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Transforming Healthcare
The Role of IT Infrastructure Modernization

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Meeting Healthcare Challenges with IT

Many of the sweeping changes taking place in the healthcare industry in the 21st century are being driven by new IT capabilities and next-generation communications, including those technologies that enable extended Internet of Things (IoT) connectivity. An emphasis on improving overall patient care, managing vital patient data more effectively, and providing personalized health support has led to rethinking the fundamental IT infrastructure and reassessing the applications and approaches that underlie healthcare delivery. Moving beyond tacit acceptance of electronic health records (EHRs), Health Delivery Organizations (HDOs) are looking into the technologies necessary to support value-based care. To achieve this, they are exploring how to connect with the healthcare continuum and investigating the potential for applying Big Data principles to support real-time and predictive analytics, and establishing clinical analytics as a key part of diagnostics and treatment protocols. Accurately diagnosing patient health conditions represents a significant challenge that can potentially be resolved with better data and information handling through a modern IT infrastructure.

Intel and Red Hat, as technology partners and industry leaders in the digital transformation of IT, play complementary roles in the modernization of healthcare. Intel® architecture provides a standardized hardware platform optimized and tuned for Red Hat’s enterprise-ready operating system, cloud-based software stack, network management tools, and integration and virtualization environment. Each company offers its perspective on the shift in healthcare IT systems in relation to Gartner’s predictions and charts a path forward, taking advantage of the bimodal IT strategy posited by Gartner whenever appropriate and justified by IT requirements. More about Red Hat’s vision for an open hybrid IT architecture can be found at redhat.com/infrastructure. Intel offers guidance and resources for digital transformation through Intel® Builders programs (builders.intel.com), a broad ecosystem of industry leading solution providers for developing collaborative solutions across data center environments.

The Gartner healthcare predictions for 2016 focused on five specific areas. In predicting the near-term role of IT in healthcare, Gartner indicated that IT is likely to move from a “supporter to a driver of business innovation in the EHR-enabled era.” The following sections highlight some of the important considerations driving this transformation.

Source: Red Hat / Intel
Gartner’s 2016 healthcare predictions reveal just how much the role of IT is changing from a supporter to a driver of business innovation in the EHR-enabled era. Few processes or people will remain untouched by innovation.

**Key Findings**

- Consumer and patient experience technologies such as experiential way-finding and postsurgical wearables will become must-haves for healthcare.

- Of the more than 100 vendors competing in the crowded provider population health arena, only one-quarter will make it to 2019 in their current form.

- Post-EHR, clinical analytics is a top priority. New surges of IT innovation will demand groundbreaking real-time and predictive analytics. This calls for a chief data officer (CDO).

- The venerable nurse call system is in need of reinvention or retirement; it has become a barrier to more effective nurse and care team connections to patient priorities.

**Recommendations**

- Healthcare delivery organization (HDO) executives should direct more innovation in patient-facing IT. Create value-assessment models to tie innovations to value: customer acquisition, patient experience and clinical/functional outcomes.

- CIOs and chief medical informatics officers (CMIOs) must guide their organizations to a much more discriminating selection process for population health vendors. Be sure you do not align just with your current megasuite vendor out of blind faith.
If your health system intends to leverage data as well as or better than your peers in the EHR-enabled world, then appoint a CDO.

CIOs and nursing leadership must redesign how nursing’s many needs and regulations for nurse call, and beyond can be met within new enterprise real-time communication and collaboration framework.

Strategic Planning Assumptions
By 2019, 25% of HDOs will use experiential wayfinding to enhance the patient experience and competitive differentiation.

By 2019, only 25% of the plethora of provider population health IT vendors/products will survive despite a large increase in HDO purchasing.

By 2019, 25% of HDOs will have a dedicated chief data officer for strategic information governance and tactical management of data.

By 2019, 30% of nurse call systems will have been replaced with real-time communications and collaboration solutions.

By 2019, wearable devices plus Internet of Things (IoT) platforms will be used to monitor at least 30% of hip and knee replacement patients.

Analysis
What You Need to Know
The five strategic planning assumptions highlighted in this research together signal just how much more new IT opportunity and change are taking place beyond major investments in electronic health records (EHRs). There’s a reason for the common 25% to 30% projections across our 2016 set of healthcare predictions: Early adopter health systems will move into new IT realms aggressively and will leverage IT to differentiate themselves in the market and advance public health system agendas.

Healthcare has entered the EHR-enabled era. Health systems are moving on from an IT vision that has fixated on getting EHRs in place for the past 30 years. Together with its decision support, its data and its establishment of a persistent connection between the clinician and the computer, EHR has become the biggest innovation trigger in health IT history. It enables new analytics and population health paradigms and creates real-time operational intelligence systems while advancing the realm of precision medicine. The EHR also brings an important, but minimally leveraged, continuous electronic connection to the consumer in the form of tethered patient portals. This is one small step on the path to personalized health support.

