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Hype Cycle for Healthcare Provider Applications, Analytics and Systems, 2013

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Analyst(s): Vi Shaffer

This Hype Cycle is a critical input for healthcare leaders in balancing seemingly insatiable healthcare IT demand with limited resources. It offers a timely, objective evaluation of the exploding variety of important applications and analytics innovations tackling healthcare's major challenges.

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What You Need to Know

This Hype Cycle is one of three healthcare provider Hype Cycles for 2013 that track IT advances of particular significance to healthcare delivery organizations (HDOs) around the world. It highlights 32 patient-facing, business and clinical applications and multiple emerging analytics categories.

To emphasize that the nature of IT's total value to the HDO is changing, we have changed the name of this Hype Cycle from "Hype Cycle for Healthcare Provider Applications and Systems" to "Hype Cycle for Healthcare Provider Applications, *Analytics* and Systems." CIOs should use this significant title change to call out to the C-suite that analytics must command equal attention alongside transactional and workflow applications. Competence and agility in analytics demand new policies, information governance, data governance, master data management and information delivery processes, analyst resources, and technical skills, as well as attention to best practices in enterprise information management. Analytics is a key enterprise-level initiative from strategic information asset valuation and planning, to choosing the right business intelligence (BI) core competency center and architecture or technology approaches. It also encompasses funding for the total cost of ownership, and the "nitty gritty" of standardized data definitions and data quality management.

The second key take-away from this Hype Cycle is the expanded focus in the application arena from business and clinical workflows and transaction systems to patient-facing technologies integrated into personal life flows. IT leaders should no longer structure application management to support just business and clinical applications and needs, nor ignore consumers when divvying out informatics responsibilities. IT leaders must elevate patient-facing applications and related content investments to form an application trilogy. Patient-facing applications have the core purpose of helping shift the focus to a patient-centered HDO model: sustaining effective patient engagement, enhancing the patient care experience, solidifying brand loyalty, and uncovering innovative ways for the patient to be a more effective player on the health and care management team.

Gartner Hype Cycles enable IT leadership, strategists and technology planners to compare their understanding of a technology's evolution against Gartner's analysis of the technology's maturity and value, to decide whether to invest in a technology, and when. IT-related innovations are one of the most important change agents in the industry for improving core processes and outcomes. If an HDO invests in a technology too soon, or relies on the wrong vendors or the wrong ideas for innovation, it could suffer unnecessarily through the wasted time and painful and expensive lessons of deploying an immature or inadequate technology. If it delays action for too long, the HDO abdicates the potential for differentiation and will likely jeopardize its mission — and its patients — by its inability to take advantage of important breakthroughs.

Every category plotted on this Hype Cycle has the potential to contribute to a new management paradigm — the "real-time health system" — and is important to consider. We also recommend that CIOs, CTOs, chief medical informatics officers (CMIOs) or chief clinical informatics officers (CCIOs), and directors of BI or enterprise data warehousing use "Toolkit: My Hype Cycle, 2012." The Hype Cycle methodology is also very useful in plotting the more detailed new developments and enhancements or release road maps for the HDO's chosen healthcare megasuite and ERP vendors. In this way, the same discipline and assessment around the definition, readiness or risk, and expected benefits can be applied across all application and analytics options. Furthermore, although it is outside of Gartner's domain of coverage, the Hype Cycle applies equally well to crystallize evaluations of advances in major medical technologies and technique advances. Using this approach creates a common language for characterizing technologies among diverse service line stakeholders, and provides a consistent approach for discussing the relative value and detailing change management steps across medical and information technologies.

While this Hype Cycle is designed for a global client audience of health systems and related stakeholders, unless otherwise noted, the progress of technologies in this Hype Cycle is evaluated against the midsize to large U.S. hospital and health system market (that is, those with more than $500 million in patient revenue, and more than 250 acute care beds). The U.S. does not represent the only or always the earliest market seedbed for ideas and early IT adoption, but it is a handy microcosm with a good representation of early, mainstream and lagging adopters. In particular, the U.S. has provided the living laboratory for many of the early lessons learned in the adoption of Generation 3 electronic health records (EHRs), and the new operations challenges and opportunities that EHRs trigger, such as clinical-data-enabled analytics.

The Hype Cycle

EHRs are the major transformative application suite that has dominated IT agendas and placed dramatic, new demand on IT infrastructure and operations management for well over a decade. Yet the industry is also moving beyond that major milestone. Now, we must ask and answer:

- What can be done with this new environment?

- How will we leverage the rich new set of patient data that EHR systems generate, the constant engagement between computers and clinicians that the EHR creates, and the potential to help them filter through the noise to the relevant insights and meld that in real time with the massive amounts of possibly relevant medical knowledge and the information byproducts of an engaged patient population?

- How will we accomplish not just evidence-based practice, but also create practice-based evidence to understand what drives clinical effectiveness?

- How will we synthesize what is happening with patients, and apply ever more significant predictive and prescriptive clinical decision support?

Industry leaders must ask what untapped insights reside in other existing and new data sources that must now be incorporated into analytics and new processes for care management, patient persuasion and overall population health management. Often, along with the EHR journey comes greater electronic engagement with the patient through the provision of portals, personal health records, and education and health management tools that meaningfully add the patient to the care team. This is an opening to explore patterns of behavior that will inform the assessment of individualized patient risks and how to influence behavior and deliver an optimal and manageable plan for chronic disease management and wellness initiatives. Clinical research discoveries (particularly in the field of genomics), common use of mobile devices and social networks, the technical and creative explosion in sensor-related technologies, advances in consumer electronics, and breakthroughs in analytical processing and visualization — continue to raise the bar on what we can know and what we can do with it. These challenge the ways in which we define, standardize, store and retrieve data in both transactional or workflow systems and analytic systems.

The Hype Cycle shows that, in general, it is taking five to 10 years or more for new solutions to reach mainstream among hospitals and health systems. It will take Generation 3 EHRs over 15 years to achieve full adoption in the U.S. market alone, with late adopters fueled by U.S. federal incentives and prospects for penalties. There are two important take-aways from this:

- It takes an unusual regulatory or market event for solutions to move more quickly. Examples in recent years in the U.S. have been the ICD-10 conversion and computer-assisted coding, U.S. Medicare Recovery Audit Contractor (RAC) audits with RAC tracking software, U.S. National Institutes of Health (NIH) Clinical and Translational Science Awards (CTSA) and new Big Data to Knowledge grant programs, and advanced clinical research information systems (ACRISs). The Final Rule for Accountable Care Organizations in the Medicare Shared Savings Program in 2011, inflated interest for HDOs to seek population health management solutions. Specifically, we project care coordination applications, which help ensure process metrics conformance, on a three- to five-year trajectory. Note that components of population health analytics, such as patient cohorting and individual care gap identification, are also advancing quickly, but the full next-generation capabilities we describe here are on a longer trajectory.

- Early-adopter HDOs can gain a differentiated advantage from both applications and analytics for two to seven years when they select high- or transformational-value areas for their innovations. Meanwhile, many HDOs that don't co-develop or beta in new areas can also differentiate from average organizations for several years by being highly effective "fast followers" that push for higher value realization from the same software as the leaders are using.

This year's Hype Cycle clearly exposes key directions in the potential of IT for the healthcare delivery industry.

1. Analytics and information requirements take center stage: It's the CIO's — and now the CMIO's — next big thing once Generation 3 EHR adoption is achieved.

Healthcare's complexity of data, thirst for knowledge as a passion and a business, and potential for life-saving insights from analytics most likely exceed that of all other industries. Healthcare is often perceived as lagging in the adoption of new technologies, but is catching up in its demand for more timely and robust performance analytics and dashboarding. We highlight this through our entries of Integrated Clinical/Business Enterprise Data Warehouse, Advanced Clinical Research Information Systems, and Big Data. Readers may note one hot topic — predictive analytics — that is not translated into an entry here. Predictive analytics is a journey of many new biostatistical efforts as more robust data and more understanding of individual patient risk factors and how to assess them evolve.

To acknowledge an important technology trigger for more development of predictive and prescriptive analytics and decision support, we have included Graph Databases. This year, we have added a separate evaluation of Next-Generation Population Health Analytics. Highlighted is the simultaneous emergence of new best practices in BI (Logical Data Warehouse). We also capture the current state of hype and potential around Big Data, which is advancing much more rapidly in healthcare than skeptics suspect and apace with its use in other industries, based on Gartner's research.

2. Game-changing new payment models to address escalating demands, and the related cost and care challenges, of chronic diseases create multiple entrepreneurial opportunities for care management and patient engagement.

The hype is almost as high around systems' care coordination and total population health management as it is for analytics, and for good reason. One of the most critical national health issues in many countries is reinventing the care paradigm for chronic diseases from siloed to seamless. Finding alternate payment models that yield shared accountability and cost-effectiveness is inventing a new marketplace. As is typical of this stage, venture money, mergers and acquisitions, and healthcare megasuite activity are heightened, alongside increased IT solution investments by major healthcare payers, and more use of traditional strategic advisory and performance benchmarking companies.

A variety of approaches tackle these new challenges. We track the progress of these models under the Accountable Care entry (not just limited to the formal U.S. Medicare Shared Savings Program that uses the term). This year, we have created two new entries to capture the specific areas of need and development that are congealing in the marketplace: Care Coordination Applications, and Next-Generation Population Health Analytics.

A companion effort seeks to find new breakthroughs that impact patients' lifestyle choices and compliance with medications and other care regimens through IT-aided tools and techniques — see Patient Decision Aids (Healthcare Provider), Personal Health Management Tools — Healthcare Providers, Patient Portals and Quantified Self. We also suggest that HDOs examine trends in CRM systems in the CRM Hype Cycle to glean insights from other industries like retail that heavily engage with consumers.

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3. Choosing strategic vendors means more than just the EHR.

Healthcare has been, is and will be for the near future a megasuite-vendor-dominated industry for its core needs. Leading healthcare megasuite vendors are rounding out their clinical, revenue cycle management and patient access capabilities. They are also targeting growth and competing with a new set of best-of-breed vendors and large IT and payer-owned corporations in the hottest development domains, such as care coordination applications, population health analytics, enterprise data warehousing, big data, patient engagement, patient throughput and capacity management, location- and condition-sensing technology (LCST) platforms, and more.

Deploying EHR systems and optimizing their value remain a top priority for HDOs, and the ability to deliver is essential. However, for HDOs making selection or replacement decisions now, a "classic" view of EHR usability and functionality should not be the only perspective for selecting long-term partners. Vision and core competencies for the future must also be carefully probed.

4. HDOs are exploring the value of awareness applications and real-time operations management, as patient throughput and capacity management and LCSTs drive hospital care operations improvement.

With so much focus on coordination of care, and so much of this directed to the outpatient setting, the Hype Cycle reflects the fairly light amount of new entrepreneurship targeted to improving hospital operations and throughput. These must take center stage as hospitals are faced with particularly intense payment pressure from healthcare reform efforts, weaker economies and tax bases for public funding, and inpatient demand that has slower or flat growth compared with ambulatory services.

Most of the emphasis to reduce cost has been on leveraging EHR data into analytics and decision support to influence consistency of care, improvement in supply chain and labor management. However, a second wave of important information emerges from new uses of data and the creative explosion in the use of sensors (both inpatient and home or wearable sensor applications, which are covered in "Hype Cycle for Telemedicine, 2013"). This year, we have captured the evolution of the vendor landscape in two fields. As large players are rolling out new applications, platforms and predictive analytics, we have renamed Patient Throughput and Logistics Management to Patient Throughput and Capacity Management.

In the (slightly overlapping) LCST field, we acknowledge a vendor trend by adding a platform perspective, LCST (Sensor) Application Platforms, to our coverage, which in the past focused on early sensor applications that were gaining the most market traction. Largely leveraging wireless networks in place for other purposes, HDOs now seek vendors that have progressed from a focus on point applications tied to single-sensor technologies to an open, enterprise-scalable platform offering many types of sensor applications with common data capture, display, management and reporting abilities.

Additions and Adjustments to This Year's Hype Cycle

Six technologies have been added to this year's Hype Cycle:

- Care Coordination Applications

- Graph Databases

- Interactive Patient Care Systems

- LCST (Sensor) Application Platforms

- Next-Generation Population Health Analytics

- Quantified Self

Three technologies have been renamed:

- Integrated Clinical/Financial BI Systems — renamed to Integrated Clinical/Business Enterprise Data Warehouse — to make clear that this is tracking enterprise data warehouses

- Next-Generation Enterprise Patient Financial Systems (U.S.) — renamed to Generation 3 Enterprise Patient Financial Systems (U.S.)

- Patient Throughput and Logistics Management — renamed to Patient Throughput and Capacity Management — to reflect the focus as more-developed vendor systems come to market

These additions highlight the dual challenges of 2013 HDOs. They must focus on improving hospital operations and productivity, in part through a better approach to enterprise information management. That is a difficult-enough agenda by itself, but HDOs in many countries must also address the growing demand, growing expectations and expanding business growth opportunities around provider-directed population health management. For IT leaders, this creates very special opportunities and their greatest challenges yet.

As is typical of this Hype Cycle in prior years, we track only a few ideas in their earliest pre-Peak of Inflated Expectations stage. Because healthcare is very much a vendor-driven industry in the formation of solutions, and health system IT plans tend to focus on a three- to five-year window, we have found it a reasonable and practical approach to concentrate on those ideas that have morphed into serious, funded development efforts.

We cover additional select major technology breakthroughs in the companion "Hype Cycle for Telemedicine, 2013" (for example, digital telepathology) and "Hype Cycle for Healthcare Provider Technologies and Standards, 2013" (for example, nanomedicine and 3D bioprinting). Also, other cross-industry Hype Cycles, such as "Hype Cycle for Human-Computer Interaction, 2013," "Hype Cycle for Consumer Technologies, 2013" and "Hype Cycle for Consumer Devices, 2013," each reveal technology advances that offer important potential opportunities for adaptation to healthcare needs.

