THE AGE OF DATA-DRIVEN MEDICINE

BIG DATA HELPS REVEAL HIDDEN HEALTH TRENDS AND BUILD RISK MODELS

Peter Hinssen, editor
“The Age of Data-driven Medicine”

Is the second in a series of thought-provoking booklets that Across Technology will be publishing this year, sponsored by EMC Greenplum. These booklets are elements in the Data Science Series, which is also a series of events, and a website:

www.datascienceseries.com

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Across Technology

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The healthcare world is changing fast. Increased cost-pressures is a key driver, but also well-informed patients who are critical of medical services and aware they have options. And there’s digital data, lots of it. For decades, healthcare providers, pharmaceutical concerns, insurance companies and other players in the healthcare field have been sitting on a huge stockpile of data.

Today the healthcare consumer, himself, is able to log and produce relevant data through all sorts of wireless devices used to monitor healthy living and medical conditions. Healthcare providers, for their part, have begun to discover the technological tools that allow them to create added value by connecting all this structured and unstructured data. The thus derived information gives predictive value that raises the quality of patient care and comfort, reduces costs at hospitals, research laboratories and in the healthcare industry in its widest sense. Most of all: Big Data can save lives.

To achieve this, healthcare has to become truly patient-centered. Healthcare consumers need to get engaged in their medical treatment: their genome sequences are used to develop personalized medicine while their medical data, and other data from everyday life, is connected and turned into predictive information. The challenge is not just in storage and access, but in making the increasing number of datasets being developed from many sources across the healthcare spectrum usable.

With this booklet, we want to offer you the views of innovation technology thought leader Peter Hinssen on how you can steer your healthcare organization into the future, driven by the smart use of Big Data. To keep you informed on a constant basis, we have created the Data Science Series website (www.datascienceseries.com), offering you case stories from your peers, valuable insight into market research and an overview of the Catalyst partners that help EMC Greenplum bring the right building blocks to the market. Allowing you to build the right ‘refinery’ for all the information that is coming your way.

Make sure you don’t miss the installments of the series. Please contact your local EMC Greenplum organization to obtain all of these booklets.
IF HEALTHCARE CONSUMERS CHECK YOU OUT AND THEY DON’T LIKE YOU, THEY WILL SHOP ELSEWHERE.
When you decide to buy a new pair of sneakers, you might ask some friends on Facebook where they bought theirs. When picking a restaurant you can check Foursquare for places nearby that serve good quality food at value for money. And when purchasing practically everything that costs 50 euros or more you surf the web for detailed information about where you can find the highest quality and service at the best price. And what about healthcare services?

Healthcare, too, is increasingly becoming a consumerized market. People that need medical assistance should no longer be called patients; you should refer to them as customers or clients. Because if they check you out and they don’t like you, they will shop elsewhere.

It’s about data, and lots of it

This means healthcare providers need to prove they are delivering high-quality and efficient care services. Okay, healthcare is about injuries, blood, diseases, wheelchairs and men and women in white, but mostly healthcare is an information-based business.

Healthcare is about data, and lots of it.

The global size of Big Data in healthcare is estimated at 150 exabytes in 2011 and is increasing at between 1.2 and 2.4 exabytes a year. (1 exabyte = 250 million DVDs of data)

What do healthcare professionals really know about their patients, and not just what’s in their medical record? What do they really know about the wide range of treatment options and protocols? What do they really know about the likely risks, outcomes and associated costs? And how can we use all this available information to gain new insights and adopt new practices?

A key driver for everyone involved

Big Data can be a key driver for initiatives that reduce costs, increase revenue and improve the quality of outcomes in hospital environments. Moreover, it will separate winners from losers.
Managing data smartly will become a core competence for hospitals. It won’t simply be nice to have, it will be a crucial part of their strategy to successfully move forward.

And it’s not just care providers that need to put data to smart use in order to reach higher quality and reduce costs. Governments, who traditionally pick up a large part of the healthcare check (in the US ca. 40%) are eager to raise efficiency. Insurance companies too benefit from more healthy people and offer more tailor-made products. Researchers at academic institutions, pharmaceutical companies and laboratories know all about the power of Big Data; it has changed their research fields dramatically.

