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Innovation and Technology

Electronic Health Records (EHRs): A White Paper Summary

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Electronic Health Records (EHRs): A White Paper Summary

The Coming Seismic Shift in Healthcare Data Access

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Section 1: Background and Scope

1.1 BACKGROUND

Electronic Health Records, or EHRs, are a major worldwide initiative to eliminate paper recordings – including Attending Physician Statements (APSs) – of an individual's medical history and current treatment. The movement has the potential for transparent sharing, due to interoperability, thus minimizing duplication of data within and between holders of medical data; better use of medical history from all sources for medical decisions; minimization of medical errors; and reduction of total operational costs. However EHRs, while being a dream for decades, have only seen rapid adoption by providers in the United States over the past 10 years, driven by society's adoption of digital technology and legislation associated with the Affordable Care Act (ACA). EHRs are generated by software from a vendor, or paper records are converted by healthcare providers into PDF format.

Tens of billions of dollars have been spent by the private and public sectors to fulfill the mandate of converting paper recordkeeping into fully digital records, and especially the ability to transfer records, or interoperability. At present, a requirement for 100% patient access exists for 2020. Tremendous angst remains among providers as the government deadlines approach. Providers and vendors are seeking an extension, and roughly half of executives are unaware of the current deadlines (Accenture survey, 2019)(1).

Due to the enormous opportunity that easy electronic access offers the actuarial profession, the SOA has commissioned this white paper to conduct a scoping evaluation of the status of EHRs, consider the impact on the insurance industry, forecast when full access may occur, and consider the effects of 'Big Data.'

1.2 SCOPE

The goals of this white paper are listed below, and will be covered in order.

- What are Electronic Health Records, or EHRs, and what is their current state in practice?
- What are the various types of EHRs that are available?
- How is exchanging health information done in practice?
- What difficulties exist with aggregating the data (due to vendors/providers having different systems)?
- Can EHR interoperability meet Health Insurance Portability and Accountability Act (HIPAA) requirements?
- How do EHR systems deal with highly confidential – i.e. psychological/psychiatric – information?
- What about Quantified Self data – are Application Programming Interface (API) apps usable?
- How have EHRs been impacting the underwriting process?
- What protective value is being provided from EHRs?
- What benefit/protective value is there for EHRs instead of - or with - Attending Physician Statements?
- Briefly, what are the difficulties with measuring EHR impact on emerging experience?
- How are EHRs affecting other parts of the insurance business?
- What observations can be made as to where EHRs and the sharing of data may go in the future – and when?
- What will be the costs of accessing EHR data?
- What are some case studies that raise issues and/or benefits of EHR implementation?

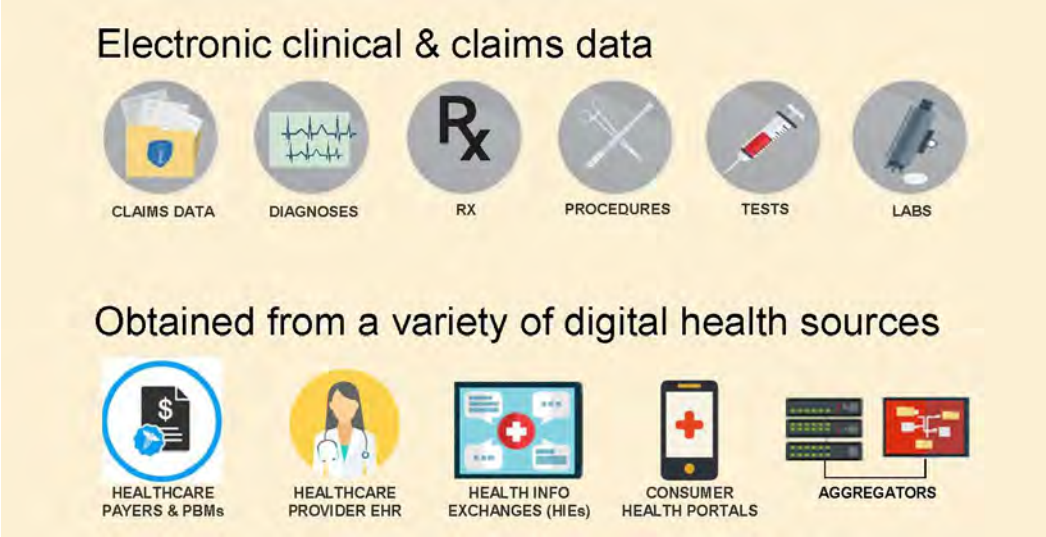
- When will access to EHRs through APIs be widely available?
- What is the background of actuarial evaluation and implementation of EHR data for insurance purposes?
- What is the ultimate potential for EHRs for the insurance business from an actuarial perspective?
- Who appear to be Key Opinion Leaders in the EHR field?
- What is the summary conclusion on impacts of EHRs for the actuarial profession?