As the relationship among clinicians, consumers and the world of computing continues to expand, making great use of innovative IT is increasingly the
defining tool for how great leaders execute big change in healthcare. Therefore, old systems like nurse call give way to much more powerful communication and collaboration platforms. New IT investments focus more attention on the patient’s total experience in a virtual environment before, during, after and outside of traditional physical encounters.

In turn, CEOs and CIOs should abandon any pretense that they can manage this new world with old operating models, traditional structures, and outdated roles and responsibilities. Just adding a chief population health or patient experience officer does not realize the radical shift in organizing principles required for an at-risk model of value-based care. Equally misguided are executives who still view IT only as a utility expense that continues to rise at an alarming rate, rather than also as the pivotal ally in executing business priorities and driving important change.

With value-based care and population health management models moving to the forefront in more countries — from Australia to Abu Dhabi, to Alabama and Alberta — health system executives must focus squarely on mitigating the risk of unjustified variance and process breakdowns. But with this shift, there is also an even greater risk in choosing the wrong IT vendors. Especially in the overcrowded field of population health IT, the unprecedented and inevitable explosion of startups, mergers/acquisitions and business failures — as well as the aspirations of “mega” vendors to dominate this new domain — requires extreme diligence among HDO executives.

Of course, many health systems do not yet have EHRs in place, and many countries are not moving aggressively to value-based care models that better support the prevention and management of chronic disease and risk-manage cost. For these executives, Gartner advises that you seize the day and champion a fast-track model for disruptive change. Drive rather than react to new government policies by showing what is possible, and lead in new approaches for furthering health and tackling disease.

**Strategic Planning Assumptions**

**Strategic Planning Assumption:** By 2019, 25% of HDOs will use experiential way-finding to enhance the patient experience and competitive differentiation.

*Analysis by:* Barry Runyon

**Key Findings:**

- Way-finding is no longer a nice-to-have. It is critical to a superior end-to-end consumer and patient experience.

- New way-finding technologies should be used to sense, collect and analyze event information to guide patients from their home through the entire continuum of care.

- Way-finding has evolved to encompass an ecosystem of technologies that mesh in a way that assists a consumer or patient to conveniently locate and navigate your space and optimize its use.
This ecosystem includes technologies such as indoor GPS and mapping, Bluetooth Low Energy (BLE) beacon technology, mapping apps (e.g., Google Maps), location and condition sensing technologies and platforms, IoT aggregation platforms, contextual messaging, parking management systems, digital signage, and self-service kiosks.

Patient experience innovation is increasingly, though not exclusively, dependent on mobile devices being in place for consumers and clinicians.

Experiential way-finding is an important component of the real-time healthcare system.

**Market Implications:**

In its most simple incarnation, way-finding is about helping a person to get from one place to another in the most efficient manner. It is a spatial problem-solving technology used to provide information on where one is located, where they are headed, and instructions or assistance on how to get there from their current location. In retail, it is fast becoming a digital engagement strategy but not so much the case within the HDO.

Experiential way-finding over time goes beyond the early, simple examples and beyond the physical footprint of the HDO. In the short term, it seeks to ensure a convenient end-to-end experience or journey for the patient or prospective patient — from the home to a parking spot near the care venue, to registration or admissions to their scheduled appointment within a facility or campus — and of course — back home again or to another facility.

Navigating the hospital or medical center campus should be at least as easy and convenient as finding your way around a shopping mall. In an “experience” economy, implementing a way-finding solution is fundamental to creating memorable and positive consumer and patient experiences. These experiences influence patient satisfaction, influence positive and negative perceptions of the HDO, create a more efficient and productive work environment, and create new revenue opportunities. Way-finding success could mean the difference between attracting and retaining, or not attracting patients.

Situational awareness is at the heart of the real-time healthcare system (see Note 1) and is the engine behind various “hospital of the future,” “digital hospital” and so-called “smart patient room” initiatives. In practice, situational awareness is about knowing where people (for example, patients, clinicians and care team members) and resources (for example, medical devices, wheelchairs and surgical equipment) are at any point in time, and in some cases their state, within the context of patient care.

Situational awareness involves sensing, collecting, analyzing and using patient activity and event data — in other words situational intelligence — to improve HDO operations and the delivery of care, making it more convenient to access and receive. The notion of situational awareness needs to be extended to include preadmission and postdischarge consumer and patient activity. An HDO can be considered a real-time healthcare system to the extent that it has mastered situational awareness — it is key to operational efficiency, care quality and a superior patient experience.
Recommendations:

Use experiential way-finding to:

- Reduce the complication and confusion of your space
- Understand where consumers and patients are going and what they are looking for
- Streamline access to common HDO destinations
- Reduce wait times and associated frustrations
- Reduce staff interruptions
- Get people to their appointments on time
- Reduce consumer and patient stress and anxiety
- Balance demand and capacity
- Improve customer satisfaction and the patient experience
- Differentiate yourself from your competitors
- Augment the use of self-service kiosks

Strategic Planning Assumption: By 2019, only 25% of the plethora of provider population health IT vendors/products will survive despite a large increase in HDO purchasing.