Heathcare providers discard 90% of the data they generate.

**Connected around the consumer**

If we want to put all this data – in all its different shapes and sizes – to good use, it needs to be connected. And at the center of all that data should be the patient, sorry, the healthcare consumer.

Big Data is very dynamic and changes fast, furiously and continuously, and Big Data is usually a combination of multiple unrelated sources; it is a combination of structured and increasingly more unstructured data, it’s inaccurate and needs lots of cleaning, processing and culling before it can be used.

Well, we all know healthcare data is a huge mess, but other than that it has no other characteristics of Big Data. In order for healthcare to become truly data-driven, its data will have to be combined with other data sources, such as social media data, Internet search data, financial data, census data, shopping data, cellphone data, and the list goes on. And herein lies the Big excitement.

Provided all these data sources are connected, Big Data can create value by demonstrating transparency, enabling experimentation, identifying population-specific needs, supporting human decision support with automated algorithms, and promoting new business models and technologies.

Big Data is transforming the healthcare industry as we speak. There is no other industry out there to which Big Data bring such high value. Not just because it could improve efficiencies, but because it could mean the difference between life and death.
THE SCAN OF A SINGLE ORGAN IN 1 SECOND CREATES ABOUT 10 GIGABYTES OF RAW DATA
Someone has an ongoing pain in the lungs and doesn’t feel well. So, after a while, he goes to see his general practitioner. This doctor starts to diagnose what’s wrong, takes a blood sample and sends his patient off to get an X-ray and MRI scan. The doctor is paid for his services and hands over the paperwork to the insurance company. Ever thought that this patient at this morning’s surgery will have generated several gigabytes of data of different types and from different sources?

Healthcare is probably one of the most data-intensive industries out there. So who’s generating all this healthcare data, and why? Basically there are four main sources:

1. **Medical care providers** – Hospitals, physicians, pharmacists, nurses, therapists and possibly long-term care facilities that log medical-encounter data, both for treatment and financial purposes.

2. **Public and private payers** – For the overwhelming majority of people who utilize insurance instruments to finance medical care, a lower fidelity version of health information is being maintained by the payer, tallying ailments, therapies and everything else that has a euro value associated with it.

3. **Ancillary service providers** – From pharmacies to laboratories and imaging facilities, ancillary service providers are also maintaining detailed lists of medical services and products provided to people and when pertinent, clinical results and invoicing information.

4. **Healthcare consumers, trying to stay healthy** – Although largely confined to a tiny minority of healthy, educated and tech-savvy people, the results of personal monitoring of health indicators are beginning to accumulate in various private information systems.

Big Data in healthcare is not just about volume. It’s also about velocity – in case of life-death emergencies, data needs to be delivered fast to the right parties. And it’s about a large variety: healthcare data is both structured and unstructured and exists in different types and formats (text, video, images, voice...).

Some 80% of patient information is unstructured, but clinicians need an aggregate view. As a healthcare provider you need to mine this unstructured data, looking for things that would be predictive of future negative health outcomes.
**The bigger picture**

IDC Global Health Insights predicted that, over the next 10 years, the amount of digital healthcare data created annually will grow 44 fold. For a large extent that’s because we want a better picture. Medical images are the single largest contributor to the expanding volume of Big Data in healthcare.

Medical image archives are increasing by 20-40% annually. If you’re a healthcare IT executive, the soaring costs and complexities associated with medical image storage are one of your most significant challenges. That’s why healthcare organizations should be deploying new IT architectures, specialized tools and expert people.

Managing Big Data, whether it originates from medical images, patient-centric analysis, clinical research studies or translational research, is paramount in today’s healthcare IT ecosystems. Healthcare organizations can capitalize on the Big Data phenomenon to change the way in which value is created from patient-related information by embracing cloud computing.

This change is likely to continue in the future, so CIOs and IT managers in healthcare need to focus on controlling and managing this change. At the same time, that Big Data is transforming business and changing the world. By harnessing it to improve their strategies and execution, healthcare organizations can gain an edge on their competitors.