Figure 1. Hype Cycle for Healthcare Provider Applications, Analytics and Systems, 2013
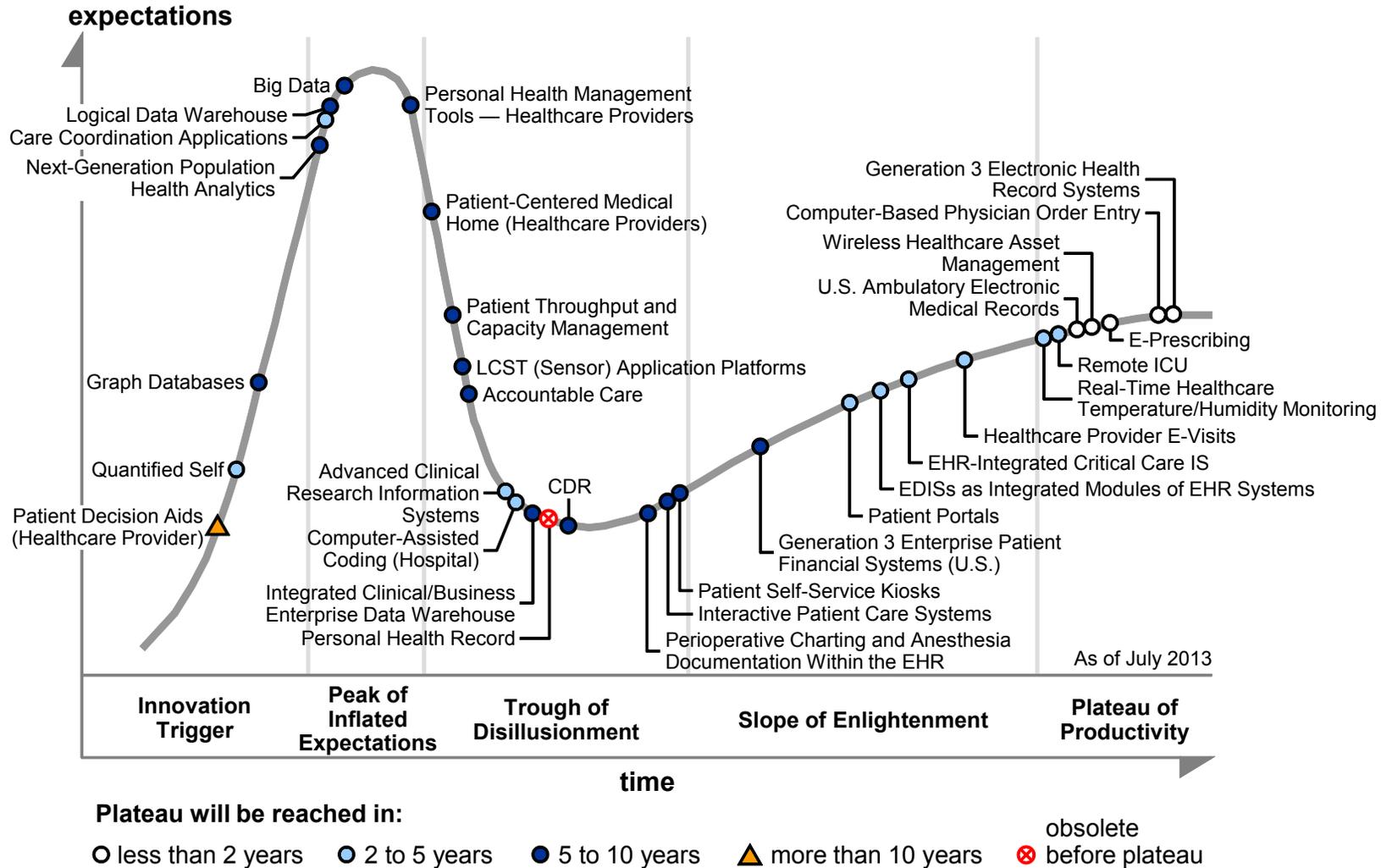
The Priority Matrix

The Priority Matrix is a companion to the Hype Cycle graphic. It maps a technology's benefit to its time to maturity. The graphic is generated from the benefit rating and the time-to-plateau values for each Hype Cycle entry. The Priority Matrix provides an easy-to-read format that answers two key questions: How much value will an enterprise get from a particular application area, and when will it be mature enough to deliver that value? As a rule of thumb, if it's red, it's hot — if it's gray, it's not. High-priority investments are in the top left of the Priority Matrix, where the technologies will potentially have a high impact and have reached a reasonable level of maturity.

Companies that are conservative in their technology adoption (Type C organizations) may limit their focus to this area. Companies that are more aggressive technology adopters (Type A and Type B organizations) are likely already using technologies that will mature in less than two years. Therefore, they will probably want to evaluate technologies further to the right or lower on the Priority Matrix — for example, technologies that will not be in widespread use for at least five years, but that may provide a competitive edge in the interim.

"Hot" Technologies, Present and Future

Generation 3 EHR systems continue to be the largest and most transformational application investments for HDOs in this century. The EHR's computerized physician order entry (CPOE) capability, listed as high-value and hot now, often is the first arena to provide a clear improvement in enterprise conformance to safety protections and evidence-based medicine by enabling the standardization of order sets, providing medication safety advice and sending an alert to the physician at the time of order.

The Value of Analytics and Revolutionary IT Support of Medical and Clinical Effectiveness Research

ACRISs also have a potentially transformative impact in the two- to five-year window as they speed up and lend clarity to research by enabling access to rich datasets and real-time collaboration. While there will definitely be pockets of earlier use by leading private and public research organizations, the truly transformative breakthroughs from big data constructs for medical discovery will likely require much more R&D and, thus, a longer window.

Accountable Care's Impact on Healthcare Delivery

HDO executives and CIOs who are leading local or national e-health efforts targeting chronic diseases should look to the cluster of applications for accountable care — including the EHR system, care management, population and process analytics, patient portals, and other patient engagement efforts. This will likely have a cumulatively transformational impact on healthcare delivery, because it is such a major part of healthcare's current and projected cost challenge for most developed countries. The healthcare industry must seek specific ways that technology and technique can aid in the effective management of the global "epidemic" of chronic diseases. Again, this is an arena on which ambitious health systems and national e-health initiatives in some countries will want to focus their attention now.

Warm Technologies

To make the EHR truly transformational, the HDO must direct more attention to high-impact clinical decision support and leverage the data via analytics. We show Integrated Clinical/Business Enterprise Data Warehouse as high-value in the five- to 10-year window. Next-Generation Population Health Analytics is defined as transformational — while outside the focus of average health systems, it should be a priority for ambitious and innovative HDOs, and successful early adopters will realize a substantial performance differentiation for many years. Big Data and Logical Data Warehouse as best practices are covered in the Hype Cycle this year to help HDOs discuss how to evolve their information infrastructures.

We consider "warm" technologies that have high to moderate value for HDOs during the next two to five years to be E-Prescribing, U.S. Ambulatory Electronic Medical Records by themselves (that is, without related disease management models or incentives), Computer-Assisted Coding (Hospital), Wireless Healthcare Asset Management and Healthcare Provider E-Visits. Computer-Assisted Coding (Hospital), while still somewhat lacking in proof points, has particularly magnified value in the U.S. by the challenges of converting to ICD-10 codes in 2014.

It will take five to 10 years or more for other high-value applications, such as Clinical Data Repository (CDR), Patient-Centered Medical Home (Healthcare Providers), and Patient Throughput and Capacity Management, to achieve mainstream adoption. These will likely provide cost, quality and competitive differentiation for successful early adopters.

Figure 2. Priority Matrix for Healthcare Provider Applications, Analytics and Systems, 2013

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational	Generation 3 Electronic Health Record Systems	Advanced Clinical Research Information Systems	Accountable Care Big Data Graph Databases Next-Generation Population Health Analytics	
high	Computer-Based Physician Order Entry	Care Coordination Applications Computer-Assisted Coding (Hospital) Healthcare Provider E-Visits Quantified Self	Integrated Clinical/ Business Enterprise Data Warehouse LCST (Sensor) Application Platforms Logical Data Warehouse Patient Throughput and Capacity Management Patient-Centered Medical Home (Healthcare Providers)	
moderate	E-Prescribing U.S. Ambulatory Electronic Medical Records Wireless Healthcare Asset Management	EDISs as Integrated Modules of EHR Systems EHR-Integrated Critical Care IS Patient Portals Real-Time Healthcare Temperature/Humidity Monitoring Remote ICU	CDR Generation 3 Enterprise Patient Financial Systems (U.S.) Interactive Patient Care Systems	Patient Decision Aids (Healthcare Provider)
low			Patient Self-Service Kiosks Perioperative Charting and Anesthesia Documentation Within the EHR Personal Health Management Tools — Healthcare Providers	

As of July 2013

Source: Gartner (July 2013)

Off the Hype Cycle

The following technologies have exited the Hype Cycle this year:

- Big Data for Healthcare and Life Science Research. This now appears only on the Hype Cycle for Life Sciences. Big data capabilities for healthcare-provider-directed research use is now covered in this Hype Cycle as a requirement under the Advanced Clinical Research Information Systems entry and highlighted in Next-Generation Population Health Analytics.

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- Healthcare Provider Disease Management Systems. Instead, we now cover Care Coordination Applications with a different set of requirements that better reflect contemporary provider requirements.

- Modular EHR. There has always been a steady background of hype around the concept of a modular EHR. Attention to this issue rose substantially in the U.S. during the run-up to Stage 1 of the U.S. Centers for Medicare & Medicaid Services' Meaningful Use criteria. Accordingly, we added an evaluation of the concept to the Hype Cycle in 2010, calling it obsolete before reaching the plateau. As the industry's interest has faded in the actual use of modules in the Meaningful Use program, we have removed it from the Hype Cycle.

On the Rise

Patient Decision Aids (Healthcare Provider)

Analysis By: Thomas J. Handler, M.D.

Definition: Patient decision aids are complex interactive systems based on decision rules that enable patients to evaluate their diagnostic and treatment options. Note that disease management applications or personal health management tools do not fit this definition, nor do sites providing patients with access to educational content without decision rules.

Position and Adoption Speed Justification: It is becoming evident that individuals need to become more involved in their own care decisions, because many of those decisions are more complicated than ever. In fact, healthcare reform in the U.S. stipulates an environment that promotes shared decision making. While patient decision aids are not equivalent to shared decision making, they are likely to be useful adjunct tools for the shared decision-making process.

Patients don't always understand all their options, and might not have considered (in a structured way) how their personal preferences and situations might or should affect their medical decisions. For example, an individual with coronary artery disease may have to choose between minimally invasive stent placement or major surgery for coronary artery bypass grafts. Patients need to understand the risk of premature stent blockage versus the risks of major surgery, but also should consider how important it is too get back to "normal" activity sooner, rather than later, and even whether or not cosmetic results are important. Lower back pain is another example. Many individuals endure years of pain and try all the nonsurgical options available to them, while others opt for surgery when it's first offered. However, few consider that if they initially seek help from a surgeon they're more likely to get a surgical solution.

At the same time that diagnostic and therapeutic options are becoming more complex, physicians are more time-constrained than ever and rarely have the time to comprehensively review options with their patients. One clear tipping point is the availability of genetic information — there is simply not enough time or specialists to fully counsel patients about genetic implications. The trend toward more collaborative care and "team medicine" may actual make this situation worse. What once might have been a narrowly focused clinical encounter is becoming more holistic in nature, and, therefore, clinicians have less time to talk about options.

Patients and their families need tools to help them make better decisions, especially for conditions in which there isn't a single evidence-based definitive option, and, therefore, the patient's personal preference is an important factor in the decision-making process.

It is still the case that only very progressive organizations are taking steps to leverage technology to improve patient decisions, and most are doing so as part of academic research. Factors that are inhibiting this market include questions regarding the content and its delivery. Is there enough evidence to help patients make these complex decisions? Will clinicians accept content from other sources, or will they demand the ability to vet that content? The tools will need ready access to clinical data, which means that the current technical limitation of interoperability is hindering advancement of these tools. There is also uncertainty regarding whether patients will accept and use these systems. Although this technology has potential, and there is more talk about its importance, essentially no forward movement of patient decision aids has occurred during the past 12 months.

User Advice: Early adopters might consider small pilots of this technology, but they must recognize the risks involved (including the possibility of medical or legal ramifications) because these tools remain unproven. Mainstream and late adopters are best advised to wait several years for these products to mature. Although patient decision aids may start as stand-alone systems, we believe that physicians ultimately are unlikely to support these systems until they are part of an enterprise electronic healthcare record system — in part because they will not want to interact with multiple systems, but most importantly because of the need for access to patient-specific information.

Business Impact: Successful rollout of patient decision aids is likely to help with branding and patient loyalty, but is likely to reduce variability in care and improving outcomes. For these reasons, we have increased the benefit rating from low to moderate, but note must be made that it's too early to determine more-concrete business effects.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Health Dialog; myOptumHealth

Quantified Self

Analysis By: Frank Buytendijk; Whit Andrews; Svetlana Sicular

Definition: Originating in San Francisco, Quantified Self is a movement promoting the use of self-monitoring through a wide variety of sensors and devices. It uses mobile apps and wearable or portable devices to collect data about a user's activities, biometrics, environment and other personal experiences. Analysis of this data allows individuals to gain a better understanding of their experiences and improve their wellbeing. Integration with social media allows users to connect with peers, share information, gain community support and learn from others.

Position and Adoption Speed Justification: The Quantified Self movement, currently expanding into Europe with conferences and new chapters, is a trigger for the socialization of new types of technology. However, it will take two to five years before these are adopted by the mainstream.

Although there are multiple types of applications, the most successful commercial implementations can be found in sports and health. There are thousands of health-related tools and supporting apps in smartphone app stores. Commercially-available motion-tracking devices include Nike+, Fitbit, Amiigo, Basis, Withings, BodyMedia and Jawbone Up. Although the areas of application are quickly expanding, self-monitoring currently focuses on motion trackers and vital-sign monitoring (blood pressure and heart rate), but some manufacturers and developers are already talking about mood monitoring.

The range of devices itself is developing quickly as well. Currently based on wristbands and reported through smartphones, various high-tech companies including Apple, Google and Samsung have announced smart watches and devices that can record visual and audio, while displaying information on displays built into glasses. Numerous startup initiatives are focusing on wearable computing with sensors in clothing. There are many other objects that are being turned into monitoring devices. One bra is already fitted out with sensors that detect the first signs of breast cancer. Or consider slippers with balance sensors and carpet sensors that track movement, or Dr. Toilet that monitors stool and urine samples, just to name a few. The sudden popularity of these devices, and the immaturity of the technology, can sometimes cause stability and quality issues.

User Advice: The Quantified Self movement isn't mainstream yet, but the number of personal devices that collect data and provide feedback to users is increasing. While people under the age of 30 are interested in sharing this information, people over 40 are seeking self-awareness and medical insight. The ability to tap into the uncharted depths of customer intimacy through offering personal analytics is also attracting the interest of marketers across all industries. Marketing has never had the opportunity of being so personal and urgent.

Marketers should, however, be careful what they wish for as users take their analytics perhaps a little more personally than you'd like. With the advent of personal analytics, consumers feel that they own the data they collect, whether that data is subject to T&Cs or not. If you violate that sentiment and the data is used for any reason other than those with direct consumer benefit, protests and subsequent reputation damage may occur. Over the past two years several cases (involving Internet providers, retailers, telecom providers, banks and consumer device makers) have made it to the newspapers.

Marketers that do it right, and focus on personal analytics with a promise to never sell that data, will get more than a loyal customer; they will get their whole network. When the data benefits the person that collects it, users will be likely to seek out like-minded companions in an effort to make their lives better. They will find people who share their interests and they will become ambassadors for the products and services by suggesting that others join; not just for fun, but to create even richer comparisons for themselves, to share again with others and, not incidentally, with any company they feel adds value.

Business Impact: As more people use mobile and social technologies to collect and assemble data about themselves and their immediate surroundings, business opportunities emerge to facilitate the process or exploit the collected data. Enterprises may take various steps to catalyze or benefit from such trends.

They may choose to:

- Create new devices or applications that generate revenue streams through subscriptions or advertising.

- Create devices and applications that provide increased affinity between their core products and the user.

- Seek to create incentives (or even imperatives) that encourage or require employees to apply such analytics to measure performance or honesty, or to track employees in hazardous environments for health and safety reasons.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Fitbit; Jawbone; Nike

Recommended Reading: "Analytics Gets Personal with the Quantified Self"

Graph Databases

Analysis By: Mark A. Beyer

Definition: Graph databases store information in a structure that records the direct relationship between any two adjacent elements. Nodes have properties and connect to other nodes at "edges." There are key value pair databases, but also network graphs and triple-stores, which are specialized forms of Graph databases that store chaining or multistep relationship sequences.

Position and Adoption Speed Justification: Graph databases are considered to have reached the Plateau of Productivity when they have penetrated at least 15% of the analytics market (which is currently many years away). Graph databases were considered a component of NoSQL solutions in 2012, but now enter the Hype Cycle as emerging rather than embryonic because Graph analysis is not a new science and has gained significant maturity. Graph analysis has been traditionally completed in advanced statistical analysis packages and can also be accomplished with open-source "R" statistical programming language.

The development of best practices for how to establish Graph nodes, directed edges and then properties that define what is in a node are already being used in statistical analysis and it is possible to adapt these lessons learned to Graph databases for feature/functional design. The preferred language and skill set for Graph is SPRQL, which requires greater familiarity in the market

to gain adoption, but these are not the only skill sets or programming paradigms and all will need more experience in the market before adoption increases.

