

A background image for the title section showing a close-up of a person's hand in a blue medical scrub sleeve pointing at a tablet. A stethoscope is visible around the person's neck. The image has a blue tint.

A Solution to the Solution

Addressing Electronic Health Records
and the Abundant Data They Produce

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ABSTRACT

The amount of data that pertains to healthcare expands daily. To date, there are not sufficient and effective ways to wrangle the data into meaning. The misuse of healthcare data can have serious consequences. Having healthcare data available electronically, rather than in bulging folders in a storage room, was meant to be a solution to this problem. However, the advent of electronic healthcare data comes with other problems including frustration and decreased job satisfaction among providers. Health informaticists have expertise in making sense of the disparate data, workflow inefficiencies, and system design that can address these issues. Marketplace demands call for more educated health IT professionals in the workforce.

The Current State of Healthcare Data

“In 1950, it took 50 years to double the world’s medical knowledge; by 1980, seven years; and in 2015, less than three years. Meanwhile, each person will generate one million gigabytes of health-related data in his or her lifetime, the equivalent of about 300 million books.” ¹ (Kelly, 2015)

It’s no secret that since the dawning of the Information Age, the amount of publicly available data and personal data—on us, on our actions, and on our health—has grown exponentially. Our memories are stored on social media accounts; our Google searches are retained and analyzed to sell us more personalized ads; and our blood pressure, weight, and other vital signs from doctors’ visits are accumulated year over year.

This is only the beginning. Across the globe, estimates suggest that our collective data will grow from 33 zettabytes in 2018 to 175 ZB by 2025.² A single Zettabyte is equivalent to one trillion gigabytes. (The amount of data centers we’ll soon need to store all those gigabytes is likewise astonishing.)

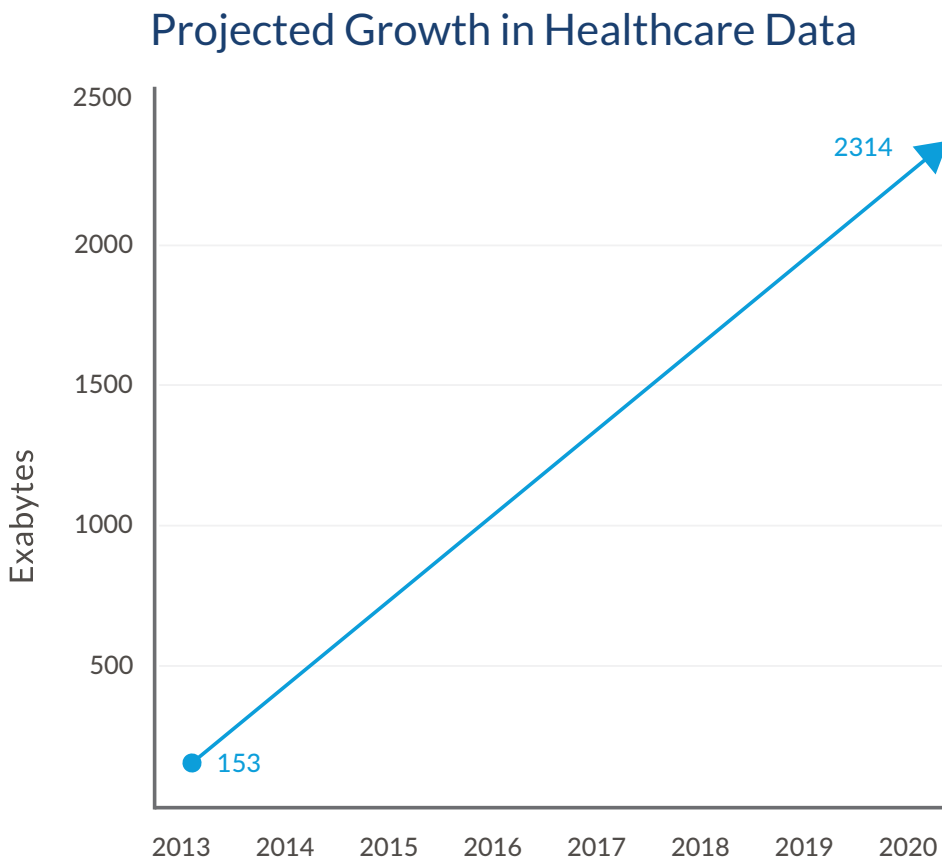


Figure 1 - Source: EMC Digital Universe, & IDC, 2014

Healthcare data is the fastest growing data segment, in part due to imaging data such as MRI, CT scans, and x-rays. (Medical imaging already accounts for about 90% of all healthcare data.³) Other current contributors to the rise in health data include wearables and “consumer-level” genetic testing.⁵ Overall, the volume of global health data is expected to grow at a rate of 48% annually.^{4,5}