Section 2: EHRs – Definition and Exchange Issues

2.1 WHAT ARE ELECTRONIC HEALTH RECORDS, OR EHRS, AND WHAT IS THEIR CURRENT STATE IN PRACTICE?

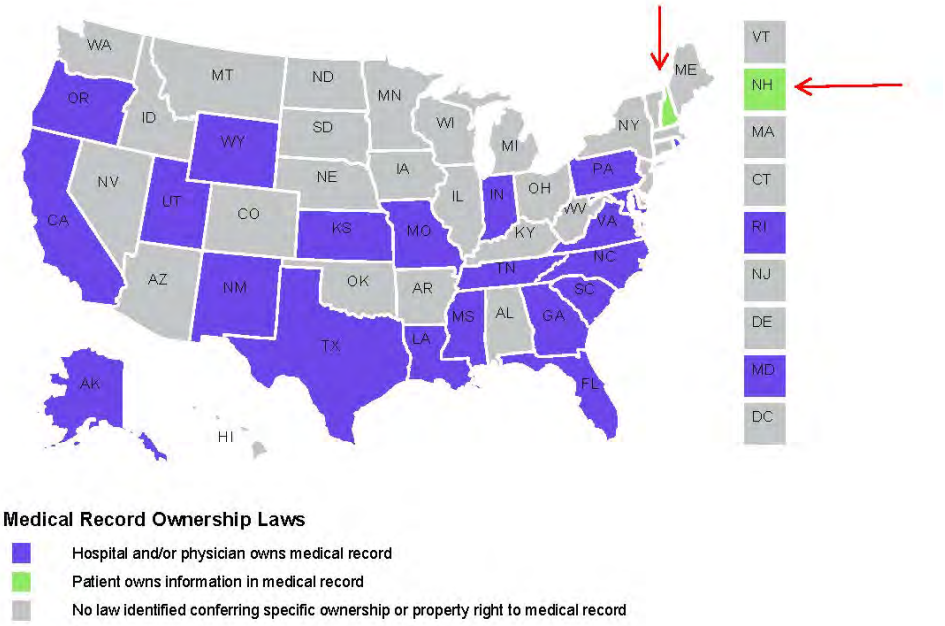
Electronic Health Records (EHRs, sometimes referred to more narrowly as EMRs for Electronic Medical Records) are digitized documents of health records of individuals. EHRs include electronically created Attending Physician Statements (APSs). An EHR should "make (medical) information available instantly and securely to authorized users" (2). These records are developed directly within existing provider computer systems, within software from vendors, or on paper or other media followed by electronic conversion. At this time, the bulk of earlier paper records have been converted to digital records, and are less relevant with the passage of time. EHRs are governed by a strict government privacy law, the Health Insurance Portability and Accountability Act (HIPAA) – which has important implications for actuarial access.

Examples of raw data that feed into EHRs are shown below (©2020 RGA. All rights reserved):



In 2009, the federal government mandated that EHRs and systems must be installed by large healthcare providers in a way that allows free and complete access by patients by 2020. This is important, as it sidesteps issues of 'ownership' of EHRs where – except for in New Hampshire – patients do not themselves clearly own their EHR data.

(source: www.healthpopuli.com)

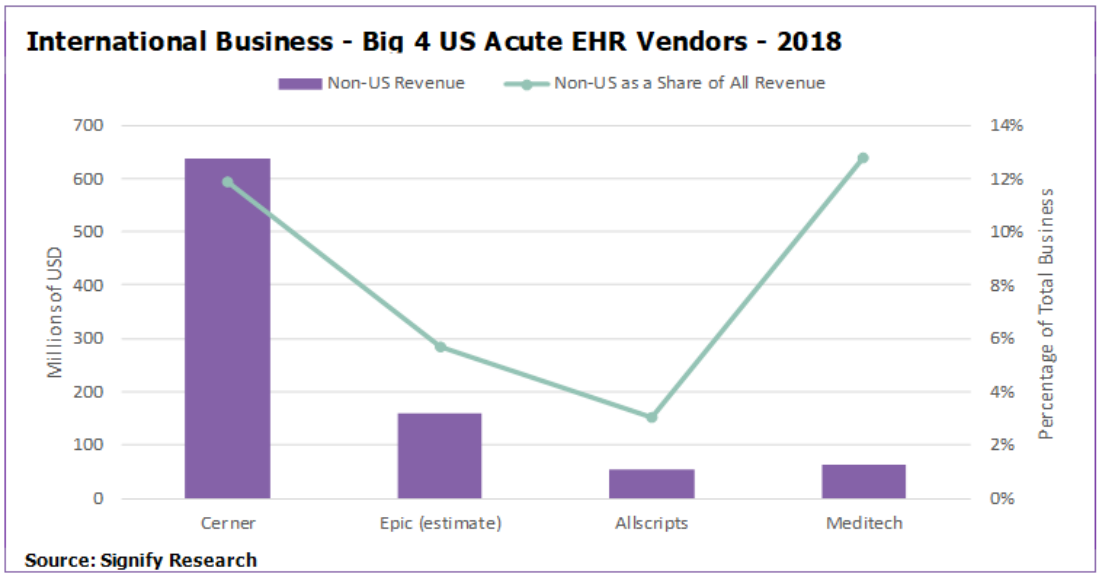


The Veterans Administration's healthcare system, managed by Cerner of Kansas City, is targeted for completion of this goal by March 31, 2020 (3). Broad adoption remains controversial in terms of timing. Specifically, the 21st Century Cures Act states clearly what stakeholders need to accomplish to achieve the ultimate goal of EHR utility:

"enable the secure exchange of electronic health information without special effort on the part of the user; [provide] complete access, exchange, and authorized use of electronic health information; and [has] no information blocking."

It is worth noting that, internationally, Cerner is also the leading EHR vendor (chart below); however, only 12% of their revenue is earned outside the United States, and mostly in Canada. Oddly, they do not interface with ICD-10 (World Health Organization) disease classifications and data.

Outside North America, no vendor has more than 8% market share, indicating an even more fragmented EHR implementation. However, governments are active and approaching EHRs from a legislative perspective. The EU has internal initiatives for setting up a template format for EHRs (4). In Israel, data from pre-birth to death is maintained electronically, complemented by 100,000 Israeli genomic files where all medical records shall be under the same format and usage language (Dr. Yair Babad, personal communication).



