard and Massachusetts General Hospital developed the Computer Stored Ambulatory Record (COSTAR), which was implemented in the public domain in 1975 and used at hundreds of sites worldwide. COSTAR had 2 innovative features: 1) a modular design that allowed the system to be separated into parts to improve efficiency (for example, the accounting portion of the system could be separated from the portion containing clinical information); 2) the system registered multiple terms for the same disease, which allowed users across organizations to recognize a given condition despite terminology variations.7,8

In the 1970s, the federal government implemented an EHR system with the Department of Veteran Affairs called De-Centralized Hospital Computer Program (DHCP), which was used nationwide. The federal government also initiated the Composite Health Care System (CHCS) to serve as the Department of Defense’s (DoD) clinical patient record system used worldwide.7,8

By the 1980s, further effort was made to increase use of EHRs, especially as experts in medicine recognized the potential of EHR technology to improve health care. The Institute of Medicine (IOM), the health advisory arm of the National Academy of Sciences, launched a study in the mid-1980s on the potential of EHRs to improve patient clinical care.7,9 This study, *The Computer-Based Patient Record*, published in 1991 and again in 1997 with revisions, was the first to call for the widespread implementation of EHRs to provide timely, accurate health data and to improve the quality of care while reducing costs.10

In 1987, an EHR standards-developing organization called Health Level Seven International (HL7) was formed to tackle standardization issues surrounding use of EHRs. HL7 recognized that different components of EHRs, often made by many
different manufacturers, need to be made with standardized specifications and language so that communications can take place, especially across different institutions’ EHR systems. With members in more than 55 countries, the HL7 develops standards for the exchange, integration, sharing, and retrieval of health information from one application to another.7,8,11,12

Need for EHRs Gains Momentum

By the early 2000s, recognition of the problems in the US health care system was mounting. In 1999, the IOM had issued a report titled *To Err is Human: Building a Safer Health System*, which concluded that tens of thousands of Americans die each year as a result of preventable mistakes in their care. The IOM published yet another report in 2001, this time focusing on the fundamental need to revamp the entire health care system in order for high-quality, consistent medical care to be delivered to the American population. This report, called *Crossing the Quality Chasm: A New Health System for the 21st Century*, outlined the reasons why our health care system was falling behind. These included: 1) the inability to incorporate new medical and technological advances appropriately into practice; 2) the inadequacy of the current system, originally developed to address acute medical needs, to provide an infrastructure of quality care to the increasing numbers of people living longer and requiring care for chronic conditions. In addition, the IOM highlighted the problem of poor organization in the health care system, which leads to health care delivery that is cumbersome, time-consuming, and uncoordinated. Health care organizations, hospitals, and physician practices for the most part function as separate silos, providing care without complete information about a patient’s condition, medical history, services provided in other settings, or medications prescribed. Patient care is marked by inefficient “handoffs” between providers that leave gaps in information, care, and safety.13

A required step to addressing these problems relied on the adoption of information technology, concluded the IOM:

“Information technology, including the Internet, holds enormous potential for transforming the health care delivery system, which today remains relatively untouched by the revolution that has swept nearly every other aspect of society.”13

It called for a nationwide commitment to building an information infrastructure to support health care delivery, consumer health, quality measurement and improvement, public accountability, clinical and health services research, and clinical education. The goal was to eliminate most handwritten clinical data by 2010.13
Legislative Action

Despite broad consensus amongst health care experts and policymakers on the need for EHRs, the adoption rate remained low in the early 21st century. This contrasted with the level of EHR use in other industrialized nations, such as the United Kingdom, the Netherlands, Scandinavia, Australia, and New Zealand. A 2008 US study found that only 17% of physicians had basic or fully functional EHR systems. A 2009 study found only 9% of hospitals surveyed had basic or comprehensive EHR systems, and only 17% of hospitals had CPOE implemented for medications.

To address this problem of low EHR use, President George W. Bush in his 2004 State of the Union address introduced an initiative to make EHRs available to the majority of Americans by 2014:

“By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care.”

To promote the adoption of EHR technology, the Bush administration established the Office of the National Coordinator for Health Information Technology (ONC) in the Department of Health and Human Services. The goal of the ONC was to develop standards necessary to achieve the interoperability of the multitude of varying EHR applications. The ONC contracted the Certification Commission for Healthcare Information Technology (CCHIT) in 2004 to develop EHR certification criteria and create an inspection process. Since 2006, it has been certifying EHR products and capabilities. A second goal of the ONC was to develop a national capability for HIE in a secure computer environment.

