Electronic Healthcare Records: data, access, and an insight-driven future

Driving patient outcomes through EHR adoption

Executive Summary

Not so long ago, patient records lived in doctors' desk drawers – often in bulging, untidy files, written in illegible handwriting. For many healthcare providers, those days are over. In the US, the last decade has seen an increasing push for healthcare organizations to adopt Electronic Healthcare Records (EHRs), digitising reams of patient information and making it 'portable, accessible, and shareable among patients, physicians, insurance companies, pharmacies, labs, caregivers, and researchers.'[1]

EHRs hold all the information related to a patient's medical history including medications, diagnoses, immunization dates, treatment plans, radiology images, allergies, and test results from laboratories – enabling professionals to make real-time, patient-centered decisions.

Under the Obama administration in 2009, the HITECH (Health Information Technology for Economic and Clinical Health) Act was passed as part of an economic recovery stimulus. $27 billion of government money was set aside for incentives encouraging EHR uptake, along with billions more to help with training and set-ups.

Though implementing EHRs entails more than a few challenges, as covered in this paper, financial incentives are contingent not just upon adoption but 'meaningful use'. The impact of this government push is indisputable. Between 2009 and 2017, 'Use of EHRs in doctor's offices nearly doubled to almost 86%. Hospitals fared even better, with 95% adopting certified EHRs by 2017.'[2] This impact has been felt by patients – according to a 2019 poll, '45% of US citizens think that electronic health records have improved the quality of care, with only 6% reporting a decline.'[3]

More recently, in the wake of the COVID-19 pandemic, the Biden administration has committed to improving healthcare services that complement EHR adoption, such as telehealth provision and modernization of public health data.[4] With this in mind, it's more important than ever that healthcare providers ensure patient data is 'portable, accessible, and shareable' – as well as secure and resilient – at all times.

The success of EHR isn't just an American story either: 90 percent of General Practitioners in the Netherlands, the United Kingdom and New Zealand use EHRs (although uptake is likely far lower in hospital settings)[5]. And EHR vendors are increasingly looking to growing markets in the Middle East, Asia and Latin America[6] – across the world, EHRs are set to become an integral part of healthcare's future.

1, 2 https://insights.som.yale.edu/insights/are-electronic-health-records-useful-yet
3 https://www.nature.com/articles/d41586-019-02876-y
4 https://www.healthcareitnews.com/news/biden-outlines-health-it-funding-priorities
5 https://www.ncbi.nlm.nih.gov/pubmed/18657471
6 https://www.healthcareitnews.com/news/epic-cerner-and-others-moving-expanding-global-ehr-market-says-klas

Transforming healthcare

Though 'EHR' is often used interchangeably with 'EMR', there is a difference. An EMR (Electronic Medical Record) is a digital patient chart, used for the reference of just one physician or practice. By contrast, an EHR 'contains the patient's records from multiple doctors and provides a more holistic, long-term view of a patient's health. It includes their demographics, test results, medical history, history of present illness (HPI), and medications.'[7] An EHR follows a patient from practice to practice over the course of a lifetime, offering an all-inclusive record of everything from childhood vaccinations, to ER visits, to regular prescriptions.

The potential for EHR to transform healthcare is evident, and the process is already underway. Clear and accessible records reduce the chance of mistakes or oversights – vital, considering that 'medical errors are the third leading cause of death in the United States, after heart disease and cancer.'[8] Costs will naturally lower as facilities run more efficiently. Doctors can take a patient's full history into account, check for interactions between medications, and communicate with colleagues in different teams and at different locations. The availability of clinical data to any authorized user, from anywhere, allows for highly flexible care including remote consultations. Telehealth tools are often built to integrate with, or as part of, EHR software: a reported 28% of caregivers who use telehealth services conduct their video visits through an EHR platform.