Source link: https://www.signifyresearch.net/digital-health/cerner-epic-allscripts-meditechs-international-ehr-endeavours/

The online publication EHR in Practice provides online tools to compare and contrast current EHR players, at the following links:

https://www.ehrinpractice.com/ehr-product-comparison.html

https://www.ehrinpractice.com/ehr-vendor-directory-8.html

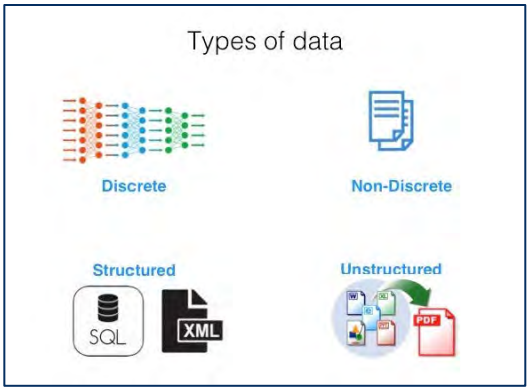
2.2 WHAT ARE THE VARIOUS TYPES OF EHRS THAT ARE AVAILABLE?

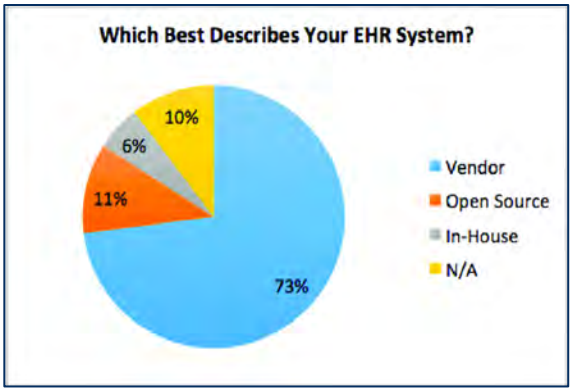
All-digital EHRs – generated in a structured format by contracted software leaders Epic Systems (Madison) or Cerner – have been steadily incorporated into major healthcare providers over the past 10 years at the cost of billions of dollars. Other lesser-known EHR vendors are also active, along with in-house custom EHR systems. It is important to note, however, that there is presently no 'universal format' for a person's EHR, which has implications for ease of use for actuaries.

For earlier and/or contemporaneous paper-based records, conversion into searchable PDF format continues, but appears to be fading especially at larger providers. Smaller providers – especially in the psychiatric area – are behind in achieving fully electronic conversions.

While not widely referenced, a group in Australia is evaluating speech- or video-based EHR possibilities (e.g., MP3 or MP4 formats) (5).

The following figures show current types of data that are eligible for incorporation into EHRs - increasingly as vendor software-driven EHRs.





Discrete data for EHRs are factual, verified numerical medical information that can be categorized, such as a test result, whereas *Non-Discrete data* are generally APS conclusions or images. *Structured data* is organized Discrete data in a consensus format, while *Unstructured data* are not organized and can be largely text. Structured data is statistically accessible, and the goal of EHR interoperability. Increasingly, with the onset of 'quantified self' data, the conversion of unstructured data will likely emerge as the next frontier in supplementing EHRs for a far richer profile. This is seen in surprisingly intensive investments by Apple, Google, and in the insurance industry's leading firms like John Hancock and its Vitality program, which has recently partnered with Google for diabetes (6).

It is important to note that claims are, and continue to be, a rich data source for de-identified aggregation for actuaries, and are being pursued accordingly at this time. However, it is also critical to obtain the insured's appropriate consent so that all analysis can be done in a non-HIPAA fashion. This is discussed in the following section.

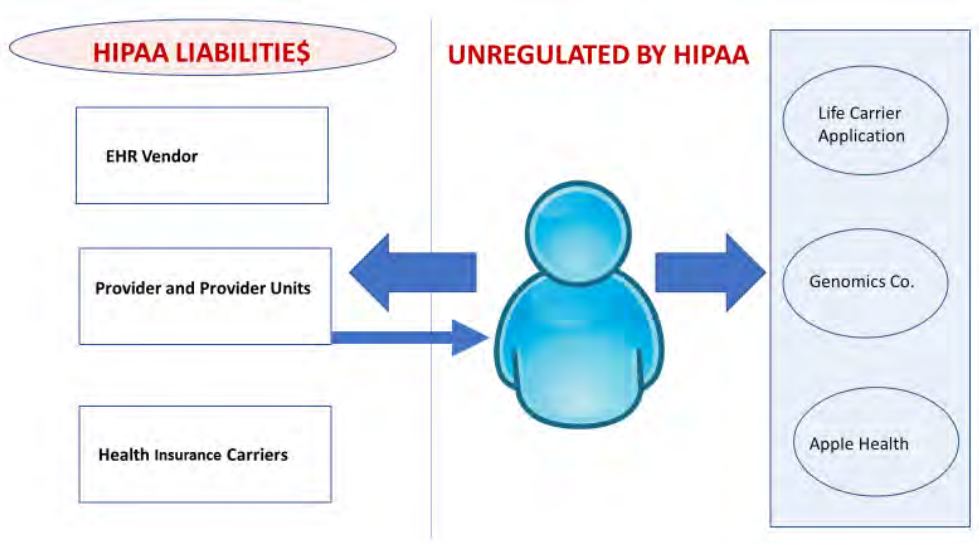
2.3 HOW IS EXCHANGING HEALTH INFO DONE IN PRACTICE?

Currently, there is no universal computer language or agreement in place to exchange EHR data between healthcare systems. Costly paper-based or in-house electronic exchanges are the norm, driven by patient consent. Standardization of EHR exchanges is widely acknowledged as premature – but a critical need.

Fast Healthcare Interoperability Resources (FHIR) is a nonprofit-driven draft standard that is in development for the NIH genomics institute, and is growing in popularity for EHR application developers (7), including at large healthcare systems. The latest version (2019), FHIR 4, includes an application programming interface (API) for exchanging EHR data that includes images, financial accounts, and decision support.