Unfortunately, it’s estimated that a staggering amount of data—potentially more than 97% of medical imaging data in particular⁶—cannot be analyzed because there isn’t a way “to quickly and easily handle and process large amounts of data in an accurate and efficient way” (Nosta, 2017).⁷

“By 2025, the total number [of bytes] of genomic data will likely surpass that for astronomy, YouTube, and Twitter combined.” ⁴ (Frisma, 2018)

EHRs: The Original Solution

“For patient data to become more impactful in health care, provider organizations will have to figure out how to efficiently obtain, integrate, and share information across disparate systems.”⁸ (Compton-Phillips, 2016)

Ten years ago, legislators devised a solution to the healthcare data problem in the form of the Health Information Technology for Economic and Clinical Health (HITECH) Act. Since this Act offered financial incentives (and penalties) for the adoption of health information technology, many hospitals and healthcare practices began to implement EHRs nationwide. Electronic health records were expected to reduce healthcare record discrepancies and improve care coordination, population health, patient privacy, and overall security. Since the passing of the HITECH Act in 2009:

- 85.9% of office-based physicians adopted EHRs by 2017 and hospital adoption of EHR's reached 96% by 2017.^{2,5,9}
- 50% of health systems are projected to be on second-generation technology by 2020.¹⁰
- 74% of hospitals and health systems now share clinical or summary of care records with hospitals outside their system, up from 30% in 2012.¹¹

Electronic health record adoption promised many benefits over paper records, such as eliminating legibility concerns, sending prescriptions electronically, and adding the ability to share patient histories between healthcare providers. Other potential improvements included:

- Making critical lab value reporting and notification simpler
- Helping clinicians determine when to repeat a lab test and reducing duplicate tests
- Giving patients access to their own health information through patient portals
- Maintaining patients' current medication list
- Facilitating performance improvement projects and quality assurance
- Giving “providers comprehensive data that can guide them to more accurate, reliable diagnoses”¹²

Electronic health records have certainly made improvements in the healthcare system. About 88% of those with highly sophisticated EHR systems agreed that EHRs provide at least one positive benefit, with 83% noting improvements in “clinical staff quality performance” in particular.¹³ For example, in 2014, the Office of the National Coordinator for Health Information Technology found EHRs reduced adverse drug events by 52%.³

At the same time, EHRs are a source of a considerable amount of data. One study estimates that an average hospital admission generates 137,882 individual data elements (such as patient names, medication names, and other information) in an electronic health record. By the time a patient is discharged, an average of 216,744 data elements have been accumulated.¹⁴ This begs the question: Could the cure (EHRs) be contributing to the disease (mass amounts of healthcare data) instead of solving it? Unfortunately, adding more data to our glut is just the tip of the iceberg in terms of EHR issues.

Major Issues Stemming from EHRs

“We believe that computing is essential to the future of medicine. We simply want all EMRs to live up to their promise of improving care and making patient information readily available.”¹⁵ (Levinson, Price & Saini, 2017)

The influx of healthcare data has also increased the potential for catastrophic errors. When the ECRI Institute Patient Safety Organization investigated 7,613 patient identification error events, they found that “almost 15% of events (1,148) were associated with technology contributing to patient identification errors.”¹⁶ Though 91.4% of identification errors were caught before they resulted in harm, two worst-case scenarios stood out: “The two wrong-patient events associated with patient deaths involved documentation failures; in one event, the wrong patient record was accessed, and in the other event, the wrong patient’s documentation was used to give another patient clearance for surgery.”¹⁶

It’s all too easy to make a small yet momentous mistake with an EHR, especially with contributing factors such as communication issues, insufficient training, and poor user interface design. Fewer than 20% of those quizzed on their organization’s use of data for direct patient care called it “extremely effective” or “very effective” and most believe their organizational effectiveness lies somewhere between either “effective” (36%) or “not very effective” (32%)⁸, making it clear there is plenty of room for improvement.

Three major issues with EHR stand out: usability, interoperability, and correlation with healthcare provider burnout.