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**More data makes more sense**

The more data you have, the more likely you are able to extract something useful from it. By observing patterns and correlations in this sea of information, you may discover answers to questions you might never have thought of.
What if someone was in a car accident and is brought to a hospital by ambulance? And what if this person’s medical data including blood type, allergies and previous medical complications are known even before the ambulance reaches the hospital? The savings in time could prove crucial to saving his life.

And what if the treatment that patients receive at a hospital is based on data from thousands or even tens of thousands of past patients who were in a similar situation? Already hospitals have used data-mining technology to achieve measurable improvements in patient care. Has the patient been admitted for congestive heart failure and does he have a bulging jugular vein? Then the odds are he will be readmitted pretty fast.

Individual doctors will treat the same conditions in very different ways, based on his/her experience and also on the latest research they’ve gathered on it. In 99% of the cases there’s nothing wrong with that, but sometimes this leads to the wrong treatment and bad outcomes. With help from Big Data analysis, doctors will see which tests are necessary and which won’t add any value.
Hospitals and health management systems need to leverage their data to further improve patient care. This implies more than traditional basic reporting, scorecards and dashboards. And it needs to happen across departments and organizations. That way, they can design an effective care plan, diffuse medical knowledge, engage in population-health management and disease management, and make fact-based decisions about quality improvement.

**Monitoring anytime, anywhere**

Technology exists that can take readings off pacemakers and upload that data into a patient's Electronic Medical Record, or EMR. That way, doctors can see and track that data over a period of time. It’s especially suited for patients with chronic conditions. Also data from other devices like those monitoring blood glucose levels or blood pressure can provide similarly valuable information.

“**Medicine is learned by the bedside, not in the classroom.**”

*William Osler, founder of modern medicine*

That’s where the data is, with the patients.

This monitoring can also provide early warning of any potentially damaging conditions. The advantage? A physician doesn’t need to see the patient on a daily basis, giving time efficiencies to the practitioner and less stress to the patient. Systems such as this will enable doctors to monitor thousands of patients in future, enabling them to better cater for a growing population of elderly folk.
THE MOST EXPENSIVE DRUG IS A DRUG THAT DOESN’T WORK
Did you know that the average cost of developing a successful drug is in the market range of 1.5 billion to 2 billion dollars? The bulk of that is attributable to the amortized costs of drugs that did not succeed. If the success rate could be improved, the cost would come down. Big Data can make the difference between a successful drug and a failure. Big Data will ultimately allow drug researchers to identify those compounds that are not likely to be drug candidates. Big Data could also identify patients who would be a good match for a certain drug.

In the last couple of years, some leading institutions have finally made significant progress on multiple fronts to bring the long-held vision of utilizing Electronic Medical Record (EMR) data to accelerate drug R&D to life.

The technology to extract data from EMRs has been around for a while, but it is now easier to deploy, cheaper and more reliable thanks to investment in a new generation of analytic platforms.

The motivation to share data has also grown significantly as health systems have become more confident in their ability to deal with security and privacy concerns, and see the potential benefits of better research collaboration.

Companies that research and manufacture drugs (but also therapies and devices) have been into Big Data for quite some years. Drug effectiveness in the field is essentially a Big Data application, especially when correlated with other health and treatment information, demographics, etc. The more data from more sources, the better the insight.

As a result, the underlying data repositories now appear to be growing at hyper speed. Perhaps the most extreme example of this is the new wave of genomics companies. An enormous amount of data is generated by sequencing genomes, but that specific data is of limited use unless it’s correlated with actual life histories, therapeutic results, etc.
Medical research, in which 100,000 participants are genotyped (ca. 1.5 GB/person), could result in a staggering 150 terabytes of data.

Since finding new drugs, therapies and treatments that are more effective and cheaper at the same time, use of Big Data by these type of companies is set to rise in the future.

Healthcare analytics is moving toward healthcare prediction. Collaboration between Big Data analytics experts and healthcare Insurance companies will lead to a personalized approach to health risk prediction.