Outside these mainstream efforts, Google Health is also developing an overriding 'search bar' that would work with any vendor's or provider's custom EHR system. Apple Health's focus is on a suite of medical measurement apps.

Ironically, the fastest way to exchange healthcare information between organizations continues to be patient consent-driven. This is due to both the coming 2020 mandate for 100% patient access apart from who actually owns the EHR, and also that Health Insurance Portability and Accountability Act (HIPAA) restrictions, for EHRs to be a breakthrough, will first require an extensive legal agreement between large organizations for request and transfer procedures. The below figure maps the regulated (left) versus the unregulated (right) domains for EHR information.



While a capable individual can handle HIPAA (Health Insurance Portability and Accountability Act) requests from several providers, this can be a burden for a seriously ill patient (e.g., oncology) attending multiple providers, who must deal with individual EHR systems along with their disease issues.

The desired goal – Interoperability – is a growing urgency for the government and patients. Conversely, alignment with government mandates is the subject of much angst among EHR vendors, healthcare systems, and payers, and stalling behaviors are evident.

A data scientist at a top 5 healthcare system (Optum) was emphatic that interoperability is nowhere near ready (8), as he struggles internally to manage multiple EHR formats, adopt FHIR standardization, and use patches such as Tableau within his company's intranet. One of his biggest struggles is nonstandardized identifiers for patients and Medical Record Numbers (MRNs) – even among a provider's institutions.

Thus, seriously ill patients and physicians do not have easy access to their records, even within a single provider institution. Actuaries and insurers are especially interested in high-cost profile EHRs, to maximize protective value and obtain early warning signals for emerging experience.

2.4 WHAT DIFFICULTIES EXIST WITH AGGREGATING DATA (DUE TO VENDORS/PROVIDERS HAVING DIFFERENT SYSTEMS)?

EHR vendors – through their software and control of versioning – maintain powerful sway over provider institutions, and wish to maintain or grow their market share. They are, thus, loath to devalue their existing competitive advantage.

Providers, also, are held to high standards and costly liability risks to maintain HIPAA confidentiality for patients, and therefore, hold tightly onto their patient records, except for consents for research.

The situation is analogous to the early days of mobile carriers where access was essential – but coverage and interoperability were not yet fully in place. Strong regulation and a commitment to standardization are essential. Thus, there remains great difficulty for third-party groups to aggregate data. As a Deloitte healthcare VP put it – why can't medical records be readily available for healthcare stakeholders, in the same way telephone and data exchanges are easily made among mobile carriers and their customers? (9).

An interesting approach for aggregating data is taken by Genomics companies, such as 23andMe, who are avoiding HIPAA requirements by asking users to 'volunteer' their health information via extensive surveys so health data can be correlated to their genetics. While these inputs are not directly from medical professionals, thus accuracy is not assured, it is a significant start to HIPAA-free data aggregation and could expand more formally once the federal mandate of 100% free access to EHRs is in place for all citizens. Epic is moving in this direction also with nine healthcare systems, labeling the program – COSMOS – 'medical research' (10).

Another non-provider source of data for aggregation is through the use of claims data, an approach mentioned by actuarial consultants later in this report as the current best route for actuarial access. However, HIPAA certainly appears to govern electronic records submitted in claims to insurers and, since over 95% of providers now are generating electronic records, this may open up direct HIPAA liability in the event of data breaches unless insureds waive HIPAA in their claims' submissions.

Alternatively, for the Optum data scientist mentioned earlier, until FHIR formats mature further, this data aggregation approach is to slowly convert multiple, often-unstructured EHR data into Python or CSV files.

2.5 CAN EHR INTEROPERABILITY MEET HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT (HIPAA) REQUIREMENTS?

Interoperability under HIPAA is an absolute requirement among the various EHR stakeholders – vendors, providers, and increasingly researchers and drug/diagnostic companies. However, this remains challenging and risky in an environment where publicized database breaches occur on a monthly basis. No foolproof HIPAA interoperability format exists at present. Except for one-patient-at-a-time consent and release, any inter-organizational transfer glitches can result in HIPAA liability or fines that can reach $1 million or more per event.

Direct transfer to patients of EHR medical records, however, will soon be mandated by law under the HIPAA and ACA/21st Century Cures requirements. As seen for the genomics companies, once health information is obtained by patients, the latter's further voluntary or incentivized disclosures to third parties legally falls outside HIPAA requirements (11). Admittedly, in any subsequent patient transfer, there is no guarantee that full records are transferred with fidelity.

2.6 HOW DO EHR SYSTEMS DEAL WITH HIGHLY CONFIDENTIAL – I.E., PSYCHOLOGICAL/PSYCHIATRIC – INFORMATION?

Current HIPAA policy disallows (12) disclosure or transfer for the following original written records:

1. Psychotherapy (also psychology) notes, which are the personal notes of a mental health care provider documenting or analyzing the contents of a counseling session, that are maintained separate from the rest of the patient's medical record. See 45 CFR 164.524(a)(1)(i) and 164.501.

2. Information compiled in reasonable anticipation of, or for use in, a civil, criminal, or administrative action or proceeding. See 45 CFR 164.524(a)(1)(ii).

However, underlying EHR records dealing with the individual's medical or payment records, or other records used to generate the above types of excluded records or information, remains part of the designated record set, and subject to HIPAA access by the individual. In addition, patients' Personal Representatives (generally, a person with authority under State law to make health care decisions for the individual) similarly have the right to access the patients' underlying EHR records.

2.7 WHAT ABOUT QUANTIFIED SELF DATA – ARE APPLICATION PROGRAMMING INTERFACE (API) APPS USABLE?

At present, unless personal consent is given to healthcare providers and the latter has a system for incorporation into EHRs for quantified-self data from real-time monitoring devices, there are no EHR regulations specific to this 'Big Data' source of health-related information. However, once incorporated by HIPAA covered entities, any such information will be subject to EHR oversight and HIPAA.