EHR systems can also help keep doctors up to date with the latest medical advances[9], while AI and machine-learning open the door to a world of new possibilities: with patient information stored in electronic form, algorithms may be able to search through vast data reserves to find the best and most cost-effective treatments[10]. Though there are still challenges to overcome before these benefits can be fully realised, trials using EHR datasets have demonstrated 'superior patient outcome predictions such as mortality, length of hospital stay, readmissions and discharge diagnoses compared to some of the existing models.'[11]

7 https://www.nextgen.com/insights/emr-vs-ehr/emr-vs-ehr

8 https://www.practicefusion.com/blog/ehr-adoption-rates

9 https://www.commonwealthfund.org/publications/newsletter-article/federal-government-has-put-billions-promoting-electronic-health

10 https://www.nature.com/articles/d41586-019-02876-y

11 https://ai-med.io/machine-learning-ehrs-electronic-health

Key benefits of EHR

In summary, the main benefits of adopting EHR include:

- Enabling healthcare providers to easily share and access medical records through network-connected, enterprise-wide platforms

- Eliminating the need to track down past patient records before making amendments to care plans

- Easy monitoring of a patient's prescribed medications over time, thereby helping to track outcomes and side-effects

- Sending and receiving electronic test results, doctor's orders, and reports almost instantaneously

- Minimizing the chances of data replication, inaccuracies or other mistakes – since there is only a single digital record

- Generating timely appointment reminders and additional warnings to prevent mistakes and keep care on the right path

- Reduced processing times and more accurate billing, as digitization reduces the chance of poor legibility or mistakes in calculations

- Smoother transitions between physicians and care settings, as all appropriate stakeholders can access a patient's full medical records

- Better care in emergencies, by providing all test results and notes over time for evidence-based patient recommendations

- Increasing the scale of medical research, education and advancement, as data-based health information can be correlated across a much larger pool of resources during medical research, testing and analysis

- Overall, a fundamental improvement in the quality of care for all patients.
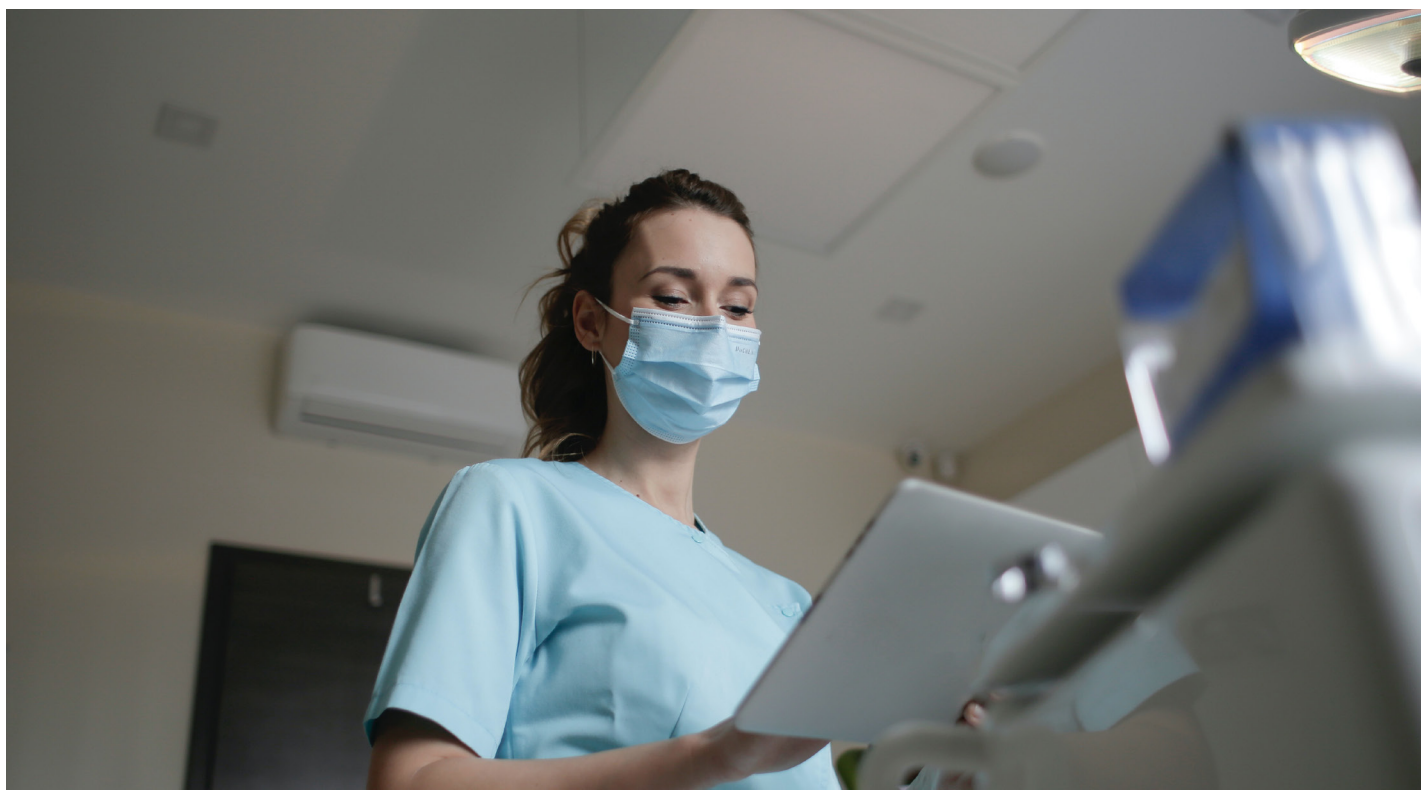
Putting data in the hands of healthcare consumers