EHR technology gained even greater federal backing under President Barack Obama. In 2009, President Obama launched an unprecedented effort to adopt EHRs nationwide by passing the Health Information Technology for Economic and Clinical Health (HITECH) Act, part of the much larger stimulus bill known as the American Recovery and Reinvestment Act of 2009. HITECH set aside a total of $29 billion for the ONC and the Centers for Medicare and Medicaid Services (CMS) to support development of a nationwide EHR system. For this goal, the CMS would administer a large-scale incentive payment program to encourage millions of health care providers and thousands of health care institutions to adopt certified EHRs and to demonstrate “meaningful use” for improving patient care. The HITECH Act represents one of the largest federal investments ever in health technology, demonstrating a broad consensus and commitment to fully realizing the potential of EHRs to transform the health care system.
The HITECH Act laid the groundwork for a massive transformation via the EHR incentive program, which was designed to financially reward early EHR adopters and to penalize late adopters. Through CMS, the incentive program would award providers with extra Medicaid or Medicare payments for early adoption of EHRs. The maximum incentives are for people who adopted in 2011 or 2012. No incentives will be paid to those who adopt after 2014. Under Medicare, eligible providers who choose not to adopt certified EHRs will be penalized with reduced Medicare payments starting in 2015. The incentive payments are contingent on providers being able to fulfill specified criteria of “meaningful use” of certified EHRs.\textsuperscript{19}

Table 2. The EHR Incentive Program as Administered by Medicare and Medicaid\textsuperscript{19}

<table>
<thead>
<tr>
<th>Medicare EHR Incentive Program</th>
<th>Medicaid EHR Incentive Program</th>
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<tr>
<td>Run by CMS</td>
<td>Every state runs its own program</td>
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<tr>
<td>Maximum incentive amount is $44,000 (across 5 years of program participation)</td>
<td>Maximum incentive amount is $63,750 (across 6 years of program participation)</td>
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<tr>
<td>Payment reductions begin in 2015 for providers who are eligible but choose not to participate</td>
<td>No Medicaid payment reductions if you choose not to participate</td>
</tr>
<tr>
<td>In the first year and all remaining years, providers have objectives they must achieve to get incentive payments.</td>
<td>In the first year, providers can receive an incentive payment for adopting, implementing, or upgrading a certified EHR. In all remaining years, providers have objectives to achieve, just like Medicare.</td>
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**EHRs Now**

Participation in the EHR incentive programs has been overwhelmingly positive. As of March 2013, according to the CMS, more than 85% of eligible hospitals are participating, and more than 75% of eligible hospitals have received incentive payments for meaningfully using EHR technology. More than 388,000 of the nation’s eligible health care providers have joined the program, representing 73% of all eligible providers. More than 230,000 (44%) of all eligible providers have received an EHR incentive payment.\textsuperscript{20}
Physicians and Hospitals Receiving Incentive Payments for EHR Adoption

With the HITECH Act in effect, the digital transformation of the US health care system has sped up and even surpassed the government’s own targets. Between 2009 and 2011, the proportion of physicians reporting at least a basic EHR increased from 22% to 34%. The percentage of primary care physicians with a basic EHR had nearly doubled in those 2 years, increasing from 20% to 39%. The White House just reported in May that more than half of eligible health care providers now use EHRs, due to the administration’s policies on health technology, including HITECH. This rate exceeds the target set by the administration for the end of 2013.

And now, with the widespread adoption and demand for EHRs, there is also a widening marketplace for EHR technology products. As of March 2013, there are 941 manufacturers providing more than 1,700 unique, certified EHR products.
**Remaining Challenges**

While the digitization of our health care system is inevitable, the following key issues will need to be addressed in the process:

- **Interoperability and HIE**—An interoperable national EHR system rests on the development and testing of technical standards that truly allow for smooth information exchange. The ONC has allocated funds to this area, and already developed standards needed to support a simple form of exchange similar to e-mail. The ONC is now working on more advanced, complex, multidirectional forms of information exchange. The ONC also needs to examine the need to foster a different economic environment that encourages health care providers to share information and coordinate patient care and to not view each other not as competitors.