In doing research for this white paper, certain pilot projects appear to be active - largely at university medical centers (e.g., Johns Hopkins, Columbia), which are incorporating wearable data and APIs into EHRs for participating provider or patient benefit (Appendix A)(13). In a recent development that will be keenly watched, the VA has fully rolled out Apple Health's apps in its coming conversion to EHRs (14). Interestingly, Apple's Health Record API is not subject to HIPAA regulations, because Apple does not store patient data on its servers (15). One of several issues affecting API usage with EHRs is that no privacy data standards exist for APIs and information exchange, apart from carrier and app representations. Still, there is a massive amount of lifestyle and biometric data that is conceivably available with current technology, that was impossible to access just a few years ago. Capturing this data will allow a more accurate risk adjustment and pricing environment for actuaries and insurers.

Section 3: Impact of EHRs on Insurance

3.1 HOW HAVE EHRS BEEN IMPACTING THE UNDERWRITING PROCESS?

Teleconferences were held with two major insurance advisory firms active in EHR implementation for input on EHR impacts (16), for this section except where noted.

Thus far, EHRs have had a small but growing impact on the underwriting process, largely for life insurance and short-term health policies and with stable provider organizations. A broader impact is predicted in years (not months) ahead, with interoperability in place. The key impediment – as seen in data access for providers – is the unstructured nonstandard state of today's EHR datasets across provider institutions. Pilot programs are underway at selected carriers for specific (lower complexity) use cases to start, and their success incorporating EHRs should be published during 2021 for keenly interested executives wishing to expand further.

A leading underwriting support nonprofit company that serves the insurance industry, MIB, is a pioneer company interfacing with EHR developments, with multiple alliances in place including last year's agreement with the major EHR software vendor, Epic Systems (17).

3.2 WHAT PROTECTIVE VALUE IS BEING PROVIDED FROM EHRS?

According to these consultants, there is not enough experience yet to quantify protective value, but they are optimistic that it will be eventually at a substantial level. Only isolated examples currently exist, and the providers and/or carriers are still in 'silo mode' without easy data access for others. One source believes a well-known vendor is currently putting out a robust high-quality EHR indicating demonstrably higher protective value, yet still remains dependent on complementary resources.

3.3 WHAT ARE EHR'S BENEFIT/PROTECTIVE VALUE INSTEAD OF - OR WITH – ATTENDING PHYSICIAN STATEMENTS (APSS)?

At present, the use of (new) claims-driven EHR information – such as lab results and further correlations to risk – is working well, but it is slow and has its highest benefit in the life sector. Transfer from the life data into aggregation was a noteworthy source for the interviewed consultants. For carriers, the goal is to marry this growing database with the ultimate consensus interoperability standard, e.g., FIHR-4, for an expanded database. Only at that time can EHR protective value come under definitive, rigorous assessments across the industry.

In the meantime, APSs are rapidly transitioning to electronic format, except as mentioned in mental health treatment. However, as shown below in section 4.3, there are serious concerns on the burdens of electronic APSs on doctors. Healthcare systems remain insistent on implementation, despite MD complaints, as the power of EHRs to implement Value-Based Healthcare (compensation based on patient outcomes).

3.4 WHAT ARE THE DIFFICULTIES WITH MEASURING EHR IMPACT ON EMERGING EXPERIENCE?

As with protective value, the field is still too new to draw any conclusions regarding emerging experience in the use of EHRs. Variability of data sources and general lack of data access, in particular, are the key bottlenecks. This is further supported by MIB (16, 18), who believe at least another 24 months will pass before this milestone may be reached for the industry.

3.5 HOW ARE EHRS AFFECTING OTHER PARTS OF THE INSURANCE BUSINESS?

EHR data is having a more direct impact on life insurance and short-term health policies, as mentioned by these advisors, due to questionnaire and required disclosure-driven data access. However, thus far it appears to be used on an individual basis without large data analysis or aggregation conclusions and benefits. In their view, life

insurance will be the primary beneficiary of available EHR data within the industry in the near term. Part of this advantage is that EHR content (if not the EHR) disclosure falls outside HIPAA when consumers submit applications.

According to one interviewee, as underwriters gain EHR experience and then work closely with actuaries within carriers, creative analytical approaches and data access are expected to exponentially improve in years ahead.

Section 4: Future Status of EHRs

4.1 WHAT OBSERVATIONS CAN BE MADE ABOUT HOW EHRS AND SHARING OF DATA MAY GO IN THE FUTURE – AND WHEN?

There appear to be three routes to EHR data sharing: all-stakeholder agreement to a standardization platform (e.g., FHIR); EHR searchbar-access combinations (e.g., Google Health) (19); and volunteering (e.g., 23andMe-style health information donations).

Surprisingly, given the billions of dollars invested to date, it is too early to assess which one will be dominant. Likely all methods of data aggregation will continue for the foreseeable future, through 2023 at a minimum. However, with the federal mandate of 100% free patient access in place for 2020, the 'volunteering' route may turn out to be an efficient means for data aggregation for insurers and other third parties, likely via attractive or altruistic incentives.

In addition, use of artificial intelligence and big data algorithms for physicians' decisions, system-wide usage optimization and planning, public health management, and epidemics/pandemics management (worldwide) all can benefit tremendously from EHR interoperability (even if partial) once it is in place.

4.2 WHAT WILL BE THE COSTS OF ACCESSING EHR DATA?

Several studies estimate that the cost of purchasing and installing an electronic health record (EHR) ranges from $15,000 to $70,000 per MD/provider (20). Internally, the costs of access should be only incremental for IT departmental budgets since hardware and procedures are already in place; however, as we have seen in comments by the above data scientist, there is much 'cross-talk' yet to be streamlined within the providers.