There are currently open-source and commercially-licensed Graph databases and some mainstream vendors also include Graph analytics and Graph node management in their DBMS products (for example IBM and Oracle). Many Graph databases are triple-stores using resource description framework (RDF) data model approaches, but they do not have to be triple-stores. This debate over the best approach to Graph databases in the market will resolve over the next five to seven years and lengthen the time for the solution reaching the Plateau of Productivity.

There are also layered functionality and specific features in differing Graph databases that lend advanced data science functionality to their use (for example, the R2DF framework, which utilizes RDF weights to the path ranking). Some front-end Graph analytics leverage configurable storage to create a Graph database (for example, OQGraph, which can use MySQL or MariaDB for storage), while others run as embedded servers (like OpenLink's Virtuoso).

User Advice: Organizations should determine the extent to which manually developed graph analysis is being performed by advanced statisticians to quantify the number of hours available for reduction by introducing Graph functionality (in other words, how big is the opportunity). The analysis should include the frequency at which predictive models are determined to be inaccurate and require correction.

Business Impact: Currently, business analysts work primarily with "list-based" queries. Importantly, these same analysts do not perceive their analysis as list-based because their tools combine many list results together to give the appearance of a "cube." Even cubes in most DBMSs are the result of this same premise. In a list-based analysis, each list must be constructed first and then combined. This means analysts must know what should be "in" the lists before they get them and have some idea of how the lists go together.

Graph databases do not rely on list queries and instead record every connection of every data point (called "nodes" in Graph databases) that is available at the time of data capture. In this way, the selection of a single data point will deliver all of the relevant lists and greatly reduce human bias in analytics. A significant benefit of Graph is that it is deployed with the intention of any node being a dimension or fact, which reduces the overhead for maintaining analytic dimensions.

Graph is being used for particularly successful analytics in social networks. Social networks are groups of people interacting in a number of ways. As a result, security analysts, fraud investigators and others identifying malfeasance use it. In a case of insurance fraud detection, a major insurer used Graph to identify not only the direct agents of the fraud, but also to identify gaps in the criminal network that helped them pursue the organizers that were previously difficult to identify.

Another good example is engineering analytics, where combining issues such as harmonics, structural integrity, tensile strength and many other aspects of physical devices requires interaction of all of the aspects in the final design. Graph analysis has an enormously high potential for privacy and civil liberties violations, so the producers suggest that legal parameters need to be developed immediately ahead of technology adoption.

Graph analysis is possibly the single most effective competitive differentiator for organizations pursuing data-driven operations and decisions after the design of data capture. This is a bold claim based on how Graph contributes to breaking the "list" analysis model, enabling the removal of human bias. Graph is also used in developing predictive analytics, thereby demonstrating its validity and alternative scenario development.

Graph analysis is the data science practice of determining how different concepts relate to each other in a chain with various degrees of "weight" or tendency at each edge. Graph databases are an approach that supports graph analysis, but they are not graph analytics.

Most analytics solutions can emulate a graph relationship, but human intervention is usually required to construct the data analysis that confirms or denies the graph and its overall strength of relationships. This means that the introduction of graph databases will reduce the level of human error from early bias and the amount of time taken to discover the relationships in the first place. Faster, more accurate, data-driven analytics is the result.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: IBM; Neo Technology; Objectivity; OpenLink; Oracle

Recommended Reading: "Social Infrastructure"

"Cool Vendors in Content and Social Analytics, 2013"

At the Peak

Next-Generation Population Health Analytics

Analysis By: Vi Shaffer

Definition: Next-generation population health analytics is a set of provider-led, analytics efforts supporting a personalized and precision approach to population health management. It incorporates clinical epidemiology-type techniques to discern patterns and correlations among patient risk factors, disease characteristics, treatment approaches and outcomes. Its purposes are risk assessment, precision/flexible patient cohorting, identifying care gaps, effectiveness benchmarking and innovation research.

Position and Adoption Speed Justification: Gartner bundles various categories of provider-based population health analytics into this Hype Cycle entry. This set of capabilities is moving through the Hype Cycle apace, although different vendors and approaches apply to different components. The requirements and opportunities represented are the provider segment's response to the dramatic global change in the nature of disease and the inadequacy of addressing chronic disease in siloed, fee-for-service models. Payers are shifting more accountability for the cost and outcomes of healthcare through value-based purchasing contracts. This shift is represented by incentive-based

and risk-reward payment models, such as the U.S. Centers for Medicare and Medicaid Management's Shared Savings rule creating the Accountable Care Organization program. Therefore, while still in a formative state, it is moving through the early stages of the Hype Cycle quite rapidly.

The fast-rising demand for a new generation of population health analytics — which creates a more refined clinical and behavioral understanding of the patient — is because of the combination of population health management needs of new payment and business models, the richer data that has become available particularly from EHR systems, and technologies (such as big data) becoming available to mine it. New sources of data beyond the EHR (such as behavioral, social network and genomics data) are already being incorporated by advanced healthcare delivery organizations (HDOs) and population health research centers.

Although many companies offer analytic products and services branded as population health, this field of endeavor is largely in a primitive state. Government, private payer and research institutions' study of populations has discovered the "lowest hanging fruit," such as preventing hospital readmissions, consistently providing known best standards of care to diabetic patients, or drug regiments to better prevent heart attack and stroke. New provider incentive or risk-holding models have begun to tackle the issues of how to achieve high compliance with these, such as through care coordinators. Services are also available to analyze claims and limited clinical data for timely identification of gaps in care.

User Advice:

- Define a progression of HDO competency development in population health analytics based on whether the organization intends to go after just incentive-based or also risk-holding (incentive and penalty) contracts.

- Create an information road map that progresses rapidly from claims-based beneficiary analysis and basic care management metrics as starting points through care gap analysis. Providers that hope to differentiate their care management programs will have to glean deeper insights from mining a combination of clinical and patient experience, and behavioral data.

- Include the experience of payer-led care management in cataloging the IT requirements for provider-led care management. This tells us that personalized, recurring patient engagement built on trust will be key to long-term risk management and health improvement

- Expect that your first population health analytics approaches will not be your last. Many HDOs are beginning with external service providers and collaborations (offering both traditional and big data-type capabilities) because they can't ramp up internal capabilities fast enough to support the high interest in accountability-based contracts or are too small (with too small total populations) to perform sophisticated analytics. The larger, ambitious providers will soon evolve their internal capabilities, invigorate substantial research efforts and may offer their capabilities as a business. Some HDOs of this type have already been making venture fund investments in companies in this field.

Business Impact: Discovering a whole new and transformative approach to provider-led population health management that includes a good dose of effective patient persuasion is the best hope for bending the untenable trajectory of healthcare costs for most developed countries. The need is also a fundamental reality for many emerging market countries that are riddled with a virtual epidemic of chronic diseases, including lifestyle-influenced ones, such as Type 2 diabetes. Because analytics provides the tools to reveal the effectiveness of current and future efforts, and provides new insights into human behavior, we have given this category the rarely assigned benefit rating of transformational.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Aetna; Caradigm; Cerner; Elsevier MEDai; Explorys; IBM; Lumeris; MedeAnalytics; Optum; Oracle; Premier; Recombinant By Deloitte; The Advisory Board Company; Truven Health Analytics; Verisk Health

Recommended Reading: "Top Actions for Healthcare Delivery Organization CIOs, 2013: Support Provider-Led Care Management"

"Top Actions for Healthcare Payer CIOs, 2013: Prepare for the Era of Provider-Led Care Management"

"Care Management Defined: Clarifying the Terms Used in the Analysis of Care Management"

Care Coordination Applications

Analysis By: Wes Rishel; Vi Shaffer

Definition: Care coordination applications support care coordinators within healthcare delivery organization (HDOs) as they work with patients that have a high propensity for incurring costly healthcare services. Care coordinators may work with affiliated practices to assist in their meeting population health goals. Care coordination applications include workflow, decision support rules, interoperability with payers and other healthcare providers, and support for high-volume communications via telephone, fax, email and secure messaging.

Position and Adoption Speed Justification: Most HDOs that undertake care coordination are relying on limited IT support using spreadsheets and "swivel-chair integration," where the care coordinator has separate logins for several application systems. HDOs seem to be following the pattern experienced in the past by health plans that have included care coordination as part of their care management programs. The health plans first pursued the prerequisite analytics and only later become aware of the need for workflow support, interoperability with transactional systems and specialized monitoring. Recognizing this pattern, we position the care coordination workflow application substantially behind analytics on the provider applications Hype Cycle.

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A few countries are substantially ahead of the U.S. in adopting care coordination software. Generally, the buyer in those countries is not the healthcare provider. It is usually a governmental or quasigovernmental agency, such as a county or healthcare trust, and the functions include coordinating healthcare with other social services.

In the U.S., this market is in a very early stage of evolution, where the products' functionality, architecture and packaging with other applications vary substantially from one vendor to the next. Three common packaging approaches are to make the care coordinator a role within an electronic health record (EHR), to offer it as an integrated application along with the EHR and scheduling, and to package it within analytics applications. So far, leading-edge HDOs are choosing products that are packaged with analytics systems — if only because they need the analytics, and the requisite sources of data are broader than the scope of a single EHR.

Health plans have had considerable experience acquiring applications or services that include the care coordination function. The applications that support them are very strong in managing large-scale operations mounted from call centers that are tightly coordinated with population health, include a broader range of population health interventions that are less labor-intensive than frequent contact with the patient, have excellent communications support, and include access to claims and preauthorization data. Some of the vendors in the healthcare market are moving into the provider market. These vendors are challenged to integrate clinical data from EHRs and to support operations in settings where care coordinators are located directly in primary care clinics.

User Advice:

- Include the lessons health plans have learned in specifying the IT requirements for provider-based care coordination.

- Establish an IT approach to care coordination that enables strong synergy with primary care.

- Expect that your first care coordination approach will not be your long-term choice.

- Pair this with a sound population health analytics approach.

Business Impact: Care coordination is a necessary piece of the total IT support that HDOs need in order to respond to changes in payment systems that incentivize providers toward the triple aim of improving the experience of care, improving the health of populations and reducing per capita costs of healthcare.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Aetna; Allscripts; eClinicalWorks; Epic; McKesson; Net.Orange; Optum; Orion Health; Phytel; Solutions Hospitalis SEC

Recommended Reading: "Top Actions for Healthcare Delivery Organization CIOs, 2013: Support Provider-Led Care Management"

"Care Management Defined: Clarifying the Terms Used in the Analysis of Care Management"

Logical Data Warehouse

Analysis By: Mark A. Beyer

Definition: The logical data warehouse (LDW) is a new data management architecture for analytics combining the strengths of traditional repository warehouses with alternative data management and access strategies (specifically, federation and distributed processing). It also includes dynamic optimization approaches and multiple use-case support.

Position and Adoption Speed Justification: The LDW will form a new best practice by the end of 2015. In early 2013, Gartner clients began reporting a significantly increased interest in the LDW and its many forms (see "Understanding the Logical Data Warehouse: the Emerging Practice") for background and previous adoption rates. The discussions are taking multiple forms, including revelations that many large and midsize organizations are pursuing the approach already, but are now using the nomenclature. There is also new interest from organizations seeking some methodological approaches to combining big data technologies, federation and centralized data warehouses.

Additionally, vendors have incorporated the naming convention into their marketing and messaging. Finally, new vendors able to offer federation/virtualization solutions seek the opportunity to become major contenders for the semantic data access layer for analytics. This brings the LDW to the Peak of Inflated Expectations. LDW discussions now include the concepts of MapReduce and Graph analysis (completed in server clusters outside the warehouse with results being loaded to the warehouse or available via federation as a services call).

From 1H13, Gartner data warehouse inquiries now include the LDW in some form between 15% to 20% of the time. Early adopters are still advanced data warehouse and analytics practitioner organizations and implementers, but database and business intelligence vendors are at least addressing the LDW in their offerings. During the next two years, new organizations will begin to encounter the more difficult issues of managing SLAs for each delivery types possible under the LDW and many will fail to manage the still prevalent performance and availability issues of virtualization and batch distributed processes running on server clusters external to the warehouse. This will lead the LDW into the Trough of Disillusionment and at this time, it is possible that the LDW will fail to emerge (just as distributed warehouses failed during 2008 to 2009).

Gartner believes that as LDW architects become more practiced in using services-oriented approaches they will be able to introduce more dynamic metadata-driven services engines and this will advance the LDW from the Trough of Disillusionment and upward along the Slope of Enlightenment by late 2015 or early 2016.

User Advice:

- Conduct query analysis of existing analytics to determine how the current system performs (the current warehouse, mart or federated views) and what data/information is included in these queries. Use the results of this analysis to identify when users are leaving the warehouse to obtain data from other information resources.

- Determine if your current warehouse software systems are capable of managing external data access and managing external processing clusters in terms of specifying jobs, initializing jobs and monitoring or managing the job flows as they complete, or if new technology should be evaluated.

- Start small with ontology and taxonomy, for example deploy and populate a business glossary/data dictionary, then move onto the more advanced technologies that perform wider metadata management and ontology/taxonomy rationalization.

- Organizations should identify a single area of analytics requiring a combination of three information access and management approaches:

- Traditional repository style approaches

- Real-time access to operational systems (to pilot virtualization)

- An embedded use of distributed processing (such as, MapReduce of large datasets and graph analysis of networks of information or content analytics)

- Build a pilot analysis, collecting inputs from all three information access and management approaches.

Business Impact: An LDW has the potential to eliminate the constant level of compromise between comprehensive data needs, performance optimization and time to delivery cycles. By introducing virtualization and distributed processes as peers to the repository, it is now possible to select the deployment architecture based on the driving service-level expectation instead of defaulting to existing practices. As such, traditional data warehouse vendors are supporting aspects of the LDW to varying degrees (IBM, Oracle, Teradata and SAP, for example).

Other smaller vendors also have an opportunity specifically in the area of multiple use cases for the data warehouse data.

In addition, many information assets deployed in a repository-only style warehouse are forced to follow a single ontologic/taxonomic pairing. In the LDW, a semantic layer can contain many combinations of use cases, which are effectively deployed as new variations of data taxonomies and ontologies. Many business definitions of the same information are the result. From a technical perspective, the LDW also needs a query normalization interface.

Every DBMS requires a unique set of SQL or data access interface technologies (for example, search and API access). This capability opens up many options for end-user tools and removes the current design requirement to closely coordinate the business intelligence tools with the database management system choice (see "Decision Point for Logical Data Warehouse Implementation Styles").

Early adopters have reported that the LDW does not have to follow the 80/20 analytics rule (specifically, 80% of analysis needs can be met by 20% of the data and thus designed easily into an optimized layer of the data warehouse). Instead, the LDW is using an 80/10/5 rule in which 80% of analytic needs are met by the repository, but 10% of the demand is met by virtualized solutions and 5% is met via distributed analytics (such as content analytics, MapReduce or Graph).

This leaves a remaining 5% and LDW practitioners are pleased to acknowledge that the remaining 5% will never be solved, by even this advanced infrastructure, and will remain in end users' specific control. These same customers report that 5% of needs are never met in a fixed architectural choice, and acknowledge the credibility of undefined access using any combination of the three choices or creating their own direct access and extract outside of the LDW.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: BMMSoft; Composite Software; Denodo Technologies; IBM; Informatica; Kognitio; MarkLogic; Teradata

Recommended Reading: "Decision Point for Logical Data Warehouse Implementation Styles"

"The Logical Data Warehouse Will Be a Key Scenario for Using Data Federation"

"Understanding the Logical Data Warehouse: The Emerging Practice"

"The Future of Data Management for Analytics Is the Logical Data Warehouse"

Big Data

Analysis By: Mark A. Beyer; Sid Deshpande

Definition: Big data is high volume, velocity and variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making.