Analysis of patient data will help insurance companies to develop healthcare plans expressly tailored to customers. Big Data’s reach is touching consumers in multiple ways. It’s already helping to develop pharmaceuticals personalized to patients. And soon their healthcare plans will become personalized, too.

The market forces and few euros available are driving healthcare to become more effective. Those who embrace and leverage Big Data will be those who succeed in the future, and those who don’t will fail.
That medicine fits you

When we use Gmail or log on to Facebook we are targeted with personalized ads. When we walk in a city center, our smartphone tells us which restaurant nearby is highly rated, based on our friends’ opinions. We are living in a hyperpersonalized world; there is no getting around it. When someone is diagnosed with cancer they usually undergo one therapy, and if that one doesn’t work, the doctors try another, etc. But what if a cancer patient could receive medication that is tailored to his individual genes? This would result in a better outcome, less cost, less frustration and less fear.

In the past, the various diseases or syndromes medicine treated were nothing more than collections of symptoms. But, nowadays, medicine is capable of understanding, at the genetic level, what causes diseases. This understanding springs from Big Data.

With human genome mapping and the reduction in costs for the soft- and hardware required for mapping, it will soon be commonplace for everyone to have their genes mapped as part of their medical record.

For the first time in history we can digitize humans.

This brings medicine closer than ever to finding the genetic determinants that cause a disease and developing drugs tailored to treat those causes — in other words, personalized medicine.

Personalized medicine has the potential to radically change the healthcare business. Just imagine if every cancer patient could get a treatment customized to work best with their set of genes. But there’s a problem: storing genetic information is a data nightmare.

For personalized medicine to reach its full transformative potential, two challenges must be addressed at the same time. First, we must crystallize breakthroughs at the workbench into improved, clinically relevant insights. Second, we must accelerate the diffusion of these insights out to clinicians on the frontline and, ultimately, on to their patients.

Research focused on improving healthcare requires large sample populations; the effects of genetic factors and other methods for personalizing medicine can be modest. Only by creating consented, large, nationwide sample sets can we reach the statistical power to identify these factors and create the predictive models to personalize healthcare and make more efficient use of our current crop of therapeutic, diagnostic and preventative tools.
Patients typically remember only 25% to 35% of what they’re told by their doctors.
Patient engagement

Ok, a patient has had surgery and before he leaves hospital he receives a long list of instructions on treating the wound, moving about, taking medication, planning physiotherapy. And how much of that information does he actually remember? And if he wants to take a look at or add something to his medical record, what efforts does that require on his part? He’s the healthcare client, right?

So what if patients could be communicated to via an app in their smartphone? To remind them to take their medication, to practice a certain movement or take their temperature at designated intervals? Experiments are already being conducted in this regard.

Some 50% of prescription medications are not taken as directed.

Also, for a few years now, US war veterans have been able to make use of the ‘Blue Button’ capability to download their personal health information from a veteran healthcare account. This account allows them to self-enter their personal health indicators (blood pressure, weight and heart rate), emergency contact details, test results, family health history, military health history and other health-related information. Users can also refill their prescriptions and view their appointments, allergies and laboratory results online.

Healthcare consumers at the core

Blending traditional healthcare data with other client-specific data, including social media and other web-based data, could help hospitals understand the patient’s motivation and readiness to embrace change better. Not to mention unlocking the complex issue of how best to drive improvements in healthcare consumer commitment, at the individual level.

Getting healthcare consumers involved in the development of applications to engage them in their medical life is crucial. They can bring a much-needed perspective that all the smart doctors and professors are currently not seeing.
Healthcare providers must incorporate the most important member of the care team: the healthcare consumer (we used to call him/her the patient).

With their finite resources, healthcare providers must figure out ways to offload tasks that needed, in their view, to be done by its staff. In most cases, it’s the patient who can do it more effectively. In the process, the patient is more engaged and it’s more efficient for everyone.

Be like the marketing people

People aren’t sitting around waiting for the healthcare industry to lecture them into living a healthier life.