For the insurance industry, access costs are not yet quantifiable due to lack of interoperability among large stakeholders, or yet-to-estimate internal workup based on claims data or other submissions associated with policy applications. Cost assessments also remain challenging according to the insurance consultants interviewed for this white paper, since certain large stakeholders – such as Epic – are not sharing data (only accept claims data on a one-way basis).

Some growing third-party data aggregation vendors are active; however, they currently are pricing themselves too far above budget limits.

4.3 WHAT ARE SOME CASE STUDIES THAT RAISE ISSUES AND/OR BENEFITS OF EHR IMPLEMENTATION?

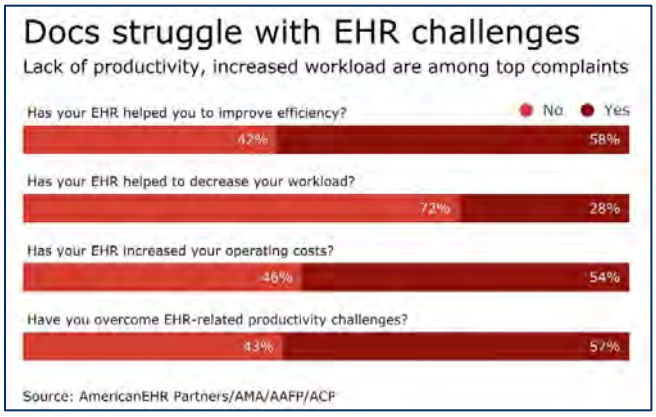
There are mixed reviews publicized on the quality of EHR implementation at provider sites. Write-offs of tens of millions have occurred at various institutions, despite successes cited by the government's Health Information Exchange (HIE) website. Please link to the substantial articles attached within references (21) and (22) for more case studies; however, below are noteworthy case studies they cited. Keep in mind that the federal government fed the initial investments in EHRs which, through May 2016, totaled $34.7 billion for incentives for adopting EHRs; individual hospitals and health systems further spent tens of millions and sometimes billions of dollars, thus far, to install new health record-keeping software.

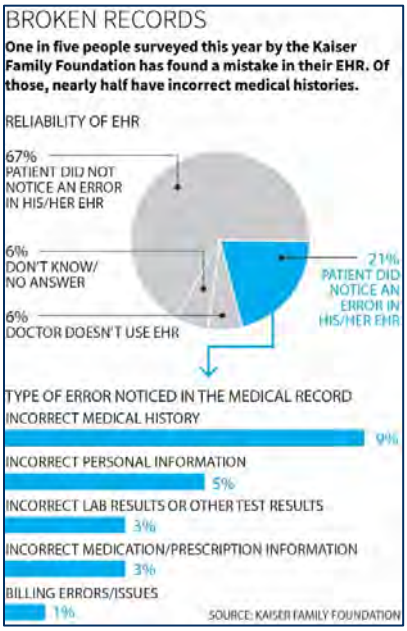
- Trinity Health reported a $107.8 million asset impairment charge for its fiscal year 2018 related to its hospitals and continuing-care facilities switching to a single version of Epic EHR and revenue cycle management software, a four-year project with an undisclosed cost. Trinity officials said they were not available to comment.

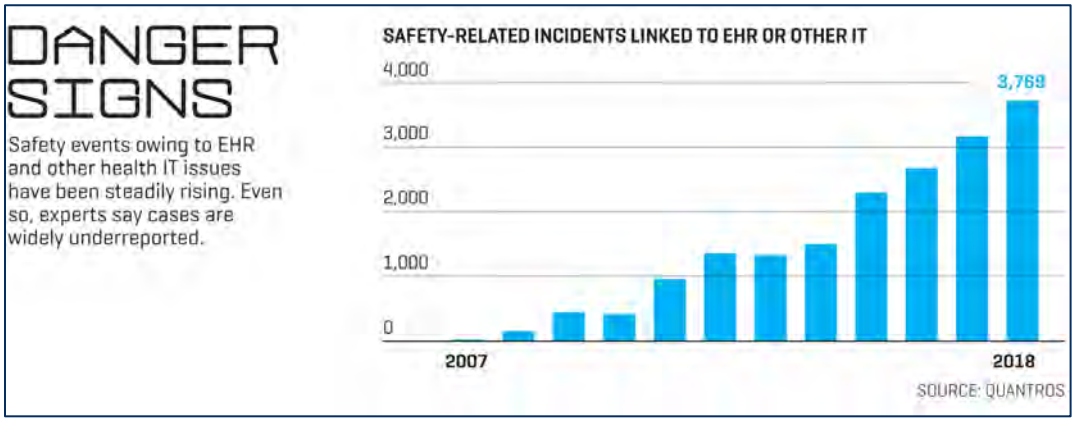
- Scripps Health ran into some EHR-related road bumps a few year ago, reporting weakened financial results as it readied an EHR conversion budgeted for 10 years to cost just over $300 million and expected to incur $360.5 million in operating costs.

- In 2017, MD Anderson Cancer Center cut between 800 and 900 administrative positions after experiencing significant losses after EHR implementation, but did not provide details on how the EHR installation affected patient revenue (AMA, 2018) (23).

The published losses have caused significant wariness on the part of providers going forward, exacerbated by widespread complaints by and 'burnout' of MDs and other care providers in transitioning their APSs and other electronic records (24) for patient care. The interviewed data scientist also relayed a story where an EHR glitch caused a misreporting of results. A large order of A1C tests went out and just one result was above normal. However, the EHR system flagged the entire set of tests as "above normal" – and integrated this into the normal patients' EHRs. The following figures show survey data on these topics of concern in EHR implementation, some of which are more serious than typical launch issues (i.e., 21% of EHR records are erroneous).