Analysis by: Vi Shaffer

Key Findings:

- Already, more than 100 vendors are purporting or positioning to offer some kind of population health- or accountable care organization (ACO)-related IT support in the U.S. alone. More vendors are popping up than even Gartner can count.

- Merger and acquisition activity has already been quite active (e.g., Humedica by Optum, Medventive by McKesson, Phytel and Explorys by IBM). That will continue as vendors look for an entry point or assemble a portfolio of solutions.

- As Gartner predicted a few years back, the crowded landscape includes the majority of entrenched healthcare megasuite vendors. Many of their solutions are immature now, but are improving. As we predicted last year — earned and unearned — they are already riding their relationships to capture market share. This makes it ever more difficult for weaker niche players to even get in a prospect’s door.
**Market Implications:**

This is our third prediction relative to the population health of the IT market. It comes on the heels of our published prediction that at least 50% of healthcare megasuite vendors would enter this market (2013) and that they would capture 40% of the spending by 2018 (2015).

Substantial venture money is still pouring into this area of health IT, which is the usual case with large, hot markets that are visible but still roiling in uncertainty and opportunity. But population health is notable for the massive number of diverse companies (from behemoths such as IBM and United Health Group to the many tiny startups). That kind of increase usually yields far more disappointments than it does big successes. And this market is no exception.

Vendors that will falter will do so mostly from flawed business models, inadequate solutions and underestimation of the power of the megasuite vendors. Red flags for failure that tell you to avoid a vendor include:

- Companies and executives that believe provider population health is simply a matter of translating payer disease/care management tools to providers. From an IT perspective, provider population health management’s value is in overcoming the severe limitations of trying to do real-time disease management and coordinated care from retrospective claims and administrative data, and without a meaningful concurrent medical understanding of each patient.

- Companies that target the small and shrinking end of the market (independent small and midsize physician practices). This is an arena where more than 80% of the investments will be made by larger integrated delivery systems and independent practice groups of scale.

- Companies with problems delivering a platform that can scale both to large customers and to multiple functions to gain a more strategic positon with the HDO.

- Companies that think offering health information exchange is a short jump away from the heavy-lifting of pop health analytics or care management. In fact, it is a quantum and nonlinear leap to a fundamentally different business.

- Companies that underestimate and fail to define how their solutions are complementary to the most common megavendor population health plays. Although patient engagement/relationship management solutions are more likely to be complementary, the biggest competitors to the independent analytics vendors will be the megasuite vendors.

- Companies that are known to have one niche play idea and struggle: one clever algorithm, one expert consultant, some nice-looking reports, etc. Provider enterprises will look for more strategic platform relationships among and across analytics, care coordination, patient engagement and pop health business management angles.
Acquired companies will most likely disappear in their current form either because the acquirer will not nurture them or because they will be rebranded and combined with other organic development or acquired companies.

Providers need the new value-based models such as ACOs and provider population health to work as much as payers do. Both CEOs and CIOs need to get ahead of the curve in understanding requirements more clearly. They must maintain strong influence over government policy and have equal footing with big private payers.

**Recommendations:**

- CIOs need to guide their organizations to a much more discriminating selection process for population health vendors. Completeness of vision and ability to execute include far more scrutiny than just handy functionality. Whereas in the past it was OK to select niche players with point solutions that worked and helped provide “first-level maturity,” the stakes and risks from choosing the wrong partners or vendors are much higher now.

- Set realistic expectations for the timetable of fuller solution delivery from megasuite vendors and pace deployment with both organization- and vendor-readiness. Do not simply align with your current megasuite vendor out of loyalty and convenience. Do not ignore that the change management needs are just as great as when deploying these vendors’ population health solutions as they would be with specialists. Not all the megasuite vendors will deliver effectively and none are likely to deliver all the components you will need.

- Include consideration of offerings from nonincumbent megasuite vendors that are sold separately, where solutions do not require true integration — even if it might be politically incorrect.

- Realize that moving to a population health/value-based model should be viewed as the organizing principle of the serious health system. The change management aspects of this shift are great and no less daunting when deploying incumbent megasuite vendor solutions than with specialized companies.

**Strategic Planning Assumption:** By 2019, 25% of HDOs will have a dedicated chief data officer for strategic information governance and tactical management of data.

*Analysis by:* Laura Craft

**Key Findings:**

- The volume of healthcare-related data continues to grow. Some healthcare executives report that their data volume has grown 50% in the past year alone.¹

- Storage of volumes of data is easy, it’s deriving enterprise value from the data that is the opportunity.

- Like other industries, healthcare will become an algorithmic business and will rely on precise data to power the equations.
CIOs simply do not have the bandwidth to spend the needed time to focus on management of enterprise data and information.