Healthcare players need to start learning from industries like food and beverage, electronics, entertainment and the like, which do a much better job seducing the consumer. They need to learn how to be worthy of the mind share that we are asking people to give us in our efforts to seduce them into making healthier lifestyle choices, on a daily basis.

The goal here is to harness the incredible creativity and passion in all healthcare professionals who are working so hard to effect change and to use that creativity and passion to bring joy and inspiration back into the dialogue we are having with the public about their health and well-being. Couple that philosophy with a data-driven approach and you will be amazed at what you can do.
Reducing cost in healthcare

If patients are helped more efficiently and effectively in the healthcare cycle, healthcare becomes cheaper. Keeping patients out is a big ambition of any hospital. Sounds like a paradox, but that’s how it works. Taking a closer look at administrative costs and ever-cheaper genome sequencing (with today’s technology) are two other ways of deploying Big Data to reduce cost pressures on the healthcare system.

The McKinsey Global Health Institute has reported that in Europe, savings through Big Data analytics could be high as 205 billion euros. That is about a third of the total spend wasted in healthcare, according to Thomas Reuters. Areas of healthcare spending waste (expenditures that fail to improve patient outcomes) are medical errors, criminal fraud, unwanted use of health services, administrative inefficiencies and lack of preventive care.

Cutting costs via Big Data can be done by adopting a six-part approach:

1. **Unwarranted use**: Big Data analytics could help generate a model that implements a performance-based payment method.

2. **Fraud waste & abuse**: Using Big Data analytics, individuals who charge for services never rendered could be tracked much faster through by utilizing outlier detection algorithms.

3. **Administrative costs**: By updating billing systems and employing Big Data records management, facilities could spend less time working on bookkeeping and more time on providing accurate information to doctors and physicians’ assistants.

4. **Provider inefficiencies**: A wide implementation of clinical decision systems could reduce errors and increase congruency among various healthcare providers.

5. **Lack of coordinated care**: Improved sharing of information would open systems up to predictive modeling and also allow patients to view their history. This would allow the patient to have greater control in their treatment.

6. **Preventable conditions**: Through the use of Big Data, healthcare providers can track the change in behavior of patients after treatment. Using this data, medical professionals can better educate patients on the resulting effects of their behavior.
A THIRD OF THE TOTAL SPEND WASTED IN HEALTHCARE, COULD BE SAVED THROUGH BIG DATA ANALYTICS
Keeping the patients out

One of the major goals in hospitals is to reduce the average length of stay for patients (not only because a patient in a hospital costs a lot of money, but also because hospitals harbor the most serious, highly resistant bacteria and pathogens). Already medical centers in the US are having laptop-equipped nurses treat their patients at home. They use their wireless data cards to tap into the patient records, giving them the same access to patient information as they would have back in the hospital. For patients with chronic conditions, like congestive heart failure and diabetes, regular monitoring can be done at home and reported by nurses or remote monitors.

Risk management

The use of mobile technology, such as tablets and smartphones, will grow rapidly. Inevitably, that places healthcare providers in the risk management business. In the past, providers were reimbursed on the basis of payment for service. They didn’t take on financial risk. In the future, they will increasingly take on risk in the delivery of agreed-upon outcomes for defined patient populations. Risk is the element that you are now adding that wasn’t there in the past. And as risk managers in finance know, managing risk requires lots of data plus sophisticated analytics.

Avoiding readmission

A readmission to the hospital within 30 days of being discharged typically causes a lot of pain and suffering for the patient and sends bills skyrocketing.

Patients might not have the social infrastructure or family support to help make sure they know how to continue their treatment at home or to take their medication. So they end up in hospital again shortly after being treated there. It’s a major problem in the healthcare system. Big Data could allow hospitals to flag patients in danger of readmission, via certain key indicators.

One of the problems in healthcare is that healthcare consumers have no idea of what healthcare actually costs. Providing patients with more data will help them make better and more economical choices. With analytics, those consumer choices will include new insurance options.

Addressing administrative healthcare costs

Current administrative systems in healthcare are a set of clumsy transactional systems that don’t interact very well together. Three areas associated with administrative healthcare costs that could be addressed by Big Data include: the billing process, the coding process and the logistics process:
1. Addressing the costs associated with the administrative transactions to automate (and standardize) the medical approval and billing process between participants in the healthcare system.