Insurance industry-related case studies are not yet available nor significant, according to the consultants, except for the observation of 'one-way data flow' behaviors by some larger EHR vendors that appear to hinder progress for the industry.

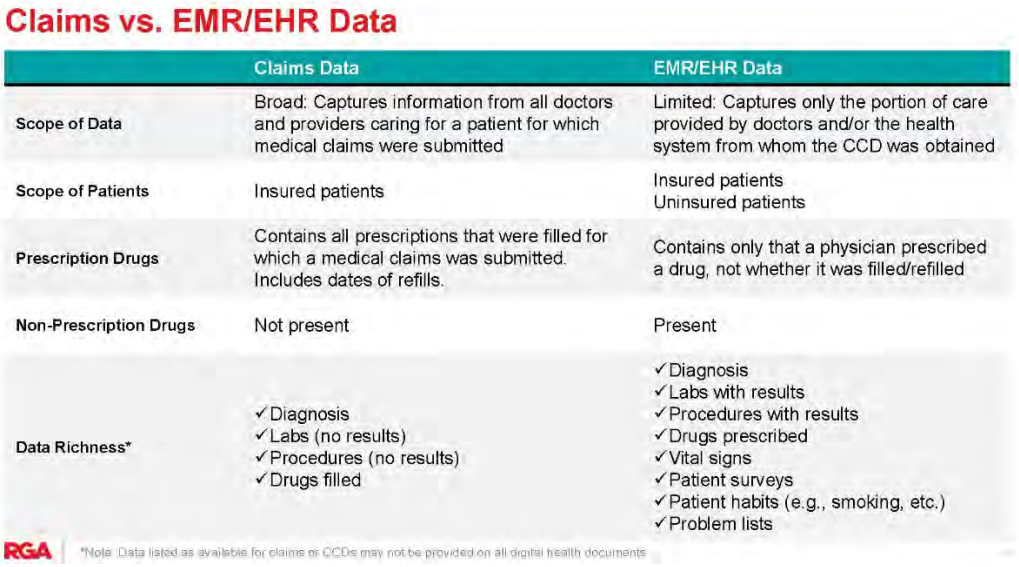
4.4 WHEN WILL ACCESS TO EHRS THROUGH APIS BE WIDELY AVAILABLE?

Likely 2023 at the earliest, and this is supported by all parties interviewed, as well as MIB estimates (16). 2020 will be a 'pilot year' for limited interoperability within government agencies such as the VA. HIPAA functionality standards are predicted to be challenging for the near future and, when activated, will likely be subject to intense hacker activity and breach risks.

At present, the pace of availability depends critically on all stakeholders agreeing on a consensus interoperability standard – likely an FHIR 2020-2022 version. This is not on the near-term horizon.

4.5 WHAT IS THE STATUS OF ACTUARIAL EVALUATION & IMPLEMENTATION OF EHR DATA FOR INSURANCE PURPOSES?

As mentioned, actuarial evaluation of EHR data appears to be limited to claims-related sources, although higher-cost options do exist from data aggregation vendors. Claims data remains a rich resource, as shown in the figure below, however, HIPAA liabilities for usage might be growing once records are transmitted electronically, based on risks for massive data breach or human error (removal of all Identifiers).



Claims vs. EMR/EHR Data

	Claims Data	EMR/EHR Data
Scope of Data	Broad: Captures information from all doctors and providers caring for a patient for which medical claims were submitted	Limited: Captures only the portion of care provided by doctors and/or the health system from whom the CCD was obtained
Scope of Patients	Insured patients	Insured patients Uninsured patients
Prescription Drugs	Contains all prescriptions that were filled for which a medical claims was submitted. Includes dates of refills.	Contains only that a physician prescribed a drug, not whether it was filled/refilled
Non-Prescription Drugs	Not present	Present
Data Richness*	✓Diagnosis ✓Labs (no results) ✓Procedures (no results) ✓Drugs filled	✓Diagnosis ✓Labs with results ✓Procedures with results ✓Drugs prescribed ✓Vital signs ✓Patient surveys ✓Patient habits (e.g., smoking, etc.) ✓Problem lists

RGA *Note: Data listed as available for claims or CCDs may not be provided on all digital health documents

Costs or business restrictions remain prohibitive at this time from Providers and EHR vendors. Private aggregators do exist (e.g., Datica, MedFusion), but are priced up to $300,000 per year in subscriptions according to contacts at Milliman. MIB – as a leader and nonprofit – is a key group to watch for developments here as they have an alliance with Epic.

4.6 WHAT IS THE ULTIMATE POTENTIAL FOR EHRS FOR THE INSURANCE BUSINESS FROM AN ACTUARIAL PERSPECTIVE?

There is great potential for enhancing protective value, according to all the consultants. As one reviewer notes, there are numerous potential benefits – and actuaries should consider all of them:

(1) Improved underwriting at entry, to coverage or renewal time.

(2) Better data – and also claims, sales, and administrative tasks and overall management, thus potentially changing both the risk profile and the cost profile of the whole insurance operations – and consequently also the actuarial pricing.

(3) Providing for more exact and more dynamic actuarial models, which take personal medical history (in parallel to the developing personal medicine trend) into account, rather than just one-time snapshot-based models.

However, at present, EHR-based data aggregation remains in its infancy. One advisor is watching very closely the 'gold rush' on quantified-self data and where and whether it will integrate ultimately with EHRs. The key trend to watch is how much consumers tightly embrace their EHR – and quantified self – data for their own disclosures, versus allowing their EHR data to be shared by their provider.