**Market Implications:**

Healthcare data and information are powerful tools in industry transformation and evolution toward value-based care and precision medicine. It can safely be stated that just about every process in the hospital is reliant on some form of data input, exchange or information retrieval to care for the patient and run the operations. The rapid digitalization of healthcare has created even more sources and types of data that can be exploited to improve care, advance research and discovery, and contain costs. Data and information are important, valued strategic assets. However, years of bad practice, and quite frankly neglect, are becoming exposed as more data and information is being used to make patient care decisions and drive real-time operations. Thus the role of the chief data officer (CDO) is gaining momentum as it offers a position designed exclusively to deal with data problems as well as opportunities. It is driven by an increased focus on realizing value from data by turning it into information and knowledge — this calls for better governance over the vast amount of data that is generated, gathered and stored, but not understood or exploited.

Management of data has typically fallen under the responsibility of the CIO, is often delegated to a direct report, and is rarely a full-time, dedicated position.

As the industry transforms into a digital business, and the role of the CIO becomes more difficult and complex by focusing on infrastructure and digital innovation, there must be parallel leadership, authority and accountability for the enterprise data. Consider the creation in recent years of the chief medical information officer (CMIO), chief nursing information officer (CNIO) and the chief health information officer — all point to the rise in importance of Information.

The role of the CDO takes on two primary responsibilities:

- **Data governance and management:** The processes, policies and activities that create data definitions, standards, business rules, etc. Builds network of data stewardships and ensures enterprise data is accessible, available and reliable.

- **Strategic information governance:** Partners with executive leadership in making sure data is turned into information and knowledge. Establishes strategic planning cycles to prioritize investment in data and information, and develops enterprise methodologies to measure the value of data and information across the enterprise.

**Recommendations:**

- Hire a CDO. Establish a single point of accountability for enterprise data and information.
Build toward the underlying data competency by focusing on clarity of data stewardship and accountability. Build rigor around enterprise policies, standards, and master data.

**Strategic Planning Assumption:** By 2019, 30% of nurse call systems will have been replaced with real-time communications and collaboration solutions.

*Analysis by: Barry Runyon*

**Key Findings:**

- The venerable nurse call system is in need of reinvention or retirement.
- Nurse call has been comfortably ensconced as a system of record within the HDO for some time now (see Note 1). It needs to move up a layer or two to provide differentiation and innovation.
- With the advances and convergence of clinical communications and collaboration, mobile apps, interactive patient care systems, care coordination applications, patient experience platforms, location and condition sensing applications, and medical device connectivity platforms, there will be many other ways, possibly less costly and more agile, to provide nurse call capabilities to the HDO within the next few years.
- U.L. 1069 and FDA certifications will no longer keep competitors and disruptive vendors at bay.

**Market Implications:**

A good place to look for opportunities to innovate or optimize is in the lowest layer of Gartner’s pace-layering model. A system of record is often found in business processes that have a focus on standardization or operational efficiency and are subject to regulatory and compliance requirements. Nurse call (aka call light) is one of those systems within the HDO.

Nurse call systems have evolved with the introduction of converged voice and data networks, alarms and notification gateways, location and condition sensing technologies, unified communications, and wireless and mobility into the HDO. The drivers are the usual suspects of patient safety and staffing shortages, with an increasing emphasis on improved care quality and the patient experience. Most modern nurse call systems address these requirements with hardware and software such as:

- Master, duty, patient and emergency pull stations
- Master console that allows real-time, interactive display and control of all calls, staff assignments, triage calls, and the ability to monitor response times and other outcomes.
Wireless device interfaces that can route patient calls to the nurse’s wireless phone, pager, communication badge and mobile phone

■ Interface to building control and monitoring (fire, smoke and motion) systems

■ Interface to enterprise PBX or IP telephony system

■ Activity and reporting management software for capturing staff response times, patient satisfaction metrics, etc.

■ Interfaces to personnel and asset tracking systems

■ The ability to interface with medical equipment for alarms and values that will appear on the master console and clinician’s wireless device

■ Patient management and clinical system interfaces (e.g., ADT, CPR, dietary and transportation) to continuously import updated patient information into the call system

However, nurse call hardware such as emergency pull stations, corridor/room dome lights, bed stations, motion detectors, pillow speakers, handheld devices and others will become more commoditized, open, nonproprietary and wireless. This will make it easier for other vendors to provide traditional nurse call functionality. Underwriters Laboratories (UL) and FDA certifications will no longer keep competitors and disruptive vendors at bay.

On the software side, mobility is a powerful thing. Coupled with collaboration, it is a transformational thing. Clinical communications and collaboration (CC&C) vendors and interactive patient care (IPC) systems are beginning to take on more traditional nurse call responsibilities. Nurse call market leaders (e.g., Hill-Rom, Rauland-Borg, Tyco SimplexGrinnell) will likely more closely align themselves with or acquire CC&C and IPC assets to advance their platforms.