Position and Adoption Speed Justification: Big data is almost at the Peak of Inflated Expectations. It will become an embedded and state-of-the-art practice by 2018, and it is more likely that big data management and analysis approaches will be incorporated into a variety of existing solutions in existing markets (see "Big Data Drives Rapid Changes in Infrastructure and $232 Billion in IT Spending Through 2016").

Notably, organizations have begun to indicate that existing analytics will be modified and enhanced by big data and not replaced (only 11% of data warehouse leaders indicated they would consider replacing the warehouse with a NoSQL or big data solution as of November 2012, down from just over 20% in 2011). Practices are diverging at this point, with confusion starting to emerge regarding exactly what constitutes big data and how it should be addressed. Some very traditional vendors that have not been considered for big data solutions should be considered, and this confusion may

be their entry point into the debate about which tools to use. Other vendors will simply relabel their existing products as big data and not actually offer anything new.

Beginning late in 2014 and through the end of 2015, big data will descend into the Trough of Disillusionment as conflicting concepts of what it is and how organizations can benefit from its management and analysis multiply.

There are two significant facts that will drive it into the trough.

- Tools and techniques are being adopted ahead of learned expertise and any maturity/ optimization, which is creating confusion.

- The inability to spot big data opportunities by the business, formulate the right questions and execute on the insights.

MapReduce continues to persist as the "darling" of big data processing. Even with new additions or wider use of the Hadoop project (such as HCatalog) it remains a batch solution and so has to be combined with other information management and processing technologies. Hadoop implementations require expert-level staff or system implementers.

As anticipated in 2011, attempts to combine MapReduce with Graph have followed and inadequate attempts to address other big data assets, such as images, video, sound and even three-dimensional object modeling, will drive big data into the trough. Some big data technologies represent a great leap forward in processing management, especially relevant to narrow but deep (many records) datasets, such as those found in operational technology, sensor data, medical devices and mobile devices, among others. Big data approaches to analyzing data from these technologies represent the potential for big data solutions to overtake existing technology solutions when the demand emerges to access, read, present or analyze any data.

The larger context of big data refers to the wide variety and extreme size and count of data creation venues in the 21st century. Gartner clients have made it clear that big data must include large volumes processed in streams, as well as batch (not just MapReduce) and an extensible services framework deploying processing to the data or bringing data to the process, spanning more than one variety of asset type (for example, not just tabular, or just streams or just text). Importantly, different aspects and types of big data have been around for more than a decade — it is only recent market hype around legitimate new techniques and solutions that has created this heightened demand.

User Advice:

- Identify existing business processes that are hampered in their use of information because the volume is too large. There are many information gaps that could be filled by new information types (variety) or the velocity will create processing issues. Then identify business processes that are currently attempting to solve these issues with one-off or manual solutions.

- Review existing information assets that were previously beyond existing analytic or processing capabilities (referred to as "dark data") and determine if they have untapped value to the business, making them a first or pilot target of your big data strategy.

- Plan on utilizing scalable information management resources, whether public cloud, private cloud or resource allocation (commissioning and decommissioning of infrastructure), or some other strategy. Do not forget that this is not just a storage and access issue. Complex, multilevel, highly correlated information processing will demand elasticity in compute resources, similar to the elasticity required for storage/persistence.

- Extend the metadata management strategies already in place and recognize that more is needed to enable the documentation of big data assets, their pervasiveness of use and the fidelity or assurance of the assets by tracking how information assets relate to each other and more.

Business Impact: There are three principal aspects to big data — success will be limited unless all are addressed. The quantitative aspects of big data generally do not emerge one by one. Volume, variety and velocity most often occur together. The second aspect is that innovation must be cost-effective both in costs to deploy and maintain and in terms of time to delivery — solutions that arrive too late are useless, regardless of cost.

Finally, the focus must be on increased insight by the business into process optimization from immediate automation through the development of completely new business models. Big data permits greater analysis of all available data, detecting even the smallest details of the information corpus — a precursor to effective insight and discovery.

The primary use cases emerging include leveraging social media data and combining operational technology (machine data) with back-office and business management data and further validating existing assets (increasing their "fidelity").

Perhaps the most important business benefit of big data management and analysis techniques are that analytics and decision processing can include multiple scenarios, including highly disparate definitions and temporality of events in the data. This means that analytics can now comprise many different scenarios. Each scenario could have different starting and ending points, and differing relationships within the data and circumstantial inputs. Finally, analysts would be able to attach probabilities to each scenario and monitor many of them simultaneously.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cloudera; EMC-Greenplum; HortonWorks; IBM; MapR; Teradata-Aster Data

Recommended Reading: "Big Data Drives Rapid Changes in Infrastructure and $232 Billion in IT Spending Through 2016"

"Big Data' Is Only the Beginning of Extreme Information Management"

"How to Choose the Right Apache Hadoop Distribution"

"CEO Advisory: 'Big Data' Equals Big Opportunity"

"The Importance of Big Data: A Definition"

Personal Health Management Tools — Healthcare Providers

Analysis By: Thomas J. Handler, M.D.

Definition: Personal health management tools (PHMTs) are applications that provide interactive functionality to aid consumers in managing their health and disease processes. They include health education information on prevention (such as routine screenings, nutrition and exercise) and diseases (such as identification, common treatments and pharmaceuticals). These tools enable consumers to establish programs to track diet, exercise and routine care, and to monitor typical chronic illnesses, such as asthma and diabetes.

Position and Adoption Speed Justification: There is growing interest among healthcare providers, governments and healthcare payers to increase patient engagement as a way to improve outcomes and lower costs. PHMTs are thought to be a good way to accomplish all of these ends, and have the added benefit of being of high interest to healthcare consumers as well.

Healthcare consumers have been interested in online PHMTs for a long time, although most of what has been available consists of simplistic weight or health status calculators. With the growth in chronic care and increasing Internet and mobile use, there has been increasing interest in PHMTs worldwide. There's a growing belief that providing tools to patients will result in less-costly care. In the U.S., the advancement of consumer involvement in healthcare financing and health management means there's a greater need for better PHMTs, particularly in populations where chronic illnesses or complex medical conditions are present.

Today, there are two basic categories of PHMTs:

- Web-based tools that are linked with a richer underlying dataset of individual health information from a provider or payer

- Smartphone-based tools that do not have access to health data except as entered by the user

This distinction will blur with time. Sources of the tools are increasing, and vary widely from payer and provider organizations to consumer advocacy groups, personal health device manufacturers, medical device manufacturers and commercial wellness firms.

Even as PHMTs become more prevalent (Apple's App Store is expected to have more than 30,000 healthcare apps by the end of August 2013), they remain very close to the Peak of Inflated Expectations. There haven't been many advances in the adoption or utility of these products, and there's little hard evidence of the effectiveness of these tools. There is now more discussion about how to vet the products for quality. Initially, the more complex PHMTs are likely to be provided by healthcare payers or personal health record (PHR) vendors. Eventually, healthcare providers will become the dominant promoters because of changes in healthcare payment approaches that will reward them for taking an active role in managing patients with chronic diseases. Healthcare reforms in the form of patient-centered medical homes and accountable care organizations require

patient engagement. PHMTs provide a useful way to connect to patients, and this may accelerate adoption rates.

User Advice: Healthcare delivery organizations (HDOs) should roll out PHMTs, especially for subsets of their patients with chronic or complex medical conditions. At the very least, organizations should be implementing procedures to vet the quality of these tools. Although the general public isn't embracing these applications as strongly as hoped, there's increasing evidence that individuals who have complex medical conditions and are motivated to participate more actively in their healthcare will use PHMTs. HDOs, as trusted advisors, are in an ideal position to promote the use of PHMTs.

Business Impact: Patient noncompliance has been shown to be one of the largest components of increased medical expenses. PHMTs may lead to greater patient engagement and, therefore, better compliance, although this is more theory than fact. In addition, PHMTs could profoundly improve the quality of care delivered to patients. Key to this change will be the difficult tasks of achieving patient acceptance and use. In the new era of pay for performance and documented quality, HDOs that provide good PHMTs can be in a better position to attract patients and reap the benefits of pay-for-performance initiatives.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Fitbit; MyFitnessPal; OptumHealth (myOptumHealth); WebMD

Sliding Into the Trough

Patient-Centered Medical Home (Healthcare Providers)

Analysis By: Thomas J. Handler, M.D.

Definition: The patient-centered medical home (PCMH) is a holistic model that designates a personal physician to integrate all care, and includes the patient and, as appropriate, the patient's family or authorized representative. It impels the effort required to create and maintain such a care model by financially rewarding providers who perform these services.

Position and Adoption Speed Justification: The basic premise of the PCMH is that having a personal physician responsible and incentivized to track the entire care of a patient, regardless of where that care is taking place and who is performing that care, will result in better and more cost-efficient care. Note that this Hype Cycle entry assesses PCMH in light of the U.S. market. While similar practice models are being discussed outside of the U.S., they are in the very early stages and are not called PCMHs. The utility of the PCMH relies on information exchange among all medical care providers working with a patient. The model also requires patient participation to maximize the improvement of health status and medical costs. It consists of a definition of

principles and characteristics, rather than a specific and unequivocal set of defined attributes. These principles are:

- Personal physician

- Physician-directed medical care

- Whole-person orientation

- Coordinated and/or integrated care

- Quality and safety integration into care delivery

- Enhanced access to care

- Payment changes to fund the medical home

Although there is a great deal of discussion about the PCMH model, especially in light of accountable care organizations, adoption remains slow, because it requires changing reimbursement models from government and private healthcare payers. We are tracking adoption by looking at the number of certified PCMHs as a percentage of estimated numbers or primary care practices. Some industry leaders (and demonstration project participants) have adopted some version of the medical home approach in advance of the payment and are helping to define just what episode groupers and/or other service definitions and processes should be adopted. These experiences will help to push or inhibit further changes.

At this point, there are few true PCMHs where there is a personal physician, overall coordinated care and sufficient technology to support the model. Some large hybrid (covering both the provision and payment of care) organizations (such as Kaiser Permanente and Geisinger Health Systems) have started down this path and have the potential to reach large numbers of patients. However, as of yet, they only have some of their patients in PCMHs. The PCMH requires significant information exchange between and among all of a patient's medical care providers. For this to be accomplished, providers must be using advanced clinical systems, and there must be more trust and business arrangements between providers.

Growth in ambulatory services, interest in tighter business alignment with physicians for referral business, and the U.S. Centers for Medicare & Medicaid Services (CMS) PCMH are all forces driving the acquisition and employment of independent physicians and practices. These forces help propel PCMHs. To date, the most successful organizations employing the PCMH model have been large integrated delivery systems that have implemented a fully integrated (not interfaced) clinical application that crosses most, if not all, care venues, but especially inpatient and outpatient settings. The model also includes patient participation to maximize the value of the effect on health status and medical costs. For most organizations, the issues involving the patient have not been fully fleshed out.

Many private health insurers, while appreciative of the PCMH concept, have been hesitant to fully embrace the concept because of concerns that it will not actually positively impact cost savings and quality.

User Advice: The PCMH model can be key to helping clinicians provide a higher and better level of care. Healthcare delivery organizations (HDOs) need to be prepared for when healthcare payers opt to reimburse for this model. In the meantime, ensure that advanced clinical systems are in place, and that the culture of transparency and process improvement exists.

Business Impact: The differences in the value proposition for the PCMH model and its use vary among payers and providers. Although the goals of the PCMH are almost universally considered admirable, there are skeptics who do not consider that it brings value to patients. Some early evidence from CMS pilot sites and from Kaiser and Geisinger do tend to support the notion that, when done correctly, there can be cost savings and increased quality of care delivered. However, the costs for IT enablement and provider practice changes may prohibit the investment in the PCMH. Factors in question include the degree to which there are valuable changes in the way care is delivered, and the elimination of duplication and defensive medicine practice patterns.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Recommended Reading: "U.S. Health Reform 2010: Healthcare Delivery Organizations"

Patient Throughput and Capacity Management

Analysis By: Vi Shaffer

Definition: Patient throughput and capacity management (PTCM) systems, formerly patient throughput and logistics management, are a next-generation evolution that springs from earlier bed board/bed management applications. It represents new, more sophisticated thinking about patient management concepts and moves away from simple process/occupancy single-point support. PTCM includes means to analyze patient flow, anticipate downstream demand, monitor and alert to progress against clinical pathways, and adjust in real time to changing circumstances.

Position and Adoption Speed Justification: Because hospital operations cost and resource utilization are a hot topic, especially during times of pressure on government spending, this is a quest for a next-generation, more fact-based and logistics-informed PTCM. The value of optimizing patient throughput and resource/capacity management is well-understood by most healthcare organizations, but big breakthroughs have yet to be achieved by current market offerings. While there remains this gap, significant investments are being made by major vendors such as McKesson and GE Healthcare (which is also currently conducting an intense media campaign on this capability touting $2 billion in investment). Evidence of repeatable successes in improved throughput, combined with a heightened need for more-efficient hospital operations to deal with payment pressures from payers, will spike market interest in the next two years. However, the substantial amounts of R&D still needed, and work to be completed to standardize deployment and services approaches cause Gartner to predict that mainstream adoption is still more than five years out.

Bed boards in emergency departments are fairly common. Bed board applications to facilitate patient flow, nursing and communications with housekeeping staff hospitalwide are also penetrating the market. The solutions that we define as truly PTCM are, however, fundamentally different. As with care management in the chronic disease realm, PTCM is a more patient-centered approach that focuses on coordinating processes, and the flow of groups of patients. This is one of many indications that the correct cohorting of patients based on enhanced combination of disease and risk assessment, matching them to more-personalized staffing assignments, and mapping them to a consistently-delivered bundle of hospital/physician processes emerges as a core competency. PTCM provides predictive models and real-time awareness of patterns of flow, use of resources and causes of process breakdowns that cause delay, inefficiency or poor quality. Of course, analysis of this "megaprocess" is equally key to its reinvention and conformity to new approaches.

Some vendors are now articulating a product vision farther along the PTCM lines, and beginning to deploy more functionality (e.g., algorithms and analytics), while other potential players are still largely providing improved visual alerts within bed boards, experimenting with sensors, analysis of processes and the physical flow of patients and clinicians to detect patterns and opportunities. PTCM's natural relationship with the data and workflow/decision-support capabilities of electronic health record (EHR) system (rules and workflow support) and admission, discharge and transfer (ADT) data makes this a fit for megasuite vendors.

PTCM winners will be those with more complete overall solutions for repeatable results that include real logistics experts in their development.

The vendors we list here are representative of those that have the interest and potential to more fully flesh out this application. Most do not have the full capabilities we allude to in this future-oriented entry, but are focused on evolving in this direction.

User Advice: Consider a fairly early investment in a PTCM system. Choose a vendor that is emphasizing situational awareness and operations insights, not just bed boarding or real-time location. Emphasis should be on situational awareness. The PTCM system should know and show where a patient or critical resource is relative to prescribed care pathways, and the underlying causes relevant to deviations in workflow.

The risk lies in failure to gain benefit from weak leadership and poor change management that alienates clinical staff or erodes, rather than enhances, the patient experience. This is a conundrum, because it's likely there is a correlation between greater opportunity to improve utilization, quality and margins through PTCM, and poorer change management skills (noting the exception for hospitals with challengingly high percentages of uninsured, poor/Medicaid patients).

A senior enterprise leader will need to be responsible for PTCM at the health system level, at least to oversee the enterprise's hospitals. The sponsor will most likely be the chief nursing/clinical officer or the COO. Throughput touches all departmental domains and is also closely linked to quality/safety management, as well as the traditional functions of utilization review and case management. Many large integrated delivery systems (IDSs) are still working to create the consolidated operating model, leadership and culture of "systemness" that will enable them to direct enterprise best

practices. Larger organizations will benefit greatly from drawing interfacility comparative benchmarks such as hold times, utilization and key patient satisfaction metrics.