For those not persuaded by the potential long-term benefits of EHR, the HITECH ACT offered financial incentives to make the switch. The average physician with at least 30 percent of their patients covered by Medicare was eligible for up to $44,000 in federal funding. If those patients were covered by Medicaid, the physician could be eligible for up to $63,750.
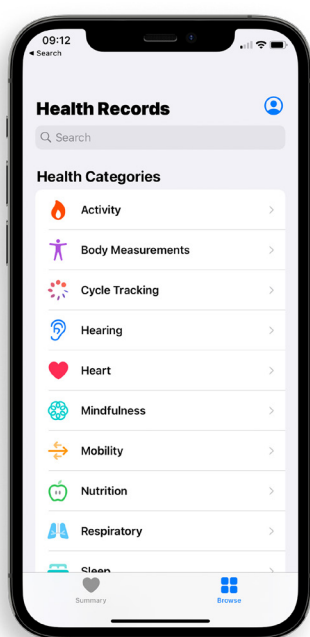
Incentive payments tied into the Medicare and Medicaid schemes began to draw to a close in 2015 and 2016 respectively. Private insurers were also keen for providers to use EHR technologies, and they offered financial incentives, as did large employers such as General Electric Co., IBM, United Parcel Service, Proctor & Gamble, and Verizon Wireless[12]. The Centers for Medicare & Medicaid Services (CMS) continues to encourage eligible professionals and hospitals to adopt EHR through the Promoting Interoperability Programs[13].

EHR can empower patients by more actively engaging them in their own care. 'Patient portals' offer immediate online access to information such as lab results, discharge summaries, medications and X-ray reports. Patients are also able to communicate securely with medical staff via email: as well as being a preferred method of contact for younger patients, this can help reduce incoming phone calls to surgery front desks, cut appointment times, and ensure a clear record of doctor-patient interactions[14].

Consumer brands also consider personal health data as a valuable, desirable commodity for customers – in 2019 Apple launched its Health Records mobile app (pictured), enabling US consumers to view their own data from compatible EHR sources. Toward the end of 2020, Cerner deepened its ties with Amazon to collaborate on consumer-friendly health and wellbeing wearables, which can 'help achieve greater interoperability across health care when integrated directly into a patient's electronic health record (EHR)' according to Cerner[15].

On 5 April 2021, rules set by the Office of the National Coordinator (ONC) for Health IT came into effect, that at a high level prohibit health providers, technology vendors, health information exchanges, and health information networks from preventing the exchange, use, or access of electronic health information. With such high demand for data to be accurate and accessible to so many entities, one of the main challenges for the sector – and key vendors like Epic, Cerner and Allscripts, which together control 70% of the market – is the ability to make EHR data more interoperable across systems and devices.