**Recommendations:**

■ Revisit nurse call’s value proposition for your enterprise and closely examine the use cases it satisfies, rather than just the capabilities it provides.

■ Consider more cost-effective or agile approaches to satisfying nurse call use cases and those that extend beyond the space occupied by traditional nurse call.

■ Use this information to challenge your nurse call vendor to identify what will continue to make nurse call a unique and necessary investment.

■ Examine your nurse call vendor’s three- to five-year product roadmap for overlap with your clinical communications and collaboration, interactive patient care system, and other care team coordination and collaboration systems.

■ Hold off refreshing your nurse call system until you have a firm grasp on what your clinical communications and collaboration needs are or will be, and where your nurse call vendor is going.
**Strategic Planning Assumption:** By 2019, wearable devices plus IoT platforms will be used to monitor at least 30% of hip and knee replacement patients.

*Analysis by:* Thomas Handler, MD

**Key Findings:**

- Worldwide, it is estimated that osteoarthritis affects 10% of men and 18% of women over the age of 60.²

- The incidence of hip and knee replacement surgery is rapidly growing.

- Postsurgical exercise is considered an important factor for long-term success of joint replacement operations.

- It has been difficult to adequately monitor patients’ exercise habits once they are home.

- Gartner expects sales of wearable electronics to exceed 500 million units per year in 2020.

**Market Implications:**

An aging population will require more joint replacement surgery. It will become increasingly difficult to ensure good outcomes without leveraging technology more than is being done today. The move toward a health model focused on pay-for-value will make it even more imperative to have good measures. It is well known that post-operative movement is important for the long-term success of knee and hip replacements. Today, post-joint-replacement patients frequently come for a follow-up visit, and only then does it become apparent that they have not been following the prescribed movement regimen or that they have a complication from the surgery. The increased presence of wearable devices can be combined with IoT aggregation platforms to provide clinicians with near real-time indications of level and amount of exercise. This, in turn, can reduce complication/failure rates by quickly identifying the cohort of postsurgical patients who need more education on the importance of movement or whose drop in activity may by an early indication of a complication.

The rapidly expanding IoT is providing a connective environment that can act as a key evolutionary step: enabling wearable devices. Some obstacles that will need to be addressed relate to the devices, regulatory concerns and technical challenges. Consumer wearable devices have been shown to have a margin of error, but for this use case that is probably not a major issue. On the software side, mobility is a powerful thing. Furthermore, CIOs need to track how FDA regulations will influence wearable devices.

**Recommendations:**

- Work with clinical leaders to map out a clear business benefit outcome as part of your technology development strategy for the use of wearables.

- CIOs should work with clinical leaders to implement an IoT aggregation platform(s) that can link wearables to dashboards and the EHR.

- Implement an IoT platform and wearables for post-joint-replacement surgery patients and look for other use cases.
Replay Prediction: Improving Medical Diagnosis Error

The replay prediction is a prediction from a previously published report that is so significant that it is being republished here. It was originally published in “Predicts 2014: Healthcare Delivery Organization IT Leaders.”

**Strategic Planning Assumption:** By 2017, public attention and IT innovation directed at the problem of wrong or delayed medical diagnosis will equal that directed at therapeutic errors.

*Analysis by:* Vi Shaffer

**Key Findings:**

- Medical diagnosis error is one of the most significant, least discussed barriers to delivering effective and efficient healthcare.

- The Institute of Medicine’s recently announced intent to focus its next major publication on diagnosis error will create a pivot point for action for all stakeholders.

- To date, information technologies have provided important, but limited, contributions to the improvement of diagnosis. This will change significantly mid-decade.

- Diagnosis will be the most difficult medical transformation and IT challenge yet confronted. There is no one easy solution, and possibilities push against physician autonomy, belief systems, cognitive processes and culture — ultimately redefining what it means to be a 21st-century physician.

Although nearly impossible to fully quantify, there is no doubt the problem of medical diagnosis error is big. Indeed, we venture to say this is so common that most readers can recall at least one incidence of serious diagnostic error or delay among family or friends.

In the landmark report “To Err Is Human” (“IOM-1”), the Institute of Medicine (IOM) of the National Academies identified diagnostic error as one of the key categories of error to tackle, together with failures of treatment, prevention, and others such as failures of communication or equipment. But why is it so difficult? As Poon and others identified in their study of cognitive errors and logistical breakdowns contributing to missed and delayed diagnoses of breast and colorectal cancers, “studying [errors and breakdowns] is extremely challenging because missed diagnoses generally involve acts of omission, rather than commission, which are elusive, and when they are identified, there is rarely enough information in medical records to support thorough causal analyses.”

Specific to medical diagnosis error, the IOM has flagged four categories:

- Error or delay in diagnosis
- Failure to employ indicated tests
- Use of outmoded tests or therapy
- Failure to act on results of monitoring or testing
Now the spotlight is turning on. In September 2013, the IOM announced that its next major study and publication focus will be on medical diagnosis error. As of early November 2013, funding is not finalized, the research is yet to be assigned, and the publication date is uncertain, but likely to be at least two years from now. Therefore, we set 2016 as the likely timing of heightened visibility.