The vendor landscape will be fragmented for some time. Pick a specialist with some early successes with an approach that looks repeatable. The systems will commonly help the organization analyze patterns of activity, timing and efficiency of processes, and they will affect throughput to a greater degree than bed boards or location services alone. Not all of the current solutions use real-time location/sensor technologies, but we believe that will be an essential component for assessing conformance and informing process analysis.

It is advisable to think beyond real-time location. Emphasis should be on situational awareness. Simply pinpointing a location on a map should not be considered on a par with true operational insight. Ultimately, health systems should know where a patient or critical resource is relative to prescribed care pathways, and the underlying causes relevant to deviations in workflow.

Business Impact: These systems aim to deliver higher patient throughput at lower resource use and are a key part of evolving toward the real-time health system. They do this by providing real-time, hospitalwide visibility into operations, patients and resources. While many in healthcare have become more focused on chronic disease management strategies, there is still critical work to do in making hospitals more efficient, maximizing asset and scarce human resources use by optimizing patient throughput and quality.

PTCM systems offer the strong long-term potential to significantly improve patient flow and resource use for complex HDO processes akin to advances in the manufacturing industry. Therefore, we rate the potential benefit as high. The few offerings in this arena are largely unproven in terms of that magnitude of impact. Gaining this high impact will be elusive for most health systems, when one considers the complex process re-engineering, likely cultural resistance to change, and (in the U.S.) the major distraction of buying up primary care physician practices and creating/managing accountable care organizations for chronic conditions.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Allscripts Healthcare Solutions; Care Logistics; CentralLogic; Cerner; Epic; GE Healthcare; McKesson; Medworxx; Patient Focus Systems; TeleTracking Technologies

Recommended Reading: "Awareness Platforms Are Critical to the Real-Time Healthcare System"

LCST (Sensor) Application Platforms

Analysis By: Vi Shaffer

Definition: Location- and condition-sensing technology (LCST) application platforms provide a flexible, scalable enterprise solution that accommodates a wide variety of applications leveraging sensor technologies and wireless networks within the physical locations of the healthcare delivery

organization. Application examples include wireless healthcare asset management, temperature/humidity monitoring, hand sanitization monitoring, newborn location and patient wander monitoring.

Position and Adoption Speed Justification: LCST application platforms represent a natural evolution of a vendor marketplace that originally promoted one or two discrete sensor applications. Gartner previously has tracked the evolving hospital LCST market via profiles on wireless healthcare asset management and temperature and humidity monitoring, while noting the technology evolution and creative explosion of uses underway. An application platform vendor in this category provides a common and scalable system where multiple applications can leverage common data, tools and reporting capabilities. Vendors in this category must provide a more sensor technology-neutral approach to support a wide variety of LCST, often through multiple technology partners.

Although vendors have been marketing the multiapplication approach for many years — and delivered some — we conclude that the landscape is still shifting (with mergers and acquisitions, shifting fortunes and failures among relatively smaller vendors). Companies are still proving their full financial viability, scalability, extensibility and ability to serve large enterprises across many applications. Thus, we place this at the midpoint between the peak and trough. For this category to move to plateau requires both demonstration of scalability for larger enterprises to manage at the corporate, regional and local levels, flexibility around types of sensors and applications, and investment in developing and providing additional innovative applications. To be enterprise-scale platforms, winning vendors will mature in their software development (for example, the use of agile), standardize enterprise deployments and spruce up customer support operations.

Some health systems' in-place vendors have evolved to this approach, and HDOs have worked with vendors to help make them capable of this important transition. Those that are will win more of the business now and are going in the direction that health systems should plan for. Notable is the very large (maximum value $543 million) real-time location system contract by the U.S. Veterans Health Administration — covering 152 medical centers and seven outpatient pharmacies. It's not the only example of this trend, but is a very visible and sizeable one. (This contract was actually awarded to a team led by HP as the system integrator providing program and implementation management, operations planning, and site readiness. It teamed with Intelligent InSites as the platform vendor, plus CenTrak and WaveMark. The program will start with tracking equipment and supplies using Wi-Fi).

Although we benchmark this profile against U.S. hospital penetration, this is a category where the U.S. does not represent earlier use than elsewhere. Appeal and adoption patterns are similar in major hospitals around the world, although the vendor landscape and early application priorities do vary. For example, their national focus regarding newborn tracking and safety has been presented by Saudi officials at conferences.

Individual applications generally rate a "moderate" value assessment, in total and with creative innovation in the field; however, we assess that these will be "high" in value as enterprise platforms.

User Advice: CIOs need to assert leadership and move toward an enterprise platform decision in this important application area. In the past, discrete sensor application purchases have often been led by departments, such as biomedical engineering for wireless asset tracking, or nursing for

refrigerator temperature and humidity monitoring, infant tracking, or patient wander uses (prevalent in nursing homes). Multiple vendors have proved that they can deliver value at this level.

An LCST platform purchase, in contrast, requires a CIO-directed enterprise procurement process, a substantial evaluation of vendor architecture, core competencies and business viability. CIOs want to be sure that executives and managers across at least the hospitals are exposed to the many potential uses of the platform, and prioritize among them. As with other major application arenas, these vendors will move from tactical considerations to being strategic to the enterprise. Strategic vendors earn their place at the planning table, and participate in regular road mapping for new applications and additional facilities.

Monitor, report and benchmark across facilities to drive standards and best practices, and achieve economies of scale.

Business Impact: Although many individual LCST applications offer clear and quick ROI (such as wireless healthcare asset management and temperature and humidity monitoring), taken discretely, each is relatively moderate in the context of the enterprise's total operating budget and key strategic initiatives. In aggregate across many applications, however, the platform approach offers a total value potential that we assess as "high." These platforms reduce operating/capital expense from more effective asset management, improve clinical and biomedical staff productivity, improve patient safety/security, aid regulatory and Joint Commission compliance, and can positively impact patient throughput. We've only scratched the surface of their total potential. Prior Gartner research suggests that healthcare will be one of the biggest beneficiaries of sensors overall.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Allscripts; Awarepoint; Cerner; Ekahau; Epic; GE Healthcare; Intelligent InSites; Stanley Healthcare

Accountable Care

Analysis By: Vi Shaffer

Definition: "Accountable care organization" (ACO) as used here is an umbrella term for a major switch in contracting between providers and public or private payers. In an ACO model, a group of providers, operating as a legal entity, contracts to assume some portion of the risk for cost and quality for a panel of beneficiaries through a variety of value-based payment models over a specified contract period. ACOs include primary care services. The U.S. CMS Distributed Shared Savings Program, which began operation in 2012, is one version of this model.

Position and Adoption Speed Justification: Although the term "accountable care" is used primarily in the U.S., concerns for coordinated management and optimal outcomes — particularly for patients with one or more chronic diseases — is a major health and healthcare issue for government officials and private stakeholders around the world.

Proponents of accountable care models recognize that:

- The risk of and occurrence of chronic diseases (such as cardiovascular disease, diabetes and hypertension) have become an "epidemic" — a dominant driver of total/rising healthcare costs and quality of life/productivity issues for developed countries and are becoming more dominant in the developing world.

- Morbidity for chronic diseases is much higher in many countries because they have much larger elderly populations living much longer in the 21st century.

- Chronically and acutely ill patients frequently are managed to low standards of total quality and efficiency that suboptimize the overall health system in favor of specific stakeholders.

- Pure fee-for-service/activity-based payment models neither motivate healthcare providers to change siloed service delivery approaches nor encourage patients to pursue better approaches.

Accountable care models, therefore, include a variety of grand and more modest payment models and quality metrics to encourage/leverage a trusted relationship between provider and patient for proactive disease prevention and management in individual patient care, as well as population health management.

A further proposition put forth in support of accountable care is that, although investments yield longer-term gains, it can be funded largely by near-term savings. Relying on near-term savings or outside capital is important because healthcare costs have risen to the point where there is no room for long-term investments without sure moderations in the rise of costs. This belief is supported by the notion that high-risk patients represent the "low-hanging fruit" of cost improvement. That is, if new ACOs focus on identifying them and some improvements in primary care, engagement, and the transitions and coordination of care, they can achieve a sufficient level of savings to share between the payer and the ACO payers.

A good measure of ACO penetration over time is the number of primary care physicians (PCPs) who work in practices with ACO arrangements compared to the total number of PCPs as the denominator. However, this is tricky to count because of the wide arrange of ACO-type contracts with a wide variety of payers. Many approaches will overcount our measure because not all patients in the practices will be covered by ACO patient arrangements. It may also undercount because ACOs are typically measured by the costs of many services not provided by PCPs. To the extent the information comes from payers, there is a concern for double counting, because ACOs will contract with more than one payer. Nonetheless, this measure is a reasonably stable way to track progress from year to year, because virtually all ACO models rely heavily on having a primary care practice to be the pivot point for population-based risk stratification, physician- or team-based chronic disease management, and coordination of the application of more-specialized medical services.

Our current approach is to apply our measurement to U.S. PCPs. We know that some countries (so far, smaller countries) are ahead of the U.S. in adoption of effective chronic disease management models or other precepts of accountable care, but the variety of models and implementations of

them in the U.S. make it a good overall bellwether for assessing international progress to a Plateau of Productivity of this new paradigm.

This is a radical departure from traditional care models for most health systems. Significant issues will arise such as the effectiveness of quality measures, the ability to track all costs for patients in publicly funded health systems, and techniques that ACOs, participating healthcare providers and payers use to "game" the system. Therefore, the definition, adoption and success of the model will continue to go through periods of discovery, hype, progress, disillusionment, stalled progress and renewed determination for many years.

Because a number of U.S. health system executives have projected that ACO-type business will account for 25% or more of their revenue in five years, but not be a significant percentage of their business in the short-term years, and because of the substantial acquisition and aggregation of primary physician practices into healthcare delivery organizations (HDOs) just beginning to target ACO business, we expect that the ACO model will enter the Plateau of Productivity at 20% adoption between five and 10 years from now, probably closer to 10 than five.

The same time frame will apply to adoption of the first iterations of ACO-specific IT solutions. New and innovative IT solutions, however, will arise as the industry gets experience working with the model. The specific information and communication applications and systems necessary to measure and manage an ACO are emerging — some derived from payer disease management and claims analytics approaches. The list of representative vendors here is an eclectic landscape that includes current healthcare megasuite vendors extending their reach, IT megavendors with analytics and CRM platforms, large payer corporations with a portfolio of acquisitions and/or development efforts, and specialty vendors. Applications include care management/patient relationship management (CRM systems), patient portals/and patient engagement tools, related content suppliers, and various claims and clinical data-based patient, provider and performance analytics, benchmarking, and predictive modeling.

User Advice: If the HDO is entering into ACO models now, contract with vendors that can deliver essential functionality now (population health analytics and flexible patient cohorting, Medicare/claims analysis, gaps in care identification, care management systems and patient portals).

Recognize that this is a roiling and confusing vendor market with many unfamiliar new entrants, lots of venture money, emerging partnerships, rapid acquisitions, and many market successes and failures to come. The landscape and names of companies you consider today will be substantially different from the market leaders in five years. The representative vendors listed in the Sample Vendors section have current capabilities or serious strategic intent, capital and pending products behind ACO-related product strategies.

Incorporate consideration of healthcare megasuite vendors' ACO and value-based purchasing functionality into your planning and into your evaluation criteria if you are adding an EHR or considering replacement of an incumbent.

HDO business and medical executives — including CIOs — should step up to being the ones to define the specific responsibilities and lead the march to a new paradigm. For the more reticent, the demand to rethink the old ways will be thrust on them by government policymakers and public/

private payers. However it happens, HDOs and their CIOs and chief medical informatics officers need to be prepared for this eventuality.

It remains to be seen what is a sufficient improvement, but a big advantage goes to ACOs that are operated by HDOs that already employ the required spectrum of clinicians, include the necessary range of venues, and have invested years in "clinical integration." These create the culture and governance among clinicians that enable them to collaborate holistically on the patient. These HDOs are also likely to have successfully implemented high-functioning EHR systems, patient portals, advanced analytics and other innovations in IT that enable their organizational changes.

Advancing into higher-growth segments (ambulatory services versus inpatient acute care) compel the ambitious health system to play and are driving aggressive merger and acquisition activity. HDOs in competitive markets that lack the necessary positioning and preparation for ACO and value-based purchasing services bundling with physicians face serious erosion of their market position and probably their margins. This new patient-centric operating model is a major shift, and likely cannot be achieved by trying to make incremental advances with minimal resource investments.

Larger HDOs that have learned to think and act like a system should harness high value from electronic health records (EHRs) and cost accounting systems, and demonstrate a performance-curious culture. If your HDO falls short in these areas, then focus there. The information sharing, manageability, conformity, agility, financial sustainability and resource leverage challenges are much tougher to tackle under loose federation organizing principles and operating models. Strong EHR, patient scheduling and revenue management systems, and the ability to share patient information, are necessary parts of an operating foundation for the ACO model, but are not sufficient. Next up are care management/CRM and analytics approaches that leverage administrative, clinical and other data to monitor, report and better understand structure, process and outcome relationships. Note especially that ACO population health analytics differ from the analytics priorities HDOs would set under a traditional operating model, so information governance and prioritization are quite important. Consider using specialized vendors for ACO needs, at least for the next three to five years, while working with your megasuite vendors to expand their integrated capabilities and strengthening your internal analytics capabilities.

Business Impact: A significant number of HDO executives responding to U.S. surveys expect that accountable care will make up more than 25% of enterprise revenue in five years. The ACO (with substantial required IT support) is, therefore, transformational. Equally significant is that it requires the major redesign of the care processes and player roles of previously siloed overdelivery and underdelivery of service healthcare delivery players (for example, physicians, hospitals and home health) into an increasingly integrated and managed system of care, at least for higher-cost, higher-risk patients with one-to-many chronic conditions. The major impact and the requirement for finding new ways of doing business mean that ACOs have the potential to be transformational.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Aetna; Allscripts; Caradigm; Cerner; Elsevier MEDai; Epic; Explorys; GetWellNetwork; Health Care DataWorks; Health Catalyst; Healthways; HealthyCircles; Lumeris; McKesson; Net.Orange; NextGen Healthcare; Optum; Oracle; Phytel; Premier; Recombinant By Deloitte; Siemens Healthcare; Solutions Hospitalis SEC; The Advisory Board Company; Truven Health Analytics; Verisk Health

Recommended Reading: "Top Actions for Healthcare Delivery Organization CIOs, 2013: Support Provider-Led Care Management"

"Care Management Defined: Clarifying the Terms Used in the Analysis of Care Management"

B. Spooner, B. Reese and C. Konschak, "Accountable Care. Bridging the Health Information Technology Divide," Convurgent Publishing, 2012.

Advanced Clinical Research Information Systems

Analysis By: Vi Shaffer

Definition: An advanced clinical research information system (ACRIS) is a complex constellation of capabilities that can rapidly assemble data assets for clinical research questions. It also provides data mining and research process support to meet the needs of clinical and translational research, and related biostatistics and biocomputation. It includes open-source components and, this year, includes having an approach for "big data" problems.

Position and Adoption Speed Justification: This Hype Cycle entry is relevant to those healthcare delivery organizations (HDOs) around the world for which medical R&D and formal clinical research are considered a core capability for driving and delivering medical innovations, and also a big business. This year, rather than making existence of electronic health record (EHR) systems a capability on the list, the perspective is that the existence of data from EHRs is a presumed foundational asset for building an enterprise ACRIS. There might be an enterprise research asset including some clinical data without EHR data, but it is not what we mean by an ACRIS.