One way this is already underway is with the US Department of Health and Human Services' mandate for shared data among payers and providers to use a common standard – the Fast Healthcare Interoperability Resources (FHIR) protocol.

12 https://www.commonwealthfund.org/publications/newsletter-article/federal-government-has-put-billions-promoting-electronic-health

13 https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms

14 https://www.reviewofophthalmology.com/article/ehr-making-the-most-of-patient-portals

15 https://www.cerner.com/newsroom/cerner-teams-with-amazon-to-help-consumers-improve-their-health-and-wellness

Meeting the challenges of EHR

With such wide-ranging advantages around EHR, especially in the US, why has the potential of these systems not yet been fully realised? Three years after the HITECH act, in 2012, only 40% of providers reported using EHR. By 2017 this had crept up to 67%, but a far-from-positive picture was emerging regarding physicians' relationship with the new technology. One survey revealed that nearly 70% of doctors felt their EHR systems had not been worth the trouble and expense[16]. A 2019 poll found that 59% of physicians thought their EHR systems needed a complete overhaul.

One possible explanation is that because EHR adoption in the US was driven by politicians, systems were not truly designed with medical staff in mind. Doctors have reportedly been left feeling like data-entry drones: 'Many physicians have come to hate their computers. Overwhelmed by administrative work, they now spend more time attending to data entry than they do interacting with patients.' By disrupting workflows, do EHR systems add to the growing problem of physician burnout, rather than curbing it?

A 2017 open letter on the subject from 11 US healthcare leaders emphasized the importance of working with vendors 'to align technology. . . with advanced models of team-based care and to reduce the burden of the EHR on all users.'[17] EHR needs to work for doctors, not the other way around. There is some evidence that, however good EHR systems might be at curbing potential for human error, they can actually introduce errors of their own:

> *Tracking by the Pennsylvania Patient Safety Authority in Harrisburg found that from January 2016 to December 2017, electronic health-record systems were responsible for 775 problems during laboratory testing in the state, with human–computer interactions responsible for 54.7% of events and the remaining 45.3% caused by a computer. Three of the errors physically harmed patients, and the agency warned that "every event in this analysis had the potential to affect patients" by causing inconvenience, errors or delays in diagnosis.[18]*

Then there's the challenge of interoperability – the ability of EHR systems from different vendors to communicate with each other and share data. Systems that can't talk to each other run counter to the purpose of EHR, which is to make records more available and accessible. These issues can be tackled through more widespread adoption of the FHIR (Fast Healthcare Interoperability Resources) draft standard, which is increasingly being taken up both in America and Europe. Open standards like FHIR provide 'definitions for and structures of the data that can be communicated across a wide variety of healthcare use cases'[19], so that disparate systems can be brought together.

The EHR issue perhaps most likely to concern patients – and to hit headlines – is that of security. Compiling a lifetime's worth of sensitive patient data and storing it in digital form carries obvious risks, identity theft chief among them.

> *" The Pennsylvania Patient Safety Authority found that from January 2016 to December 2017, electronic health-record systems were responsible for 775 problems during laboratory testing "*

16 https://www.medicaleconomics.com/health-care-information-technology/physician-outcry-ehr-functionality-cost-will-shake-health-information-technology-sector
17 https://www.healthaffairs.org/do/10.1377/hblog20170328.059397/full/
18 https://www.nature.com/articles/d41586-019-02876-y
19 https://www.himss.org/library/interoperability-standards/faq-standards-health-it

Reports of large-scale date loss, breaches and targeted hacking regularly make the news; EHR breaches have exposed the data of more than 100 million people in the United States. Naturally, levels of concern are high.