**Market Implications:**

As the IOM work progresses, and especially once the study is out, the impact will be large, triggering major media attention and a frenzy of hyped activities by investigators, innovators, investors, informaticists and policymakers around the world. Then, breakthrough progress will take a long time. The other shoe to drop after the study will be a succession of efforts for vigorous regulatory and payer scrutiny of diagnosis effectiveness, and some kind of new reporting requirements.

David Newman-Toker, MD, observes that experts have been “afraid to open up a can of worms they couldn’t close. Progress has been made confronting other types of patient harm, but diagnostic errors ... are more complex and diverse than other patient safety issues.”

We predict the attention will be a game changer for investments in diagnostic technology and cognitive decision support, tackling major root causes of diagnosis error chunk by chuck largely by complementing human cognition with more science and fact and reducing the ability to ignore it.

Despite the heavier pressure as IOM’s new research gets underway, we project that, through at least 2017, the current small band of vendors and innovators focused on diagnosis support will still find it very difficult to overcome all the obstacles to market penetration (we take note also of this aspect of IBM’s work with “Watson”). After all, it’s taking decades past the “To Err is Human” publication to have the EHRs and basic patient safety protections it advocated pervasively used in the U.S. alone. A fuller rethink and a succession of solutions will most likely be necessary. We do expect this to trigger new business opportunities to emerge for leading healthcare megasuite and content vendors, as well as leading academic medical centers.

**Justification:**

Since our original publication of this prediction in 2013, the Institute of Medicine has concluded its new landmark study, “Improving Diagnosis in Healthcare (Quality Chasm).” A [prepublication version](#) is available to download for free, with official publication planned for January 2016 — earlier than originally projected.

Frankly, the reason for highlighting this topic again is that, although the report has already gained much media attention, we think most of the medical and medical informatics communities are ignoring it. We fear its critical points will be lost in the weighty process of translating this to real medical community action. Although it will better prepare the physician, it will also inevitably erode individual physicians’ independent discretionary decision making and power. Resistance to focusing on diagnosis improvement — just like disproportionate resistance to EHRs, performance analytics, enterprisewide standard order
sets or decision support — helps preserve some physicians’ legacy identity.

Our initial look at the prepublication report also found the discussion of IT’s role in improving medical diagnosis to be somewhat disappointing — a fairly narrow view that seemed to spend more time on EHR blame and risks than on IT promise for infusing better knowledge and decision making. We urge medical informatics and vendor experts to weigh in.

Recommendations:

■ Begin right now to address generally weak information governance and data stewardship. Accurate data is the foundation for change. The headlines on diagnosis error and continuing exposure of consequences will put extra pressure on the medical and informatics communities to act (see also the above prediction on the advent of the chief data officer).

■ HDO leaders must establish a strong trusted relationship with their physicians to ensure that there is directional alignment with enterprise strategy. This is critical because so much about being a physician changes with new business models and new technology for risk management.

■ Ensure a proper and effective medical executive committee and clinical IT governance structure, and prepare them for greater dialogue on diagnosis.

■ By 2016, focus greater attention on accuracy in capturing comprehensive patient-provided data, which is a key source to mine for understanding causes of diagnostic error and a critical aid in its prevention.

A Look Back

In response to your requests, we are taking a look back at some key predictions from previous years. We have intentionally selected predictions from opposite ends of the scale — one where we were wholly or largely on target, as well as one we missed.

On Target: 2011 Prediction — By 2015, 20% of integrated delivery systems will be investing in new healthcare-targeted CRM systems.

A very significant uptick in the number of client inquiries about CRM and RFP activity has taken place in the last couple of years. Further interest has been driven by Salesforce’s September 2015 announced launch of “Health Cloud,” its first industry product built specifically for healthcare, modestly calling it “a potential revolution in the delivery of care.”

Many more health systems are looking for a suitable enterprise partner for CRM beyond the capabilities of their EHR/megasuite vendors (such as patient access/scheduling and patient portals).

Although there are other uses for CRM in healthcare — such as managing referring physician relationships — we created this prediction back in 2011 because as we evaluated the potential impact of both disruptive pay-for-value and virtual care delivery models, we found it nearly inevitable that consumer and patient engagement would require a “CRM on steroids.”
We called this, “a souped-up and industry-specific CRM,” noting the complex nature of the consumer engagement goals it must support, the volume and variety of data it must leverage, and the sensitive nature of and high-trust level required in the patient relationships it needs to help tend.”

More sophisticated CRM, as used in some other industries, still largely doesn’t exist in healthcare, but it’s beginning to arrive. The buying interest is there now, with an increase in RFP activity this year, as we predicted. Healthcare-specific solutions, however, are still immature. CIOs should engage with vendors and new stakeholders, such as marketing and chief population health or patient experience officers, setting the right scrutiny for actual readiness to deliver versus appealing concepts, vision and platforms proven in other contexts.