In this entry, we measure the position toward the Plateau of Productivity in creating an ACRIS environment by looking at the evolution of academic medical centers or other nonacademic HDOs that have made significant clinical research part of their agendas. This is a far smaller "denominator" than most of the entries in this Hype Cycle that benchmark against penetration in the midsize-to-large hospital/health system market overall. For example, an ACRIS is required to remain competitive as one of the 60 U.S. National Institutes of Health (NIH) Clinical and Translational Science Awards (CTSA) grantee institutions. (The term "translational" is used to mean research that transforms scientific discoveries arising from laboratory, clinical or population studies into clinical applications to reduce the incidence of disease, morbidity and mortality.) Other countries have analogous and complementary initiatives for a limited number of like-focused research institutions. Life science companies leverage ACRIS and are creating their own more advanced research infrastructures. One key trigger driving more CIOs and IT services department involvement with clinical research is the increased adoption of commercial EHR systems. This makes a rich set of

structured and unstructured patient clinical data available in near real time and over time. The rapidly advancing interest in and funding for genomics, translational and collaborative research, and population health research are companion drivers of demand. Funders of research expect — and increasingly require — an ACRIS in place.

Much clinical-research-related IT has, in the past, been under the independent domain of researchers and grant recipients, with limited attention and less ability for assistance from the enterprise CIO. The ACRIS market is a subset of the total health system market, limited to those organizations of scale and gravitas in clinical research — mostly academic medical centers (AMCs), but also some other innovative health systems. Thus, adoption is measured against a much smaller set of organizations than most of the applications in this Hype Cycle. Some institutions have already made investments to position themselves. The competitive nature of clinical research is fueling speed in adoption, and grant awards are aiding investment. Because ACRIS needs evolve rapidly — partly because of open-source work, it is somewhat tricky to create a stable definition and track progress of the whole package together, so we track the progress of key components and the maturity of the IT department's engagement with, and ability to, support clinical research in the post-EHR era. This year, instead of making "big data for clinical research" a separate Hype Cycle entry, we have enfolded it as a capability embedded in the ACRIS, with internal development, on-site hosting and external big data/cloud services all available as options.

Note that there is quite a bit of overlap between how an enterprise will envision and construct an ACRIS, and the need for serious investments in the emerging field of population health management analytics and research (covered in this Hype Cycle as population health analytics).

Key attributes of the ACRIS have been adjusted for 2013, and now include:

- The acquisition of data into an enterprise data warehouse (EDW) and into a common frame of reference. Data for clinical research is typically scattered in hundreds of databases (including registries) throughout and outside the institution — an even greater challenge than the EDW for operational analytics. The EDW data model approach must meet the unique needs of AMC clinical research, and leverage master data management and metadata techniques and best practices.

- Enabling the capture of clinical information for patients in clinical trials within EHR systems and making this accessible via the ACRIS.

- A well-functioning IT and information governance (IG) process that ensures compliance with patient privacy and security mandates, and the organization's institutional review board (IRB) requirements. IG also establishes the balance of investment priorities between new business initiatives (like accountable care management), current operations needs and the demands of the research business. The IG must be agile and flexible, most likely with a working committee and/or task force structure so that urgent requirements can be addressed under major new grant awards or research business funding.

- A road map for information creation needs and a logical data warehouse architecture that offers a big data option when important research requires mining a complex array of data — the volume, velocity, variety and/or unstructured data that such breakthroughs enable.

ACRIS includes tools that enable:

- Mining patient data, including data contained in transcribed and other unstructured reports

- Automatic correlation of data with medical knowledge in published research, providing more-effective/efficient secondary research

- The use of external data and open-source tools, including assistance in translating between ACRIS data models and vocabularies, and those of other institutions, for collaborative research

- Flexible patient cohort identification

- Creation of research study data marts from enterprise and other clinical trial data, including the ability to deidentify patient data as required

- Facilitation of researcher workflows, including support of the scientific method, grant preparation, internal/external collaboration and documentation

- Enablement and management of expanding open-source capabilities like Informatics for Integrating Biology and the Bedside (i2b2) and tranSMART.

Note that the EDW and other people, process and tool/technology investments may be shared and leveraged for ACRIS as well as enterprise performance management. This combines information and data governance, data stewardship and enterprise master data management. However, the requirements for clinical research are very different from — and even more complex than — the requirements for the EDW. Vetted exceptions from IT/information governance principles, central management and enterprisewide standardization need to be permitted. IRB approval for data use is part of enterprise IG and data access rights.

User Advice: An ACRIS is not a single packaged solution an enterprise can just go buy, but certain vendors are actively positioning it to be central or value-added for an enterprise's research ecosystem. CIOs and chief medical informatics officers (CMIOs) play increasingly important roles in an organization's clinical research mission and business. They need to build effective frameworks for working with clinical research leaders, which can be extremely challenging for both sides of the relationship. The architecture and investments to enable research and health system performance management are related, and can be spread across both purposes. However, absent strong IT and IG, the risk is that each could feel bogged down by the other.

To collaborate, clinical research leaders need to learn and comply with privacy and security requirements, as well as breach reporting; become part of IT governance; and participate in the IT and information prioritization process. Research platforms need to implement restrictive U.S. HIPAA policies for data distribution and patient privacy protection. HDOs need to address the legal framework within the U.S. Health Information Technology for Economic and Clinical Health (HITECH) Act relating to research data management requirements for deidentification, audits of use and consent collection. Open-source solutions and licensed tools offer deidentification strategies.

In turn, IT staff need to increase their knowledge of the processes and language of clinical researchers. Many are unfamiliar to IT staff. We provide some of the important examples and their acronyms here to show the variation and complexity that researchers must deal with:

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- Standards for controlled medical vocabularies in Unified Medical Language System (UMLS) and related common standards; management and education services for healthcare (MESH); ICD-9 and ICD-10; current procedural terminology (CPT) codes; RxNorm; the National Drug File-Reference Terminology (NDF-RT), produced by the U.S. Department of Veterans Affairs; Logical Observation Identifier Names and Codes (LOINC) database for laboratory; and Clinical Data Interchange Standards Consortium's (CDISC's) Biomedical Research Integrated Domain Group (BRIDG) model for clinical trials. (CDISC isn't the main player at academic sites, but is important to pharmaceutical/life science firms.)

- There is an NIH mandate to be compatible with the Cancer Biomedical Informatics Grid (caBIG). Furthermore, the i2b2 Center, directed by Partners HealthCare (Boston, Massachusetts), which oversees a scalable informatics framework, provides a forum to bridge clinical research data and vast basic science data banks. Other open-source categories include OpenClinica, caTissue and GenePattern.

- A new open-source asset was added in 2012, with the first open-source version of tranSMART software, which provides an open framework to the translational research community for integrating and sharing data across medical records, clinical trials, reference content and "omics" data. It is a product of multiple collaborations among nonprofit AMCs, pharmaceutical companies and commercial groups (see www.transmartproject.org).

- Accessing online reference information is now also a critical factor in research architectures — the known published information places research observations into the context of the known facts about related biological markers. Integration of external datasets is increasingly common. For example, there is Gene Expression Omnibus; Japan's Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway maps database; The Cancer Genome Atlas (TCGA) portal; The Single Nucleotide Polymorphism Database (dbSNP) for genetic variation within and across different species; and access to the U.S. NIH National Library of Medicine's Entrez retrieval system, which includes the PubMed database of life science and biomedical topic citations.

ACRIS is, in a sense, the missing link for the much-hyped convergence of life sciences and healthcare, including clinical effectiveness research. Recommended actions for stakeholders and IT/healthcare informatics leaders include:

- National or provincial ministries of health need a more cohesive approach at the national policy and standards level. Multiple standards across different life science systems (dominated by CDISC) and healthcare (led by Health Level Seven [HL7], LOINC, etc.) could be confusing. Convergence efforts are important.

- Governments targeting a distinctive position in research should incorporate an ACRIS vision into their national IT policies and planning for government-owned or grant-funded AMCs. There must be extensive involvement from public- and private-sector sponsors and research leaders.

- AMCs serious about future clinical research business should continue to invest in the EHR system, operations analytics and the ACRIS, while bringing planning, governance and master data management to a more mature level.

- Life sciences (including biotechs) and healthcare providers continue to operate as silos. Both need each other and need stronger vision and collaboration around availability, structure and use of real-time data.

- Platform decisions for ACRIS should incorporate how those platforms will enhance or detract from collaboration between institutions and pharmaceutical partners through integrated research networks and across main sites.

- CIOs and chief healthcare information officers (CHIOs)/CMIOs should introduce a research informatics role, and possibly an epidemiologist or biostatistician, into the informatics or data warehousing team, with responsibility for understanding and guiding support of researcher data and workflow needs. They should also become more familiar with the role of big data capabilities for research.

- CIOs and CMIOs also need to be well-informed about the requirements and processes of the IRB regarding data capture and uses of patient information for research. However, the lead IRB responsibility should not reside in IT.

- Consider contracting for outside commercial vendor support and implementation services for open-source clinical research frameworks.

- Ultimately, aim to leverage tools and data for ACRIS and performance management/analytics, recognizing that the needs and tools of each do not suffice for the other.

Business Impact: Clinical research is a big business and an important part of the brand for many prestigious health systems, and there is substantial competitive pressure. Information and technology breakthroughs are conspiring to create a revolution in clinical research that will ultimately advance personalized medicine as the next medical model.

AMCs that do not invest in an ACRIS will have increased difficulty competing for research contracts and grants, and will face diminished stature and global funding within five years. In the U.S., CTSA and the National Cancer Institute are to conduct more collaborative studies and to share knowledge produced between funded research sites. This is a fundamental, challenging and incredibly exciting change in the expectations set for clinical research leadership.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: IBM; IDBS; Informatica; Microsoft; Oracle; Recombinant by Deloitte; SAS; Teradata

Recommended Reading: Clinical Data Interchange Standards Consortium

Cancer Biomedical Informatics Grid of the U.S. National Cancer Institute/National Institutes of Health

Informatics for Integrating Biology and the Bedside Center

Computer-Assisted Coding (Hospital)

Analysis By: Vi Shaffer

Definition: This entry tracks computer-assisted coding (CAC) specifically for coders or hospital/ acute care services, as opposed to assistance at the point of clinician documentation. CAC includes natural-language processing (NLP) and "black box" intellectual property to automatically identify medical concepts/terms within documentation; consider the context in which words are used; assign disease classifications and/or procedure codes; and generate a set of medical codes for validation. CAC presents precoded charts for medical coders to scrutinize.

Position and Adoption Speed Justification: Gartner is tracking CAC based on U.S. enterprise adoption. It is approaching the Trough of Disillusionment in this year's Hype Cycle due to a significant number of contracts with major vendors now including these capabilities, but still immature quantification of value/ROI. As more health systems turn on this capability, the evidence of current impact on coder productivity will become more clear. However, we project that the Plateau of Productivity in terms of CAC being just an expected feature and value for hospitals will now be achieved in three to five years. General market awareness of CAC and the enfolding of specialists into major coding software players (including the earlier 3M acquisition of partner CodeRyte and Optum's of partner A-Life Medical, and the acquisition of QuadraMed's Quantim by Nuance) demonstrated conviction in CAC's importance. As expected, the lines between CAC and these vendors' base have blurred.

CAC's earliest successful application has been in radiology; proof and quantification of value for hospital coding are still limited. Radiology presents a simpler set of CAC challenges than does the broad array of hospital/acute care documentation. However, a particular trigger for the flurry of acquisition, development and aggressive sales efforts among vendors is around the looming U.S. market shift to ICD-10. The justifiable extreme worry among healthcare delivery organization (HDO) executives is about the impact on cash flow and total revenue. This is triggering mainstream adoption. As further proof congeals, adoption should surge ahead fairly rapidly.

User Advice:

- Consider incorporating CAC into ICD-10 transition plans, but with conservative expectations of the benefit. Note that to install CAC now an HCO is gambling that the current vendors' continued R&D will be sufficiently agile to actually accomplish a significant improvement in productivity or accuracy during the pell-mell period where ICD-10 is being rolled out. The upside of the gamble is to fall behind in billing less than competing hospitals. The downside is additional delays or the need to revisit vendor capabilities as the market begins to settle down.

- Recognize that NLP and CAC are moving more under the purview of larger vendors, and that there is an intriguing "battle royal" going on for where and how the application and impact of computer assistance will toggle between computer-assisted documentation and CAC (the battle royal between and among 3M, Optum, Nuance, M*Modal and other players).

- Demand updated real-world data on experiences and impact. It is difficult to compare the black-box heavy-lifting intellectual property that goes into CAC. As more early adopters go live,

shift scrutiny to facts about what works from key revenue management metrics and best practices perspectives. Ask vendors to clearly document early best practices that early adopters have applied to gain maximum benefit.

- Recognize that CAC providers will continue to improve accuracy and effectiveness — the more they see data, apply their methods and scrutinize results, the more these learning systems improve. Therefore, keep an eye on whether acquiring companies retain the R&D, and analytics talent and commitment for further investment to advance their CAC positions.

- Pay attention to the evolving role of the health information management (HIM) department and the work of associations like American Health Information Management Assn. (AHIMA) and Association of Medical Directors of Information Systems (AMDIS) in redefining roles and responsibilities for HIM and medical informatics. Together, NLP/CAC, electronic health record systems and the need for more-advanced enterprise information management will transform roles that were defined in the paper era.

Business Impact: CAC is relevant and of potential benefit in every country that needs to improve the processes of care, study population health and especially for those that require complex coding for revenue cycle management. Ultimately, CAC will improve revenue cycle management by increasing coding accuracy, cut the cost to collect, and create objective and traceable defensibility. CAC will provide more-upfront decision support to deflect the revenue risk of initiatives, like the Centers for Medicare & Medicaid Services (CMS) Recovery Audit Contractor program. While real-world, hospital-focused use is picking up, more real-world proof, data and operations guidance are still needed.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 3M (Health Information Systems); Artificial Medical Intelligence; Dolbey; Nuance; Optum; Plato Health Systems; Precyse Solutions

Recommended Reading: "EIM 1.0: Setting Up Enterprise Information Management and Governance"

"Information Management in the 21st Century Is About All Kinds of Semantics"

Integrated Clinical/Business Enterprise Data Warehouse

Analysis By: Vi Shaffer; Mark A. Beyer

Definition: An integrated clinical/financial enterprise data warehouse (EDW) system includes an architecture, data model and systems that can incorporate at least electronic health record (EHR), claims/revenue cycle, ERP, cost accounting, and patient experience data (most commonly satisfaction survey data, but also social media feedback). The EDW enables large communities of users to develop/receive reports and dashboards/queries, and perform data discovery around core patient care and business processes and outcomes.

Position and Adoption Speed Justification: The past two years has been a period of encouraging and measurable progress for health systems' EDW efforts. An increasing number of institutions have been able to deliver a well-crafted EDW infrastructure and are achieving early benefits. HDOs are starting to benefit from the maturation of several vendors' "accelerator" offerings, including EDW architecture, commercial data models, extraction, transformation and loading (ETL), and master data management tools and related support services.

There are many reasons why the need and demand for a new integrated EDW are high. These include the aggregation of hospitals and providers into larger and more complex entities that must have timely and consistent performance reporting and dashboards, as well as the ever-increasing demand for public quality reporting. But the biggest trigger of urgent demand for a new information road map and EDW is the availability of a new and very important source of patient data that also adds complexity and a large number of new uses for an EDW — the EHR system. With the complexity of data and the many demands responding to point demands, data mart after data mart is an inadequate approach. In Gartner's experience, this approach falls apart because of its own data quality and mart management complexity after five or six years.

While there is much more market traction now, and we have upped market penetration to the very low end of the 5% to 20% category, many health systems are still struggling to gain top executive commitment, justify the investment, build strong information governance and settle on an approach. Therefore, while we have raised the market penetration category range based on a count of functioning EDWs, we have left our projected time to plateau in the five- to 10-year window. Note that this will likely move to the two- to five-year range in 2014, because of the amount of serious planning underway and the real, practical help vendors and consultants can now provide. Healthcare delivery organizations (HDOs) with EHR systems in place or pending, and which do not have a better EDW and information road mapping in their strategic plans, are falling behind.