Any organizations dealing with patient information most comply with HIPAA, the Health Insurance Portability and Accountability Act, which sets the standard for sensitive patient data protection. This means that anyone using an EHR platform – not just vendors – must ensure their compliance.[20] Failure to do so can (and regularly does) result in fines.[21]

Encrypting (digitally disguising information so that unauthorized users can't make sense of it) is also key. Between 2009 and 2014, failure to encrypt EHR data was responsible for a third of all major data breaches. As with many aspects of IT security, a large-scale mindset shift is needed – for example, a reported 14% of doctors access and keep patient records in their unencrypted personal mobile devices.[22] Common-sense measures such as up-to-date firewalls, strong passwords and logout protocols need to be in place for any organisation using EHRs. The security question links to ethical concerns – providers need to ensure that consent is always obtained before patient data is used for research or other purposes.

The impact of Covid-19 on EHR adoption

The coronavirus outbreak has given health organizations the ultimate stress test for almost a year now. Due to the spread of the virus, people have been asked to maintain appropriate social distancing by various governments to reduce contact possibilities. As a result, the number of patients visiting a doctor or a hospital for treatment came down significantly in 2020, and in the US this accelerated the uptake of digital services, including telehealth – in fact America's largest health care system saw a 10,880% increase in video appointments.[23]

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20 https://compliancy-group.com/gap-ehr-hipaa-compliance/
21 https://compliancy-group.com/hipaa-fines-directory-year/
22 https://healthinformatics.uic.edu/blog/how-secure-is-your-data-assessing-and-mitigating-risks-for-electronic-health-records/
23 https://www.sciencemag.org/features/2020/11/telemedicine-takes-center-stage-era-covid-19

Clearly, just like Zoom conversations, video consultations have gained momentum – and most EHR vendors and organizations have stepped up to make telehealth a mainstream option, collaborating to develop detailed Covid-19 dashboards, and enhancing EHR data access by way of analytics. Epic Systems helped over 200 of its clients implement a telehealth system in less than a month[24]. Epic claims that the telehealth tool being embedded into its EHR makes it user-friendly, bringing about ease-of-use and consistency for both medical staff and patients alike.

As integrating telehealth with EHRs gains importance, various healthcare IT providers are offering their assistance in building a proper setup to facilitate this shift to remote care delivery – triggering a rise in virtual EHR implementation. With patients and providers forced to understand the value of telehealth services since the beginning of Covid-19, it's hard to see uptake slowing down – after the pandemic is behind us, EHR could be at the forefront of the transition in how doctors and patients engage.

> *Load balancing helps avoid system outages and downtime – essential for every health care setup delivering 24/7 patient care*

Optimizing EHR for zero downtime

Load balancers are enterprise-grade IT infrastructure solutions used across a range of sectors to ensure optimized, resilient application access. Healthcare organizations deploy hardware or software load balancers to ensure clinicians and other staff have reliable access to various services, from email, to medical imaging archives; and EHR systems are no exception.

Also known as Application Delivery Controllers (ADCs), load balancers facilitate an 'always available' digital environment, ensuring stable, high-performing and effortlessly scalable applications. The load balancer market is a mature one, and various options are available – ranging from complex, specialist solutions recommended for use with multiple applications, to simpler, more cost-effective options designed to be dedicated to a single, mission-critical application.

Load balancers work by performing health checks, dynamically interrogating key server elements such as the number of concurrent connections and CPU/memory utilization. Using intelligent algorithms, load balancers distribute and direct users to the best performing available servers – avoiding bottlenecks and application failure. This ensures applications are always available and running at optimal performance. In the event of a server failure (or other undesired event) a load balancer can automatically reroute users to other healthy, functioning and available servers. This ability to bypass servers also facilitiates simple and easy management for IT teams, without impacting users – such as routine maintenance.

By managing traffic to an EHR, a load balancer can help avoid system outages and application downtime – essential for any organization delivering 24/7 patient care. Advanced load balancers also deliver SSL acceleration – offloading processes to the load balancer in order to dramatically increase performance of applications, such as EHRs, that require secure connections, as well as decreasing the time and costs involved, and ultimately enhancing the end user experience.

24 https://ehrintelligence.com/news/have-ehrs-been-a-burden-or-an-asset-during-the-coronavirus

About Loadbalancer.org

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