**Missed: 2010 Prediction — By 2015, despite the relaxation of Stark laws and the American Recovery and Reinvestment Act (ARRA) incentives, less than 15% of small U.S. physician practices will have implemented an EHR.**

In 2010, we underestimated the impact of ARRA, but also failed to distinguish between basic and fully functioning systems (e.g., the basic EHRs have little clinical decision support or electronic ordering of labs and radiology studies). A 2014 report by the U.S. Department of Health and Human services found that fewer than 24% of office-based physicians had a fully functioning system but that more than 71% had at least a partial EHR. Small practices continue to lag behind larger groups in the adoption of EHRs; a 2014 Robert Wood Johnson report indicated that 37% of solo practitioners and 44% of groups with two to five physicians had adopted a basic EHR, and the number was over 65% for practices with more than 10 physicians. Overall, the numbers from several surveys seem to indicate that the larger the group the more likely that it had implemented a fully functioning EHR.

The other important trend that we did not anticipate in 2010 was the mergers and acquisitions of smaller practices by larger practices or integrated delivery systems, which resulted in even more adoption of EHRs. A 2014 survey by the Physicians Foundation determined that since 2008, the number of physicians employed by a hospital or medical group had increased from 38% to 53%.

The bottom line is that there are fewer small practices in total, and more of those remaining have chosen to implement at least a basic EHR. We expect both trends to continue and that, in a relatively short time, most if not all physicians will be using a full EHR.

**Evidence**


4 “To Err Is Human: Building a Safer Health System (IOM-1),” Institute of Medicine (IOM) of the National Academies, 1 November 1999.


7 “Diagnostic Errors More Common, Costly and Harmful Than Treatment Mistakes,” Johns Hopkins Medicine, 23 April 2013.

Note 1
Pace Layers

Gartner’s pace-layering model includes the following layers:

- **Systems of Record** — Systems often found in business processes with a clear focus on standardization and/or operational efficiency; these are often subject to regulatory/compliance requirements.

- **Systems of Differentiation** — Systems often related to business capabilities that enable unique company processes or industry-specific capabilities; these sustain the company’s competitive advantage.

- **Systems of Innovation** — New applications and systems that are built or purchased on an ad hoc basis to address emerging business requirements or opportunities; these involve an experimental environment for testing new ideas and identify the company’s next competitive advantage.

Source: Gartner Core Research Note G00292489, Vi Shaffer, Thomas J. Handler MD, Barry Runyon, Laura Craft, Gibson MD, 30 November 2015
Converged Data and Balanced Architectures Help Meet Healthcare Challenges

Gartner’s recognition of the importance of health care data and information as a driver of precise, efficient delivery of healthcare services corresponds with Intel’s focus on achieving a balanced IT architecture. A balanced architecture provides value through an appropriate combination of compute resources, storage, network capabilities, and software—scaling up or out as needed to accommodate requirements of an HDO.

Both the Gartner bimodal IT model and the Red Hat IT modernization initiative make a distinction between maintaining traditional systems in a stable state, modernizing in careful stages, while rapidly developing new system capabilities using the latest SDN/NFV technologies, virtualization tools, and open-source components. Intel addresses modernization efforts in a similar way, acknowledging a division between traditional data sources in the Health IT industry and agile data capture and analysis. Traditional data resources include storage, access, and analysis of clinical data in digital form—all the elements of a well-designed EHR environment. This includes providing fluid access to claims information, clinical data, lab results, medical imaging, and diagnostic data, as shown in Figure 1.
The convergence of patient data from mobile health devices, lifestyle monitoring, and data from the life science industry represents the dynamic, disruptive aspect of IT modernization, where new ideas can be tested and tried out quickly. Personalized healthcare can be extended and enhanced in a number of ways, including diagnosis through telemedicine, treatment of chronic conditions, monitoring post-surgical patients, assessing lifestyle choices, encouraging healthy habits and behaviors. In terms of Big Data, organizations have just begun to capitalize on the massive amounts of genomic information to diagnose and treat disease at a molecular level. High-performance computer systems, including those powered by the Intel® Xeon Phi™ product family, help process this complex data to extract intelligence from it.

**Optimization Gets Results**

On the software front, Red Hat® Enterprise Linux®, optimized for the Intel Xeon product family, contributes to a range of capabilities important to healthcare IT, including security, scalability, elasticity, reliability, power efficiency, network and storage enabling. Close collaboration between Red Hat and Intel has resulted in stable, performance-tuned systems that are well suited to supporting Big Data repositories, processing multiple data sources concurrently, and scaling up or out as required to meet healthcare delivery organization requirements. All of these factors make it easier to create a cost-effective, architecturally balanced solution to address healthcare challenges.
With access to large data files residing in the cloud, collaborations among teams of doctors can become more direct and effective. Wireless connections from emergency medical technicians can inform emergency room staff and improve critical treatment in a timely manner. Intel®-based processors power these types of activities and also include a number of built-in capabilities that help ensure personal security and adherence to HIPAA regulations, including accelerated encryption, anti-theft, identity protection, and malware detection.