Typically, the EDW is running on an online analytical processing (OLAP)-optimized data warehouse (as opposed to massively parallel or "big data"-era processing). HDOs leverage one or more business intelligence (BI) platforms for reporting, query, data mining and data visualization functions. Increasingly, EDW initiatives are including better and more healthcare-specialized tools and support for vocabulary services and enterprise master data management. Another important requirement is the ability to achieve more-timely assembly of data, alerting and near-real-time dashboards, and contemporary intervention to flag and correct process failures on behalf of individual patients still in the hospital. This kind of care gap discovery, alerting and intervention is also a critical component of successful accountable care organization (ACO) operations.

Our research confirms that the majority of HDOs with Generation 3 EHR systems in place are intending to begin this initiative over the next few years — and the particular struggles they are encountering is supported by multiple Gartner market surveys plus analysis of the very high volume of HDO inquiries to Gartner on this topic. The changing nature of client questions indicates the planning and execution progress being made. This is also borne out by Gartner's primary research with healthcare CIOs in multiple countries about key initiatives, enhanced by findings from the 2013 joint Association of Medical Directors of Information Systems (AMDIS)-Gartner survey of chief medical information officers (CMIOs). While in this Hype Cycle we benchmark this particular category against the U.S. market, health systems with EHR systems in place in other countries

already have this same need, and their adoption will closely track with similar U.S. HDOs. However, they often have different and a more limited number of vendors offering accelerators, and even more limited numbers of consultants with healthcare-specific EDW services expertise. Some smaller countries will achieve high adoption more rapidly because they operate large, centrally run, health systems covering all or a large portion of the market.

Note that more and more advanced HDOs are incorporating big data needs and approaches into their overall information road maps and governance. While we *do* now include big data capabilities within our requirements for advanced clinical research information systems (ACRIS) and population health analytics in this Hype Cycle, we *do not* include this as necessary for the integrated clinical/financial EDW (which has lots of value on its own using the traditional approach). However, CIOs should note that larger and ambitious HDOs are incorporating big data into their plans. Headlines from major health systems show this trend. For example, the University of Pittsburgh Health System's announcement of its $100 million EDW, analytics and big data deal featuring Oracle (and also Informatica, IBM and Allscripts dbMotion); the investments by Kaiser Permanente, Indiana University and Partners Healthcare in Health Catalyst; and the announcement of multiple new Explorys contracts (on top of the investment by Cleveland Clinic's investment) illustrate not just early bragging rights but a real spike in interest since publication of the 2012 Hype Cycle.

User Advice: A fatal flaw in data warehousing is failure to recognize that success requires leadership endorsement, culture change and executive willingness to have persistent performance curiosity, a systemwide view of accountability, and a talent for inspiring and driving change. Other success factors include appropriate funding, oversight, management and staffing for the IT as well as the business/clinical analysis functions. In other words, IT and informatics leaders can and should advocate for the EDW and other BI. However, CIOs can lead executives to insights, but they can't make them act.

Initial expectation management and communication are key at the outset. Strong continued marketing of EDW uses for current and new data, particularly identifying champions among the clinical leaders, should be a specified responsibility of the EDW director:

- Match the magnitude and timing of BI investments to the ambition of your organization for innovation and performance leadership, so that you don't end up without critical capabilities or with an orphan asset. If your EDW plan is emerging, and your accountable care analytic needs are urgent, work with an external provider for speed in meeting ACO needs.

- Understand the right order of EDW efforts. Evaluating BI platforms, databases, data models or picking technology partners are *not* the first steps in these endeavors. Business and clinical decision makers must be educated on needs, opportunities and success factors to prepare them to actively participate in making informed choices. This is critical activity for the CIO, because enabling high impact from analytics will be one of the differentiating achievements of top-performing CIOs over the next five years.

- Look to CMIOs/chief clinical information officer (CCIOs) reporting to the chief medical officer — who should be helping transform traditional quality improvement efforts — to become leaders in directing or championing BI for clinical performance improvement. This will be a differentiating

responsibility held by top performers in the field. When recruiting a new CMIO, look for a history with championing quality improvement efforts and an interest in analytics.

- Develop data warehouse "marketing" and change management competencies in IT. Support the clinical champions who raise their hands in wanting to lead information-driven change. However, also focus resources with an eye to enterprise "priorities, power and politics" to ensure high impact and enough of the right resources.

- Don't *overestimate* the overall time/resource savings that licensing a commercial vendor's data model alone will generate (see "Top Three Ways to Leverage Commercially Licensed Data Warehouse Data Models"). The large and eclectic list of representative vendors reflects the array of approaches and technology paths: BI stack vendors with healthcare BI data models, healthcare EDW/service specialists or consultants. No one approach or vendor has yet shown itself to be markedly superior. Based on the number of projects underway, the leader board should emerge from the fog in 18 to 24 months.

- Don't *underestimate* the data quality problems you will encounter, nor the resistance from some business or clinical staff to assuming data stewardship roles. The time and resources to resolve them initially and create a sustainable process must be factored into EDW timelines, and is a common source of delay. You must put in place effective information governance process and assign clear data stewardship accountability to business and clinical leadership.

- While the focus of CIO attention is often heavily weighted on the warehouse, database, data model and ETL decisions, don't take for granted that you should continue with or only with your incumbent BI platform vendor. There has been quite a dramatic change in the vendor landscape and capabilities contrasting the "traditional ways of doing BI mainly targeted at reporting" (and often with IT as the buying center) and data discovery and visualization capabilities. HDOs will want to avoid being held hostage to inadequate approaches by licensing penalties.

Business Impact: The potential impact of the integrated EDW is high for organizations whose leaders grab hold of it with both hands. While this kind of information can be transformational for the underperforming enterprise in theory — because these have the most performance gain opportunity — in practice, these are the least prepared to act aggressively on BI insights.

Thus, it is ironic but inevitable to conclude that those best positioned to reap high gains from BI are those that already perform better. These are HDOs that consistently get good-to-high value from the same software applications and effectively act on existing BI sources of key performance indicators (KPIs), quality measures and cost accounting data. These have strong leadership, aligned business and clinical leadership, and better-than-average performance already.

Therefore, although we rate the benefit high, we do so with the caveat that impact requires the combination of technology, dedicated leaders, and the intent and ability to change.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Cerner; Epic; Health Care DataWorks; Health Catalyst; Health Language; IBM; Informatica; Information Builders; InterSystems; McKesson; Microsoft; MicroStrategy; Oracle; Premier; QlikTech; Recombinant by Deloitte; SAP (Business Objects); SAS; Siemens Healthcare; Tableau; Teradata; Tibco Software (Spotfire)

Recommended Reading: "Predicts 2013: For Healthcare Delivery Organization IT Leaders, Great Potential Will Produce Greater Responsibility"

"Cool Vendors in Healthcare Providers, 2013"

"The Future of Data Management for Analytics Is the Logical Data Warehouse"

"Critical Factors in Calculating the Data Warehouse Total Cost of Ownership"

"Magic Quadrant for Data Warehouse Database Management Systems"

"Organizing for Master Data Management: People and Processes"

Personal Health Record

Analysis By: Wes Rishel

Definition: Personal health records (PHRs) enable people to gather, create, manage and share their personal medical information in a secure and confidential environment. While the information within the PHR may have originally been transmitted to the PHR by a healthcare organization (HCO — a healthcare delivery organization or a health plan), the copy in the PHR is entirely under the control of the individual described by the record or a designee. PHRs do not include portals that permit patients access to the digital health record systems of HCOs.

Position and Adoption Speed Justification: We are keeping the PHR on the Hype Cycle even though we predict it will not actually reach the Plateau of Productivity in most countries for at least 10 years, if ever. There are two specific barriers to the success of PHRs — difficulty in engaging enough patients to care about accessing their PHRs and difficulty in moving healthcare delivery organizations (HDOs) to transmit a patient's data to third-party PHRs. HDO reluctance can be traced to two issues. The first is the substantial costs of creating and operating interfaces to PHRs. The second is the HDO view that holding the patient data inhibits patients from moving to other HDOs or obtaining services from a mixed set of HDOs. The barriers are interrelated. One reason that people are not finding value in their PHRs is precisely because very little data from HDOs is present, and one reason HDOs are unwilling to invest in PHR interfaces is the lack of patient demand.

Despite many failures the topic continues to draw interest. Government policymakers see the PHR as the solution to a dilemma trading off concerns for people to control their protected health information and the benefits of sharing long-term patient data among healthcare providers, clinical researchers and agencies that monitor the costs of, and equitable access to, healthcare. Policymakers frequently further promote PHRs as assisting in the transparency necessary for free-market healthcare and the fungibility of healthcare services. While there is no evidence to support

these views, there is also no evidence to deny them, and they are an article of faith in conservative governments.

Another reason that the topic of PHRs continues to draw interest is that there are systemic changes in technology and attitudes that could conceivably tip the scale between barriers and incentives during the next five years. People with well-developed chronic diseases or motivation to improve their lifestyle are increasingly of the generation that are used to accessing their financial data and executing financial transactions on their smartphones, and they will expect no less for their healthcare data.

Patients are increasingly finding apps that combine smartphone usage with access on tablets or PCs and have come to appreciate having multiple different ways to access and manipulate their data "in the cloud." They are also seeing that smartphones and cellular data access finally provide real ease of use for recording home weight, blood pressure, oxygen saturation, glucose and activity. These same people, however, are finding that their data is siloed at the websites of different device vendors in the cloud. This may create demand for PHRs.

In the U.S., standards required for Stage 2 of the Meaningful Use incentive program address the issues of basic data format and content, security and a voluntary and disposable patient ID (the "Direct" address). This will remove one of the issues that have inhibited HDOs from contributing data to PHRs. The National Coordinator for Health IT and various patient advocacy groups are using their bully pulpits to draw attention to HDOs holding patient data for competitive advantage.

There is a further barrier to PHRs offering sufficient value to attract patient users. This is the willingness of healthcare providers to accept data that passed through the patient's control between one provider and another. Digital signature technology can create a substantial level of assurance that a report truly comes from the purported source and has not been modified. However, there are no in-place standards for doing this, and there are substantial cultural barriers to accepting such data into an electronic health record (EHR) system.

The most effective patient engagement will continue to come by having patients use portals connected to the EHR systems of HDOs. Nonetheless, patients in many countries will have their care provided by multiple HDOs over time, and some will have their care in multiple countries. There remains the possibility that portal use will be supplemented by PHR use. There is no doubt that PHRs will continue to be a subject of interest in many countries.

User Advice: HDOs should avoid heavy investment in interfaces to PHRs until there is reason to believe that their efforts will provide sufficient value to patients to tempt them to use PHRs.

In countries where governmental programs dictate participation in PHRs, HCOs that are covered by them must treat the programs as a compliance requirement (that is, they should target "good enough" compliance, rather than seeking competitive advantage by being more compliant than their peer organizations).

HDOs that resist sharing patient data for competitive advantage should recognize that they will eventually lose that fight. If PHRs become a viable proposition for patients, they will ultimately have to send data to them.

We are not aware of regulatory requirements to accept data from PHRs in any country. HDOs that decide to accept PHR data for regulatory compliance or business issues will need to invest in substantial change management to smooth the way for providers accepting the data.

This advice applies to U.S. HDOs seeking to obtain incentive payments or avoid disincentives under the Meaningful Use program.

Business Impact: If PHRs could meet all their goals equally, they would substantially contribute to changes at the transformative level, enabling innovative care processes to arise across the siloed collection of entities that comprise the healthcare system. This could improve the level of patient engagement and contribute to transparency that would enable consumers and payers to make insightful economic choices among care alternatives.

However, during the next 10 years, the most likely scenario calls for zero to low impact.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Dossia; Microsoft

Recommended Reading: "The Definition of EHR in U.S. Health IT Incentive Regulations"

"The Cloud-Based Personal Health Record"

CDR

Analysis By: Wes Rishel

Definition: A clinical data repository (CDR) is an aggregation of granular patient-centric health data usually collected from multiple-source IT systems and intended to support multiple uses. Because a CDR is intended to support multiple uses, we do not categorize the database within any single application as a CDR. When a CDR holds data specifically organized for analytics, it meets the definition of a clinical data warehouse.

Position and Adoption Speed Justification: The defining characteristic of a CDR is its capability to parse and organize clinical data, but useful products will also support administrative data such as claims or encounter records. CDRs frequently collect data from a larger number of sources than operational systems, such as an electronic health record (EHR) system. They may frequently collect data from multiple enterprises. CDRs frequently include the ability to work with unstructured data, such as textual support, and are offered on platforms that support ad hoc reporting over very large databases. Gartner does not include products in the CDR capability if they compress the input data by aggregation or exclusion of clinical details.

One important driver of the adoption of CDRs is the need to combine clinical data from the EHR and multiple other sources. The extended purposes include dashboards that monitor caregiving

processes in near real time and collect data for specific quality measures. The need for a CDR is particularly acute in healthcare delivery organizations (HDOs) that cannot achieve the ideal of a single enterprisewide computer-based patient record (CPR) system supporting all hospitals and all practices, or where collaborative quality-monitoring efforts extend across multiple HDOs.

HDOs will choose CDRs rather than purpose-built analytics tools when they envision multiple strategic uses for the same data and can tolerate the longer time to value associated with buying a tool rather than buying a fully functional product. Frequently, the multiple use strategy will combine analytics usage with interactions involving transactional data. For example, a CDR might support data gathering for population health management and the exchange of reports on individual patients among collaborating organizations in an accountable care organization.

The large spike in HDO interest in analytics purchasing is largely responsible for an increase in CDR deployments.

As frequently happens when technologies approach the trough, the users of CDR technologies are finding many nontechnical hurdles that increase the time to value and the risk of failure. Data governance is frequently an issue that triples the time it takes to make effective use of a CDR.

User Advice: CDRs by themselves are not complete applications. They are toolkits that often come packaged with some application software. HDOs that choose to acquire CDRs must decide to emphasize the operational or access-oriented capability, even though they may support limited applications of the other kind. Best practices for introducing a new technology into an enterprise include starting with projects that are important, but not overwhelming, and using the initial project to seed a "center of competence" that will support follow-on application development.

Business Impact: The long-term value will come from treating the data in the CDR as an enterprise asset to serve as a basis for many applications over time. CDRs can enable applications that would not be possible for data remaining in separate operational systems. These applications are what are needed, not only to make existing processes more efficient, but to better manage the HDO and enable detailed collaboration across HDOs that would otherwise not be possible.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Caradigm; Carefx; dbMotion; Explorys; Humedica; InterSystems; Optum; Orion Health

Perioperative Charting and Anesthesia Documentation Within the EHR

Analysis By: Thomas J. Handler, M.D.

Definition: The perioperative charting and anesthesia documentation functionality, as part of an enterprise's electronic health record (EHR) system, is used by nurses, surgeons and anesthesiologists to document preoperative, intraoperative and postoperative care.

Position and Adoption Speed Justification: There is still a great amount of paper-based documentation in the operating theaters, especially outside of the U.S., although the transformation to clinical automation is growing. Traditionally, these tools have been supplied as stand-alone specialty niche products. However, Gartner expects these applications to follow the pattern established with emergency department information systems (EDISs) and critical care information systems — namely, implementation of an integrated module as part of an enterprise EHR system, although on a somewhat slower timetable than either of the others. The slower adoption of an enterprise solution can be traced to the fact that many EHR vendors find providing the full functionality required to displace best-of-breed vendors challenging to develop, and because healthcare delivery organizations (HDOs) have tended to place relatively lower priority on deployment of integrated automation in that care setting.

Drivers include patient safety initiatives, a desire for unified medical records, and operational ease and efficiency. In addition, in the U.S., healthcare reform is driving more accountable and collaborative care, which will likely mean that anesthesiologists will need to play an even deeper role in preparation and recovery of surgical patients. They will need greater access to the data that resides in the enterprise EHR, and will likely need to chart and place orders on patients before and after they are in the operating theater.