Usability

If you’ve ever gotten frustrated because an ad popped up over the web article you were in the middle of reading, then you’re likely familiar with a “bad user experience”. Electronic health records are notorious for having problematic user interfaces, which “is a point of frustration for clinicians and can have patient safety consequences.”¹⁷ A study that looked at 9,000 EHR-related patient safety event reports found that about a third of events reports “cited usability as contributing to the patient safety event” and 19% of those EHR usability-related errors weren’t caught before reaching the patient.”¹⁸ MedStar’s 2019 Letter to Congress offers just one example of the harm that can result: “...because of a confusing EHR display, the weight of a child was entered incorrectly, leading to a significant medication overdose that resulted in harm.”¹⁹

The provider’s ability to interact with the healthcare application’s user interface should be one of the primary concerns. So why is this issue so prevalent? While there are mandated usability certification requirements and testing standards, one 2018 study puts forth a theory that the way EHR interfaces are designed doesn’t line up with how they are used on-site.²⁰ If true, such a fault calls for improved communication between vendors and healthcare providers to understand workflow as well as improved testing, among other improvements.



Interoperability

Even if the usability issue was solved for each EHR vendor, there is still the seemingly insurmountable task of sharing data among disparate systems—a characteristic called interoperability. Without interoperability, data entered in one system cannot be shared with other systems. Like the usability issues, lack of interoperability between EHRs can contribute to patient safety errors.

One study reviewing patient safety reports found that “the most common EHR interoperability challenges...involved the EHR interfacing with pharmacy, laboratory, and radiology systems, respectively.”²¹ This intimates that patients and providers who need accurate and efficient medication, lab results, or imaging may face frustrating hurdles when trying to diagnose, treat, or refer their patient. (Also, remember the earlier estimation that 97% of medical imaging data may be going unused? This is due, in some part, to a lack of interoperability.)



This issue of interoperability becomes more pressing with the revelation that, in a survey of 526 nurses, “half (50 percent) said they have witnessed a medical error because of lack of device coordination” and 96% agreed that device coordination could reduce medical errors.²²

Improved interoperability is needed to use data effectively and reduce instances of errors, patient harm, and delayed patient care, but there is a wide chasm between ideal interoperability and what exists today: In one survey, 72% of health professional respondents named lack of interoperability as a major hurdle keeping them from accessing and using patient data efficiently, yet just over half of respondents still stated interoperability is “weak” in their organization.⁸ In February 2019, the Centers for Medicare & Medicaid Services (CMS) even proposed the Interoperability and Patient Access Proposed Rule to specifically “make patient data more useful and transferable through open, secure, standardized, and machine-readable formats while reducing restrictive burdens on healthcare providers.”²³

Thus, interoperability is another facet of EHR technology that needs to be improved in order for healthcare data to be used efficiently and effectively.



Provider Burnout

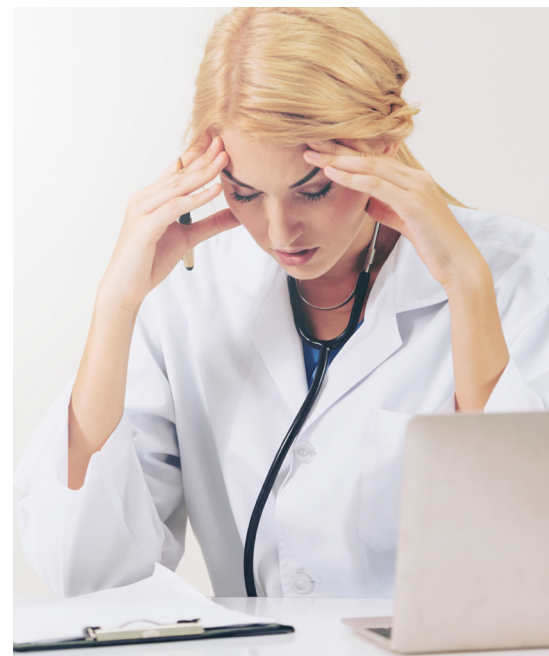
The Association of American Medical Colleges projects that by the end of the next decade, demand for physicians will exceed supply by a range of 42,600 and 121,300.²⁴ While this is partially a result of a national population decline, it's also due to a rising swell of early retirements and physicians dropping out of the workforce due to extreme or prolonged work-related stress more commonly known as burnout. In 2018, 42% of 15,000 surveyed physicians reported feeling burnout.²⁵ While this stress stems from a number of factors, there is a high correlation of burnout with the negative effects of EHRs.