2. Enhancing the coding process between clinical diagnosis and the financial billing systems by upgrading to a modern code system.

3. Improving the logistics of managing devices and supplies within the hospital and clinical environment.

**Cheaper digitization of the individual**

The new tools of molecular biology are making it much more practical to analyze a patient's genome, to determine if a patient has a genetic predisposition, say, for diabetes or heart disease. Advances in molecular diagnostics are also making it easier to regularly measure the hundreds of thousands of molecule-size constituents that are produced through genetic activity.

*Never before in human history has something that is critical to human health gone down in cost — by a factor of 1 million in a decade — the way genomics has.*

With data analytics, it's feasible to compare and chart these millions of data points over time to detect early signs of disease long before any symptoms appear. Or to compare the data from one patient with the data from millions of others to see how they compare on the bell curve of 'normal.'
In the 1980s, an average jogger carried a Walkman and played tapes to have some music while running. In the 1990s, joggers used mp3 players to listen to music and started wearing wireless heart rate monitors. In the new millennium, the iPod provided the music. After the launch of Apple’s App Store in 2008, a whole new world of applications for people who are into sports and care about their health were made available. For a few dollars (or even for free) they could now measure their performance, calories burned, heart rate, distance run, ... get a clear visualization and insights from it to become even fitter and healthier. And they could share all that data with peers to motivate them.

Today, these devices have moved beyond the park and the running track. The Nike+ Fuelband, for example, is a cool and inconspicuous bracelet that measures your steps and calories and turns this into NikeFuel. This motivates users to reach their health goals. FitBit is a wireless device that does more or less the same. You can use it to connect wirelessly to a scale and integrate it with a mobile app to log the food you eat during the day (or night). ‘Know Your Body, Change Your Life,’ is the credo of BodyMedia which offers a device that even measures heat, sweat and sleep patterns. People want to live a healthier life and now they have no excuse not to.

The (medically) quantified selves

There are also many medical devices out there today, aimed solely at consumers. A simple iPhone can be turned into an alarm clock that wakes you at the right time, based on your sleep cycle. It’s even possible to turn it into a device that measures your blood sugar level or a scanner to diagnose for melanomas on your skin, or even your very own EEG heart monitor. There are sensor-equipped and smartphone-connected asthma inhalers that let patients more effectively control their disease.

And it goes even further than that. The consumerization of healthcare even allows everyone (well everyone who has 299 dollars to spare) to get their DNA analyzed. A company called 23andMe provides genetic testing for over 100 traits and diseases as well as DNA ancestry. All you have to do is order a stick, spit on it and send it back.

The ‘quantified self’ is increasingly entering the world of healthcare. This means people can now become responsible for their own health. They are motivated through game-like applications and they can benchmark their own health efforts against others around them. Active healthcare prevention is shifting from the institutions to individuals. On top of that they generate millions of
PATIENTS TODAY SHARE, LEARN AND ORGANIZE THEMSELVES
bytes of data that holds enormous potential value to improve healthcare in the broadest sense: from
government healthcare policies to hospital protocols and drug research.

**Empowered, engaged, equipped, enabled**

“Hi doc. I’ve had these pains, just here, for some weeks now. I’ve done some online research and it’s
either this or this. My guess, it’s this. As for the treatment, I would prefer this. Can you subscribe this
medication? Okay, thanks, bye!”

For a lot of doctors this is a nightmare scenario. But there is no stopping it: patients today have
a stronger voice than ever. They are surprisingly well informed through online communities and
cyclopedia. They share, they learn, they organize themselves.

A community such as PatientsLikeMe groups over 150,000 patients who share their symptoms,
concerns, experiences with treatment and healing stories about over 1,000 conditions.

**As of July 2012 PatientsLikeMe members have shared**

4,029,661 symptom reports about 7,338 symptoms
and 548,650 treatment histories about 12,838 treatments.