- **Privacy and security of electronic health information**—Multifaceted technical, educational, and policy approaches to improving the security and privacy of patient information will need to be developed. While security breaches may indeed occur from technical failure or hacking, human error or carelessness can be causes as well. For example, providers may share passwords or not use them at all, they may fail to encrypt health data in EHRs or storage sites, or they may lose laptops or flash drives containing identifiable health information. Provider education or penalties for not observing basic security precautions may be part of the solution.

- **Usability of health information technology**—Difficult-to-use EHRs can prevent the adoption and meaningful use of health technology. Technology that is not usable can result in errors that reduce patient safety and productivity. The ONC is working with other federal agencies and EHR manufacturers to develop tests of usability so that providers can better assess EHR programs before they purchase and install them.

**The Future**

It is not difficult to envision a fully digitized health care system in our future. Thanks to the sweeping reforms brought about by the HITECH Act, EHRs are already becoming a vital part of our health care system. By 2019, projects the ONC, the Congressional Budget Office, and other experts, the adoption of high-functioning EHR systems will be at 80%. Hopefully by then we will be that much closer to the goal of transforming our health care system into one that provides truly meaningful use of technology to improve patient lives.
Next In our EHR White Paper Series

Greater Than One CEO Elizabeth Apelles hopes this examination of EHRs will further inspire the health care industry and the community at large to embrace digital technology in health care. Our second white paper in the series will provide an overview of currently available EHR technology and the criteria by which physicians evaluate EHRs for their practices.
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<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>mid-1960s</td>
<td>University of Utah and 3M developed HELP</td>
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<td></td>
<td>Lockheed developed EHR</td>
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<tr>
<td>1968</td>
<td>Harvard and Massachusetts General Hospital developed COSTAR</td>
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<tr>
<td>1970s</td>
<td>DHCP implemented by Department of Veteran Affairs</td>
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<td></td>
<td>CHCS implemented in DoD</td>
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<tr>
<td>1975</td>
<td>COSTAR launched in public domain</td>
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<tr>
<td>mid-1980s</td>
<td>IOM initiated EHR study</td>
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<tr>
<td>1987</td>
<td>Standards-developing organization HL7 formed</td>
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<tr>
<td>1991</td>
<td>IOM study on EHRs first published</td>
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<tr>
<td>1997</td>
<td>Revised IOM paper on EHRs published</td>
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<tr>
<td>Year</td>
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| 2004 | - EHR certifying organization CCHIT founded  
      - President George W. Bush State of the Union address  
      - ONC created |
| 2006 | - CCHIT began certifying EHRs |
| 2009 | - HITECH Act passed under President Obama |
| 2011 | - First year of federal incentive payments for providers demonstrating meaningful use of EHRs |
Acronyms

CCHIT=Certification Commission for Healthcare Information Technology
CDS=Clinical Decision Support
CHCS=Composite Health Care System
CMS=Centers for Medicare and Medicaid Services
COSTAR=Computer Stored Ambulatory Record
CPOE=Computerized Physician Order Entry
DHCP=De-Centralized Hospital Computer Program
DoD=Department of Defense
EHR=Electronic Health Record
HELP=Health Evaluation through Logical Processing
HIE=Health Information Exchange
HITECH=Health Information Technology for Economic and Clinical Health
HL7=Health Level Seven International
IOM=Institute of Medicine
ONC=Office of the National Coordinator for Health Information Technology
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   http://cms.gov/EHRIncentivePrograms.


   http://www.whitehouse.gov/blog/2013/05/24/more-half-doctors-now-use-electronic-health-records-thanks-administration-policies.


23. Friedman CP. *The Current EHR Landscape and Its Implications for Preservation*. Office of the National Coordinator for Health Information Technology; April 5, 2010.
About Greater Than One

For more than a decade, Greater Than One (GTO) has been the leading digital communications agency serving innovative companies in complex, regulated industries such as health care. We bring the human connection to digital and health care: this allows us to offer unique, powerful, and effective solutions that empower brands, drive sales, and change lives.

GTO offers insightful digital marketing solutions that create and strengthen the connections between brands and their stakeholders. Our work is simple, elegant, and unmistakably human. GTO is committed to:

• Empowering consumers and enhancing their health literacy by making complex information more understandable and accessible
• Supporting health professionals in maximizing their efficiency and effectiveness
• Contributing to the communities in which we live

GTO was founded in April 2000; we are headquartered in New York City, with offices in San Francisco, CA and Madrid, Spain.