In a separate 2018 survey of physicians, 78.7% of 8,774 respondents reported that patient relationships were rated as their “greatest source of professional satisfaction,” whereas EHRs were their greatest source of professional dissatisfaction. Respondents reported greater dissatisfaction with EHRs (39.2%) than regulatory and insurance requirements (37.6%) for the first time. The latter was rated as physicians’ greatest source of dissatisfaction (at 58.3% of respondents) just two years earlier.²⁶

Nurses are also reporting high rates of burnout. A “national survey of 257 RNs who work in a hospital setting” found that 63% feel that their work is causing burnout.²⁷ A separate survey noted that only 19.8% of 371 nurses reported at least one symptom of burnout, but 50.3% “agreed or strongly agreed that the EHR added to their daily frustration.”²⁸

Much of this frustration can be linked to the sheer amount of time that providers spend on data entry. For instance, only 56% of health professionals reported that their EHR had the capability to integrate clinical information received from an outside provider without manual entry in 2018 (up from 50 percent in 2014)¹¹ and 63 percent of U.S. healthcare workers say their work “requires a great deal of manual entry or analysis.”²⁹ In addition, a 2016 study found that physicians spent 49.2% of their office day on EHR and related “desk work” and 27.0% on direct clinical face time with patients.³⁰

Yet, all is not lost. The promise of EHRs is still present: In a 2016 survey of 425 practicing physicians and health care leaders, EHRs were at the top of a list of ideas to transform health care.³¹ Hospitals and healthcare professionals have invested significant time and energy into these systems, and the aforementioned efficiency benefits are still achievable. However, it's clear that physicians and other on-ground health professionals recognize that they are not and should not have to be a health IT expert.



We are brought to the crux of the issue:

How can healthcare organizations maintain their investment, use their data efficiently, and improve the patient and provider experience?

The New Solution: An Increase in Health Informatics Professionals

“Information technology has changed the way that healthcare professionals practice. And, while many health professionals see the potential that these changes can bring to improving the quality and cost effectiveness of healthcare, many are also frustrated. They are struggling to adapt, without knowing the underlying science of information in these new tools.”³⁴ (Fridsma, 2018)

Physicians, nurses, and healthcare professionals are extremely busy and understandably chafing with the demands required by the implementation of the EHR. There is a clear opening for additional health IT professionals to step in and to start working on solving the issues with EHRs.

Enter health informatics professionals.

Health informatics professionals' mission is to improve healthcare through the integration of technology and it should be noted that improvements can be devised by professionals from many backgrounds and through a variety of strategies. For example, informaticists who are familiar with healthcare processes can question EHR workflows assumptions and incorporate real-world exceptions and scenarios into picklists and program options. Informaticists coming from IT backgrounds can use their troubleshooting abilities to uncover software bugs before a fatal error (for a program or a patient) can occur. Informaticists trained in data science can scrutinize data to add to predictive analytics. Informaticists with backgrounds in adult education can create useful, brief instructional materials so that healthcare professionals better understand the programs they're using and stay up-to-date on new EHR developments. Overall, health informaticists take on these responsibilities so that everyone else in healthcare can spend their time on the most important part of their job: patient care.

Health informaticists bring a diversity of backgrounds and perspectives that can solve a diversity of issues. For example, the American Hospital Association's 2017 Annual Survey – Information Technology found frustrations for physicians involving EHRs include:

- “28% say they had to develop customized interfaces in order to electronically exchange health information.
- 35% say they have to pay additional costs to send/receive data with care settings/organizations outside their system.
- 37% say it's difficult to match or identify the correct patient between systems.
- 57% experience greater challenges exchanging (e.g. sending/receiving data) across different vendor platforms.
- 63% stated they would like to electronically send patient health information but recipients either do not have EHR or lack capability to receive information”³².

Health informaticists are at the forefront of solving these problems already:

- Informaticists are trained in **usability** standards such as user experience and user interface design, and can build, customize, or demonstrate how to use EHR interfaces best.
- Health informaticists are creating and improving **interoperability** standards such as HL7 and FHIR to avoid incurring fees in the first place.³³ (This will also address the 57% of physicians frustrated with sending and receiving data across platforms.)
- Informaticists with linguistics expertise are developing AI programs with natural language processing³⁴ which can eventually be used to recognize common typos or differences in patient identification data.
- EHR implementation is at an all-time high^{2,5,9} and, with the proper IT support systems in place, will likely reach all remaining care systems soon to **reduce care providers' frustrations and burnout**.