They can connect with people with similar symptoms and check what medication was effective and
what not. They can get answers to questions they would not dare ask their physicians. They want
to talk to patients like them. To share a burden, but also to try and find a solution that benefits their
health.

Dave deBronkart, is a famous example of a patient who tapped into the knowledge and experience
of an online network of patients with a disease like his own. Diagnosed with stage IV kidney cancer
and a projected time left of 24 weeks, he started engaging with people who had a similar condition.
‘E-patient Dave’, as he started calling himself, learned about treatment options and found support
for his recovery.

He was successfully treated and today he is a sought-after TEDx speaker who has dedicated his life
to empowering patients to have access to the best healthcare possible by connecting with resources
online. Tens of thousands of patients out there are generating and collecting data to achieve
insights in their own way of life or their medical condition. And if this data could be tapped into, it
could save even more lives.
Don’t touch my medical data

A party with friends that someone would describe as epic? Bam! Over 20 people post pictures on Facebook to boost the epicness level, for anyone to see. And what’s more, nobody minds! A tweet with a loud opinion on a certain topic? Google the sender’s name, click a few pages and, soon enough, you will find back the post on the Internet. Wherever you look, barriers to privacy are coming down. Privacy today is no longer a concern for most of us or it has, at least, been redefined. But with medical data that might not be the case.

The healthcare sector has been much slower than other industries, such as finance and retail, in transitioning to and utilizing computerized information systems, like EMRs, largely because of traditional processes and concerns over the privacy of personal health information.

In addition, rates of adoption vary from one country to the next. For example, in 2009, 99% of primary care physicians in the Netherlands used EMRs. In contrast, 36% of primary care physicians in Canada and 46% of primary care physicians in the United States used EMRs. Government initiatives promoting EMRs are accelerating the contribution of digital health information to the volume of Big Data in many countries.

A bad IT day

Healthcare IT professionals are justifiably concerned about having a bad IT day. We sometimes joke about life-and-death IT outages; in healthcare delivery it’s really no joke. Not to mention, you’re handling really sensitive information about people, and besides the strict regulations, there’s a powerful social contract in place to protect patient privacy. Both concerns can make ambitious IT initiatives more difficult to consider.

The difficulty and reality is that there is a lack of standardization and interoperability with the available solutions on many levels, as well as having to comply with privacy laws and policy. One example is that not all healthcare facilities have centralized databases in order to communicate and transfer mass amounts of data, and the ones that do have them cannot communicate with others due to different ‘language,’ which is essentially computer code. A policy that advocates privacy and security is not conducive to data transfer. Consequently, there is a lack of uniform standardized interoperability that allows healthcare professionals and radiologists to send and receive, due to regulatory constraints.
Ask, if unexpected

People do not like to have researchers of any stripe using their electronic health records. As a matter of respect, autonomy and patient-centeredness, patients want to be asked first. When they are asked, by and large they’ll support this. It’s the not-being-asked bit that’s really gets their goat. On the other hand, notifying patients too is often unnecessarily confusing. Maybe it’s a good idea to only ask for permission when data is used in ways that people might not expect.

It’s not technology, cost or the availability of talented people that is limiting the proper use of Big Data...

The biggest factor holding healthcare back from making the quantum leap to becoming truly data-driven is... privacy.

All of us have a natural need for privacy and confidentiality, as expressed in various regulations, customs and practices. We need to balance this innate desire for data privacy against that exact same rich data which can be a key element in creating better health for all of us. Just like Generation Y is happily giving up on online privacy to become more social, all of us need to change our perspective if we want to become healthier.

If people donate their body to science, why wouldn’t they donate their data?

Although health data are highly sensitive and thus require protection, they are also a public good. The more data that researchers are able to analyze, the better their chances of detecting patterns that can lead to fewer wasteful (and often painful) procedures and tests, and for finding new causes, treatments, and even cures for diseases.
THE CHALLENGE IS NOT JUST IN STORAGE AND ACCESS, BUT IN MAKING THE HEALTHCARE DATA USABLE
Challenges: complexity & costs

Does this all sound a bit overwhelming? Now that you know about the unlimited possibilities of Big Data in healthcare, how will you cope with the complexity and the cost involved in making the data work for you? Those gazillion bytes and bytes of data need not only to be stored, but also analyzed if you want to transform your organization.