Source: Intel

**Paths to Improving Health IT**

Enhanced connectivity, fast access to vital information, and improved communications among medical team staff members and caregivers makes it possible to diagnose illnesses more quickly and accurately and deliver healthcare services more efficiently. In terms of a bimodal IT model, HDOs can modernize the traditional systems that provide access to clinical data and claims information by selectively adding components, such as software-defined storage, or migrating to a more open, modern operating system—moving from Unix to Linux in most cases.
Improving Health Delivery at the HDO Level

Red Hat has been deeply involved with the healthcare industry for many years, including engagements and deployments with payers, hospitals, providers, and pharmaceutical companies. As HDOs look to IT modernization as a means to adapt to the requirements of the Affordable Care Act and to accommodate today’s evolving healthcare business models, Red Hat provides a clear path to transition to an open IT infrastructure. This path can be followed without risking the stability of established IT infrastructures or sacrificing the investments in traditional hardware and software.

To gain a high degree of interoperability between diverse clinical systems in use, many HDOs rely on Red Hat Enterprise Linux and Red Hat JBoss® Middleware. As HDOs cope with the challenge of rising volumes of data being generated as EHR becomes more universal, Red Hat offers virtualized environments that adapt easily to growth and massive volumes of data that necessitate flexible storage methods. The proven combination of Red Hat Enterprise Linux running on a hardware platform powered by the Intel Xeon product family is well suited to HDO requirements, where reliability, security, and affordability are paramount.

As noted in the previous Gartner research section, “The volume of healthcare-related data continues to grow. Some healthcare executives report that their data volume has grown 50% in the past year alone.” Storing data is easy, Gartner observed, but deriving enterprise value from it represents an opportunity.

Case Study Example: TMG Health

A case study profiling IT modernization for TMG Health, the largest business process outsourcing provider in the Medicare and Medicaid market, illustrates the benefits of Red Hat solutions for overcoming the challenges presented by traditional infrastructures.

An outdated IT infrastructure with slow data access was impeding delivery of information to TMG’s clients, organizations consisting of health plan and health insurance providers. With more than 3 million file feeds daily, TMG was unable to accommodate client requirements for real-time data visibility, a necessity for staying competitive in their line of work.

An engagement with Red Hat consulting identified an approach that modernized the application platform, based on Red Hat JBoss Enterprise Application Platform and other Red Hat solutions. By consolidating its systems on a single technology suite, TMG developers can support applications more easily and develop new applications more rapidly.
As HDOs seek ways to differentiate their offerings in the marketplace and provide more effective delivery of healthcare services, improvements to the IT infrastructure will be a critical component of their ongoing evolution. Both Intel and Red Hat have the tools and technologies that can make IT modernization more effective and accessible, whatever the scale and scope of the modernization effort.

The resulting platform eliminated data access latency, allowing clients to gain access to data in real time, as well as engaging in real-time enrollment, a service unique to TMG, not available through other BPO vendors. The modernization also reduced the development life cycle by 75 percent, resulting in lowering costs by 60 percent. TMP also gained the potential to increase market reach by 50 percent. The improvements make it possible for TMG to rapidly respond to government regulatory requirements and achieve compliance more cost effectively in less time.


**DevOps for Greater Agility**

In areas where HDOs are innovating, using fully modernized, virtualized systems, Red Hat’s DevOps offers a model—a culture of openness—that can help streamline IT service delivery and connect a diverse range of IT environments, bringing better connectivity and information exchange to the healthcare process. Efforts to gain better access to patient lifestyle data and wellness programs, often through mobile applications, can be improved by automating application delivery and accelerating development practices.

Gartner views DevOps as a bridge helping Mode 1 IT organizations transition to a Mode 2 orientation, as stated in a research note:

*Mode 1 IT organizations should look to DevOps as a bridge to a Mode 2 orientation by continuing to assess where other patterns and practices of DevOps can enable a Mode 1 environment to deliver better service to customers.*

Gartner Research Note G00276470 “DevOps is the Bimodal Bridge,” Cameron Haight, George Spafford, 03 April 2015

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*Source: Red Hat*
About Intel

Intel Fosters Innovation Worldwide
You may know us for our processors. But we do so much more. Through computing innovation, we push the boundaries of smart and connected technology to make amazing experiences possible for every person on Earth. From powering the latest devices and the cloud you depend on, to driving policy, diversity, sustainability, and education, we create value for our stockholders, customers, and society.

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About Red Hat

Red Hat is the world’s leading provider of open source software solutions, using a community-powered approach to reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.

Learn more about Red Hat’s open cloud solutions at www.redhat.com/solutions/cloud-computing or by contacting a representative in your region.