Health informatics professionals are not a new idea in the healthcare industry. In 2013, the Office of the National Coordinator for Health Information Technology noted that a shortage of 51,000 health IT workers existed³⁵ and in 2018, 86% of vendors and consultants still expected their volume of business to grow the following year.³⁶



How did there come to be such a disparity between supply and demand for health informaticists? It certainly can't be the pay: a HIMSS compensation survey of 1,900 health information technology (IT) professionals found that the average salary range reported for health IT positions (including positions at multiple seniority levels from associate staff up through executive management) is \$111,387, with a median of \$90,000.³⁶

Excluding higher-level positions, health informaticists still net a solid paycheck: The website PayScale reports the average salary of a health informatics specialist is \$61,007 a year, within an average range of \$40,986 to \$87,558 per year (depending on the professional's location).³⁷

Once again, we come back to the current overabundance of data. In its "Different Skills, Different Gaps Measuring & Closing the Skills Gap" report, job market analyst company Burning Glass found that in 2012, there was no gap in supply and demand for computer scientists and related roles. Yet now we see a gap of 1.2 openings for every worker. According to the report, "That's the largest change of any technology occupation over time. The reason for the shift is the explosion in big data analysis..."³⁸

Healthcare data systems need a solid base of diverse, adaptable informaticists who can help EHR technology fulfill its potential and allow healthcare institutions to fully embrace the full power of all the data they collect.

“Today, organizations can collect vast amounts of data, but insights cannot be drawn if they lack the technical expertise to interpret it or proper tools to analyze it. ... Experts have identified a talent gap in the health care sector. Today, there is a shortage within the system of professionals with expertise in data analysis or data science.”⁵ (Stanford Medicine, 2017)

Health Informatics Professionals’ Unique Strengths

“While [EHR] design can be an important factor, so too can implementation choices made onsite... Increased collaboration between vendors, information technology purchasers and physicians is needed to optimize experiences and address current needs.”²⁰ (Levanthal, 2018)

Informatics professionals retain a diverse set of technological skills, the most common of which (in terms of being found in job descriptions) include supporting systems implementation, user training, development of new systems, technical support of existing systems, IT strategy, sales, and research.³⁹ These skills will allow them to tackle usability and interoperability improvements on a technological level. However, health informaticists’ unique strength lies in their power to mediate between EHR developers and healthcare providers.

Healthcare informatics professionals provide a bridge between the worlds of information technology, data science, and healthcare that can address usability and interoperability issues and lead to a reduction in provider burnout. For instance, earlier we touched on the idea that the EHR created by the vendor does not always align with the needs of the physician or nurse end-user. Health informatics professionals, combining their years of clinical experience and understanding of the technology, can either customize the EHR to fit better with the organization’s day-to-day processes and/or instruct the end-users how to integrate the system into their workflow.



Above all else, health informatics professionals are a valuable solution to data and EHR issues because of their innate curiosity. As technology and its clinical uses constantly evolve, health informaticists must maintain a versatility and adaptability of mind to accumulate new skills. Already, health informatics postings “are shifting away from entry-level positions towards upper-level positions that require highly skilled employees with clinical expertise and management skills”³³ to reflect the growing complexities of both technology and healthcare.

Though “informatics training has rapidly expanded [...] to community colleges, undergraduate programs, certificate programs, and outreach to high school students,”³⁹ which will improve the supply of health informaticists over time, the present concerns outlined in this paper can start to be ameliorated by encouraging those with healthcare or information technology experience to pursue specialized health informatics skills through higher education. Degrees, certificates, and individual courses on a wide variety of health informatics topics have been developed over the past ten years to meet the demand, and researchers have found that health informaticists with graduate-level degrees responded with much higher job satisfaction rates than dissatisfaction rates.³⁹

“Technologies change quickly. This reality requires a new type of workforce and attitude from both employers and employees around continuous learning and mastering skills that will enable employees to be prepared for not-yet-arrived jobs of the future.”⁴⁰ (“The Quant Crunch How the Demand for Data Science Skills is Disrupting the Job Market,” Burning Glass, 2017)

Conclusion

We have more health-related data than we can handle, and the risks of neglecting or misusing this information can directly impede healthcare’s directive to “do no harm.” The original solution (EHRs) needs further finessing, and health professionals don’t have the time and should not be expected to become an IT expert on top of their daily jobs. As the current weight of data is pushing invaluable healthcare providers to retire from the field, the time is ripe to make another major investment in our healthcare system: experienced, hybrid professionals whose sole duty is to process, analyze, train others on, and offer actionable suggestions on improving the use of patient data. The pay is good, education opportunities are rife, and the job market is wide open: Now is the time to invest in or become a health informatics professional.

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