Big Data, in all its volume, velocity and variety, creates two major challenges for healthcare organizations: its potentially overwhelming complexity and higher IT expenditures.

Big Data, by definition, is complex. And, in healthcare, the expectations and urgency of such data compound that complexity. Algorithms capable of handling smaller datasets are insufficient for managing the volume of healthcare data now being produced.

However, purchasing more storage media is not an affordable solution, nor does it reduce the complexity of the data so that it may actually be used. Virtualization and cloud computing are effective means to manage IT complexities and costs:

- Large healthcare providers can set up their own private cloud infrastructure centered around siloed applications, with imaging-based apps being the first to move)
- Smaller healthcare providers are better off using public clouds, viewing storage as a service.

Analytics today are retrospective but, in the not too distant future, they will drive care decisions more dynamically, requiring analysis of larger data sets and requiring analysis of structured and unstructured data.

In the end, it is not just about images and large data files, but the increasing number of data sets being developed from many sources across the healthcare spectrum: medical records, data from remote monitoring and mobile health sources, genetic information, etc. The challenge is not just in storage and access, but in making this data usable.

Drowning in a sea of data, our healthcare organizations are currently overwhelmed. Few of them are able to incorporate all this data for business intelligence and/or analytics. Successful healthcare organizations need to integrate data into the very fabric of their organization: data collection, storage, management, exchange, processing and analytics.

That wealth of information should, ideally, pinpoint the optimal course of treatment. Data, in other words, must be integrated into processes and drive actions. Big Data – as a key strategic process in healthcare – can be instrumental in that.
There’s an industry for that

IDC says Big Data generated more than 30 billion dollars in revenues in 2011. They also say that this number is expected to grow to ca. 34 billion dollars in 2012 because of increased use in the healthcare industry.

Big Data requires new technologies to efficiently process it within a reasonable time. And it’s getting better, fast. The industry specializing in data management and analytics is estimated to be worth 100 billion dollars and is growing at an annual rate of 10%, or twice the software business as a whole.

In the healthcare industry, the greatest barrier to the adoption of Big Data solutions is the legitimate concern for the privacy of health-related information. Experienced IT partners understand these security requirements and can build the best solutions for protecting data and complying with regulations.

When choosing an IT partner, healthcare organizations should look for companies:

- with healthcare expertise and experience
- a range of solutions that can be tailored to unique needs and
- a long history of integrity and security with enterprise-level clients.

Tips to leverage Big Data in hospitals

**Understand what type of data you have and where it is stored:** Valuable data can be found in databases that hold employee information, patient level transactions or other medical-encounter data, or even time-stamped data giving a patient’s current location (are they in the operating theater?), etc.

**Transform data into the right format and start a basic transformation:** The data needs to be extracted from its at source systems and reworked into a usable format that is common across participating institutions. This allows hospitals to compare and benchmark datasets, cleaning the data to remove and correct it ready for the intricacies of the hospital’s operating environment.

**Perform analytics on the datasets:** Big Data analytics need to go beyond Excel and Access. Big Data analytics requires industrial grade technology that does not run on a laptop. Hospitals need to step away from the retrospective analysis they are used to and choose an IT partner that has expertise in predictive modeling.

**Give the data to the decision-makers:** What good is the data if the execs don’t get it? Hospital executives need the data presented to them in a clear and recognizable format and in the way that is in step with their management.
An entrepreneur, advisor, lecturer and writer, Peter Hinssen (1969) is one of Europe’s most sought-after thought leaders on the impact of technology on society and business. He is frequently called upon to chair seminars and consult on issues related to the adoption of technology by consumers, the impact of the networked digital society and the fusion between business and IT.

‘The Age of Data-driven Medicine’

Is the second in a series of thought-provoking booklets that Across Technology will be publishing this year, sponsored by EMC Greenplum. These booklets are elements in the Data Science Series, which is also a series of events, and a website:

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