There is a sense that a 'make vs. buy' business decision is looming for the insurance industry, if EHR vendors and data aggregation specialists persist in their resistance to standardized interoperability. If insurers and actuaries aggregate EHR data in-house, the initial data sources appear to be either from a) claims or applications, and/or b) volunteered EHR data from patients, with probably incentives in place. A key advantage for the latter approach is avoidance of HIPAA, based on patient consents. This latter issue looms large over inter-corporate relations, especially for thousands of EHRs, and potentially a liability of thousands of government fines.

4.7 WHO APPEAR TO BE KEY OPINION LEADERS IN THE EHR FIELD?

Significant individuals to monitor in the EHR sector include the following three individuals: Joel White (HealthIT.gov), Peter DeVault (epic.com), and David Feinberg (Google Health, formerly the CEO of Geisinger). In the insurance sector, MIB appears to be the leader and assisted in the writing of this report, and references there are available. As mentioned, their relationship with Epic may result in a significant database asset for actuaries, subject to HIPAA and interoperability risk.

4.8 WHAT IS THE SUMMARY CONCLUSION ON THE IMPACT OF EHRS FOR THE ACTUARIAL PROFESSION?

All sources for this white paper point to a conclusion that reasonable and widespread access to statistically sound, aggregated EHR data for actuarial purposes will eventually occur, and be beneficial to the insurance industry, but likely no sooner than 2023. Despite government mandates from the Obama presidency, powerful stakeholders remain in a competitive, versus collaborative, mode; standards for interoperability remain weak and without a stakeholder consensus.

In the meantime, actuaries have several sources to watch for EHR data access:

1. By law, patient EHRs should be fully accessible during 2020-2022 for insureds' personal access, but like a dripping faucet, these datasets can only be obtained by insurers and actuaries on an individual consent basis (e.g., volunteering EHR content for research or disease advances), and likely with some form of incentive. John Hancock is a leader in this area with their Vitality program. Other insurance leaders could

generate similar incentive-based programs along with HIPAA release terms, and this should be studied further by the SOA.

2. Another rich, but slowly building, source of EHR data is through claims and underwriting – particularly from the life insurance sector – coupled with careful HIPAA release (consent) language. De-identified data should become steadily aggregated over time for actuarial use. The success – and costs – of MIB's active partnering with leaders in EHR technology (e.g., Epic) along with Milliman (Allscripts) will be a key area to monitor for the actuarial profession in the near future. However, there were no clear case studies on how actuaries are incorporating EHRs in pricing and underwriting based on the interviews.

3. Innovative approaches that avoid HIPAA risks are not widespread, but bear watching, including the aggregation of EHR-quality data by (a) genomics firms, like 23andMe, outside of the HIPAA umbrella; (b) encrypted across-Provider search engines, such as the one under development by Google Health; and (c) API-based tools being driven by Apple Health, which also fall outside HIPAA.

Consent of insureds for HIPAA release is critical and should become standardized for actuarial access. Combined, the above approaches appear to be the most promising route in the near-mid future for the actuarial profession to achieve meaningful EHR-based healthcare data aggregation.

Endnotes

(1) https://hitinfrastructure.com/news/most-healthcare-it-execs-unaware-of-proposed-interoperability-rules
(2) https://www.healthit.gov/faq/what-electronic-health-record-ehr
(3) https://ehrintelligence.com/news/va-assures-lawmakers-of-march-ehr-modernization-rollout-date
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(7) https://www.healthcareitnews.com/news/how-fhir-4-will-drive-interoperability-progress-healthcare
(8) Audio interview with data scientist at a top 5 healthcare system, 12-2-2019 (anonymity requested)
(9) https://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/health-care-current-november5-2019.html
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(16) Teleconferences with two leading insurance advisory firms, 12-3-2019 and 12-10-19 (selective anonymity requested)
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Appendix A: Incorporating Wearables into EHRs: Some Pioneering Institutions

Table 1

Wearable health technology start-up partnerships.

Start-up organizations	Select hospital partnership(s)	Theme(s)	Technology overview
Overlap 2019 [62]	Columbia University Medical Center and UC Davis Health	Data analytics and remote monitoring	Collects patient data through a customizable Overlap app that integrates with EHRs[a] and various wearable devices
Royal Philips 2019 [63]	New York Presbyterian	Data analytics and remote monitoring	Helps physicians monitor patient health remotely and connect with 2-way video using a telehealth platform
Vivify Health 2018 [64]	Children's Health in Dallas and Ascension Health	Remote monitoring	Integrates patient mobile devices with EHRs through a remote care platform
Validic 2018 [65]	Kaiser Permanente and Mayo Clinic	Data analytics and remote monitoring	Simplifies collected health data from wearables and wellness applications and delivers comprehensive patient profiles to providers
Doximity Dialer 2018 [66]	Johns Hopkins Hospital	Access to patient records and personalized patient experience	Allows providers to access their patients' records and make patient calls on the go from their personal cell phones, using the office as the caller ID[b] while on personal phones
Xealth 2018 [67]	Providence Health & Services and University of Pittsburgh Medical Center	Personalized patient experience	Allows doctors to prescribe apps and digital tools to their patients. Doctors can also track patient's use of these tools from the EHR
Redox 2018 [68]	Brigham and Women's Hospital	Data analytics	Links hospitals' EHR systems to outside applications regardless of software vendor (Epic, and Allscripts)
Conversa 2018 [69]	Northwell Health and Ochsner Health System	Artificial intelligence technology and personalized patient experience	Allows providers to monitor patient status between visits through automated, personalized patient-provider conversation experiences. Patient also can send information through Conversa into their EHRs

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The Society of Actuaries (SOA), formed in 1949, is one of the largest actuarial professional organizations in the world dedicated to serving more than 30,000 actuarial members and the public in the United States, Canada and worldwide. In line with the SOA Vision Statement, actuaries act as business leaders who develop and use mathematical models to measure and manage risk in support of financial security for individuals, organizations and the public.

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The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

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