Although most enterprise EHR vendors are working on these modules, the continuing relative immaturity of many enterprise EHR modules and the relative robustness of niche vendor functionality inhibit growth. Furthermore, there still is not a great demand for these tools, because HDOs and vendors tend to focus on other, more-pressing care venues (such as the intensive care unit and the emergency department) and functionalities (such as computer physician order entry and clinical documentation).

A few EHR products currently have adequate or better perioperative charting and anesthesia documentation functionality and sufficient market share to push the products beyond the Trough of Disillusionment. We base this Hype Cycle entry on penetration in the U.S. market, which will continue to grow at a steady pace. Of course, this application should be considered to have higher risk for the first health systems to deploy an integrated perioperative charting and anesthesia documentation in other countries, especially where localization issues of language and practice pose greater difficulties.

User Advice: As with other care venues, HDOs need to include digital perioperative charting and anesthesia documentation as part of their clinical transformation programs. Recognizing that many enterprise EHR systems do not have sufficiently mature functionality in this area means that caution must be taken when considering automation. Carefully assess whether your enterprise EHR vendor has "good enough" functionality at this time — in other words, whether it will at least meet the needs, if not the wants, of clinicians. If the answer is "yes," then proceed. If the answer is "no," then carefully assess your business drivers for this system and, if possible, wait until the enterprise EHR system has sufficient functionality.

Business Impact: These systems can improve clinical efficiency by replacing cumbersome manual processes. The ability to store operating room (OR) documentation in the enterprise patient record reduces the need for a separate clinical database for the OR suite. It enables clinicians in all care settings to view the complete record of care when patients are transferred to critical or acute care units after surgery, and when they subsequently seek care in the emergency department or elsewhere in the hospital. They can also lead to improved financial performance by helping to reduce delayed or canceled surgeries because of incomplete medical information. For similar reasons, they can help improve reimbursements by ensuring that all required information has been documented.

Benefit Rating: Low

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cerner; Epic; InterSystems TrakCare; McKesson; Meditech

Interactive Patient Care Systems

Analysis By: Barry Runyon

Definition: Interactive patient care (IPC) systems use interactive TV, bedside multimedia devices and wireless controls to enable patients' convenient access to caregiver and personal communications, hospital services, entertainment, and educational content. IPC solutions are evolving to enable improvements in the patient experience and engagement, patient safety, care measures, and hospital staff productivity, and are beginning to extend into other care venues.

Position and Adoption Speed Justification: Patients want better services and a better hospital experience. Hospitals are looking to improve outcomes and core care measures, and more actively engage patients in their own care. With IPC solutions, patients and their families can stay in touch in a variety of ways — via telephone, email, instant messaging or social media. Patients can communicate with their caregivers and learn about their specific conditions. IPC entertainment options make the hospital stay more tolerable for patients, family and visitors. Some healthcare delivery organizations (HDOs) are positioning IPC solutions as part of their "hospital of the future" or "smart room" strategies. Hospitals have traditionally supplied in-room telephone and TV services for their patients. More recently, they have been seeking to expand their offerings to include on-demand video, Internet access, email, games, radio and educational content. IPC solutions commonly integrate with clinical, business and administrative systems, such as admission, discharge and transfer; electronic health records; scheduling; food service; call center; billing; housekeeping; and nurse call. Most IPC systems integrate with IP telephony and unified communication platforms, as well as environmental control systems. Adoption has been dampened somewhat by a generally weak global economy; yet, interest in IPC is increasing, driven by trends and incentives in the areas of patient engagement and patient-centric healthcare. IPC vendors will benefit as patient experience metrics receive more weight in pay-for-performance programs in the U.S.

User Advice: IPC solutions represent a relatively young and evolving market — particularly in the U.S. — with a limited number of mature installations. Before engaging with an IPC vendor, be sure it has sufficient experience integrating with your IT infrastructure and particular application portfolio. HDOs should downplay their revenue expectations from IPC solutions, and focus on the softer but real ROI associated with improved customer and patient satisfaction and retention, as well as better care outcomes and measures. Hospitals that decide to invest in IPC solutions should give weight to those that leverage their existing information communication and technology infrastructures, since this tends to reduce capital and support costs. It also enables faster implementation and integration, as well as a uniform approach to security.

Business Impact: IPC benefits accrue for both the hospital and the patient. Although there is a potential revenue stream for certain services, such as Internet access, on-demand entertainment and increased outpatient pharmacy activity, the real benefits will center more on improved patient satisfaction, outcomes and core care measures, and increased staff productivity and brand loyalty.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Aceso; Allen Technologies; CareView Communications; Cerner; Epic; GetWellNetwork; Hospedia; Lincor Solutions; LodgeNet Healthcare; Siemens; Skylight Healthcare Systems; TeleHealth Services; TVR Communications

Recommended Reading: "Emphasize the Patient Experience With Interactive Patient Care"

"Six Ways HDOs Can Improve the Patient Experience"

Patient Self-Service Kiosks

Analysis By: Barry Runyon

Definition: Patient self-service kiosks range from free-standing and desktop units to handheld devices, and address operational requirements such as patient registration, check-in, wayfinding and account payments. Along with improved customer convenience and data quality, these kiosks offer new opportunities to engage the patient.

Position and Adoption Speed Justification: Providing a hard ROI for kiosks can be problematic. Although there is typically a cash-flow and revenue improvement associated with kiosks' ability to accept payments, it is rarely sufficient to provide a resounding justification for, or improve staff utilization to allow for, staffing reductions. Barriers to adoption are largely financial. There's no clear ROI and the units are expensive. Although the self-service kiosk can contribute to an improved patient experience, the combination of a tough economy and competition from higher-profile initiatives has resulted in no significant movement over the past two years.

Self-service comes with its own unique challenges. For new kiosk deployments, it is best to provide a staff to assist patients. The kiosk must be able to integrate with the healthcare delivery

organization's (HDO's) particular business and clinical systems, such as patient management, scheduling, billing and the electronic health record system. It also should support common integration techniques (such as HL7, Web services and APIs), or provide the necessary off-the-shelf connectors/adapters for these systems. In certain venues, kiosks will support strong authentication measures (such as card readers, biometrics and e-signatures), and should be PCI-compliant. Kiosks can also introduce a potential hub for infection.

User Advice: Look at kiosks to enhance the patient experience, improve operational efficiency and improve data quality. Plan initial self-service functionality around the needs of patients. New registration functionality is often more complicated and time-consuming, and requires staff assistance. Use self-service kiosks as a supplement to staffing, rather than as a replacement of staff. Make self-service kiosk use voluntary, at least initially. Begin with check-in and payments. At first, kiosks will require hand-holding and should not be left completely unattended. Place kiosks in high-traffic areas where there are many repeat customers. Kiosk placement is of singular importance to ensure adoption. HDOs should incorporate the cost of application interfaces into their total cost of ownership analysis. Stand-alone units are most often found in inpatient settings for functions such as wayfinding and directory services. Wall-mounted and countertop units are used in ambulatory settings for check-in, consent forms and surveys. Handheld and tablet kiosks are found in ambulatory settings and in the admissions and emergency departments of HDOs.

Business Impact: Customer convenience should be the main consideration for deploying patient self-service kiosks. Reducing check-in times and associated frustrations will improve customer satisfaction and the patient experience. Self-service kiosks can be used to effectively automate and streamline certain registration, check-in, data collection and customer payment workflows. These self-service activities can improve the HDO's operational effectiveness, reduce head count in some cases and improve collections. Better data quality can contribute to better clinical outcomes, patient safety, compliance and revenue cycle management. Self-service kiosks can be used to capture updated patient information for near-real-time integration with other HDO clinical and business systems. Patients will increasingly view the degree to which an HDO offers self-service as a market differentiator. There is a real need to improve the patient experience — to better coordinate care, become more operationally efficient and improve the quality of patient information.

Benefit Rating: Low

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Advanced Customer Flow (ACF); AutomationMed; Connected Technology Solutions (CTS); DynaTouch; Epic; Fujitsu; HealthAsyst; IBM; Kiosk Information Systems; Medhost; Medisolve; NCR; PatientPoint; PatientWorks; SeePoint (KioHealth); Vecna

Recommended Reading: "Three Good Reasons for Deploying Patient Self-Service Kiosks"

"Six Ways HDOs Can Improve the Patient Experience"

Generation 3 Enterprise Patient Financial Systems (U.S.)

Analysis By: Vi Shaffer

Definition: Generation 3 enterprise patient financial systems (PFSs) address the needs for complex claims/bill preparation, processing and management in countries with complex diagnosis/procedure-based billing and third-party payers. This entry tracks the penetration of replacement systems in the U.S. market; however, new PFS adoption to address changing payment models and migration to next-generation systems is also underway internationally.

Position and Adoption Speed Justification: This generation of systems is a replacement of a long-deployed legacy generation. These began emerging in the early 2000s. They automate more business steps and expedite or improve processes through an architectural and functional approach to workflows, work queues and rules. The systems help prevent and rework rejections/denials and aid in receivables management.

The position and adoption percentage in this Hype Cycle is based on the count of U.S. midsize to large hospitals (300 beds and up) and integrated delivery system (IDS) markets that have adopted this technology. We have moved the position forward this year, and moved the application to "early mainstream" based on the increasing number of successful deployments, particularly among the more mature of the small number of vendors with complete and modern systems available. While five to 10 years more to achieve the Plateau of Productivity in a system area where some solutions have been available for nearly 10 years already might seem like a long time, various other forces impact adoption. Among these are the needs to re-engineer and consolidate business office processes in organizations resulting from the aggressive mergers and acquisition activity, and delays or suspension of new system selection/deployment during the transition to ICD-10.

The urgency of an upgrade is also watered down by the sense that this is in large part just jettisoning dated technology that is costly to operate and for the vendor to maintain. Next-generation PFSs benefit health systems through their advances in the use of a rule engine, and more-sophisticated workflow management. They should include improved internal claims scrubbing, more automation of claims/reconciliation tasks, flexible real-time reporting, consumer self-service Web bill viewing/interaction capabilities and direct electronic data interchange (EDI) transaction links with payers. Systems should support any level of business office consolidation or decentralization, and the ability to change among operating models. Some systems meet billing needs for hospital and physician practice/ambulatory settings.

The ICD-10 conversion mandate is a stimulant and a timing consideration for PFS migrations. It drove the elimination of legacy systems that simply could not deal with the data field requirements of ICD-10. With those largely gone, most healthcare delivery organizations (HDOs) look at this as an eventually necessary migration. So you either plan to get it done before ICD-10, or prudence dictates you to wait until that dust settles. The U.S. Health and Human Services (HHS) delay in ICD-10 has allowed more HDOs to move up a PFS conversion, betting that conversion will be easier with a new system, but that window has largely passed.

In fact, the fairly weak development predictability, deployment timeliness, or customer support from a number of the long-standing vendors after all these years is pretty rattling. Adoption of next-generation systems has been slowed for years by major vendor struggles in getting this right. Many health systems still face a fairly wrenching crossroads, with loyalty to an incumbent vendor also torn by multiple worries about the vendor's financial performance or inadequate strategic direction.

At the same time, there are successful deployments from a few of the vendors. The substantial market share disruption that Gartner foresaw many years ago is a stark reality (see "The Hospital PFS Market Faces Disruptive Transition"), with market-leading electronic health record (EHR) vendors that were not PFS players before 2000 holding significant/growing share of live and contracted PFS business. Recently, some health systems have had successful "big bang" go-lives of EHR systems and PFS together, which is upping the pace toward plateau. This same pattern of combining EHR, PFS and patient administration systems into a single integrated contract and system is happening elsewhere, for example in Abu Dhabi and Qatar.

User Advice: Moving to a new PFS is a major system transition that an HDO undertakes very rarely and that carries with it substantial risk to the enterprise's cash flow and receivables management. Implementation requires very strong project management, and substantial and meticulous attention at multiple levels of finance and IT. It is particularly challenging if you intend to use the new PFS as a trigger for a major strategic initiative to standardize revenue cycle management (RCM) processes and to consolidate business office — and call center — operations among hospitals or for hospital as well as nonhospital operations.

- Do not contract with your PFS incumbent or EHR system vendor without a full review of the marketplace. We reiterate that HDOs should evaluate whether healthcare megasuite vendors being considered have demonstrated a proven core competence in software development. Also, they must demonstrate competence and more than a lackluster interest in enterprise PFS, and awareness and ability to deliver and be partly accountable for strong client performance against revenue cycle key performance indicators (KPIs).

- Remember that unlike some suites where new first-time functionality can be rolled out in pieces every time, every part of the PFS has to work at go-live, or cash flow and revenue is in jeopardy. Don't forget about a plan for legacy data decommissioning.

- Be prepared with a baseline of key performance metrics before, during and after contract negotiations. The Healthcare Financial Management Association is a reliable source of KPIs for hospitals and owned physician practices across revenue/cash flow and cost-to-collect dimensions. Set specific expectations in contacts with the vendor about KPIs and major changes, such as moving to a consolidated business office.

- Time your implementation with consideration to the ICD-10 conversion date, because health systems do not want to be midstream in a system replacement during that window, especially with the multiple staff training requirements and the likely challenges or cash flow crises that will need to be addressed.

- What we have learned from EHR deployments applies to PFS — you need to name business process and systems savvy "revenue informaticists" to serve on the project team, and in

continuing life cycle management roles as liaisons and leaders in design/configuration, workflow analysis, training and support, data stewardship and impact optimization efforts.

- Consider vendor or remote hosting/cloud-like offerings for risk mitigation, noting that vendors' experiences and track records are variable. Of course, if this system is integrated with an already deployed EHR system, that decision will be driven by the EHR set-up.

- If your RCM performance is consistently below average versus industry benchmarks today, don't wait for a new PFS. Focus management on the issue, appoint a senior revenue cycle executive across the entire megaprocess, look at complementary niche solutions, or consider engaging an expert consultant or outsourcer.

Business Impact: The fairly limited evidence, depending on what systems is being replaced, concludes that these systems will, to a degree:

- Get the hospital or IDS more cash faster

- Enable more automation in workflows or other advances that significantly lower the cost to collect

- Eliminate the cost of bolt-on products required with older systems

- Create more agility in responding to new requirements from payers

A good PFS and strong end-to-end RCM are essential. An average-performing HDO in revenue management should realize moderate benefit from their transition. The best of these systems — deployed together with solid process re-engineering scrutiny — should create a higher level of automation than prior generations, better control the cost of RCM, enable a centralized business office and also enterprise adoption of best practices, generate a reduction in the cost of bolt-on systems, and achieve strong KPIs.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Allscripts; Cerner; Epic; GE Healthcare; Keane; McKesson; Meditech; QuadraMed; Siemens Healthcare

Recommended Reading: "Top Actions for Healthcare Delivery Organization CIOs: Become Obsessed With Total Revenue Management"

"Patient Financial System Requirements in U.S. Vendor Procurements, Part I (Technology, Architecture and Services)"

"Patient Financial System Requirements in U.S. Vendor Procurements, Part II (Functionality)"

"Update: U.S. Care Delivery Organizations Should Use These Steps to Prepare for ICD-10"

"McKesson's Move to Consolidate on Paragon Is Logical, but Poses Risks"

Patient Portals

Analysis By: Thomas J. Handler, M.D.

Definition: Clinical patient portals enable a secure online patient-provider relationship and access to clinical and educational information as well personal health maintenance tools. They also include nonclinical functionality. Portals can be stand-alone or tethered (integrated) to electronic health record (EHR) systems or healthcare megasuite (e.g., clinical as well as financial, patient access) offerings.

Position and Adoption Speed Justification: Improved patient engagement remains a critical need for healthcare organizations. A patient portal is used by many healthcare delivery organizations (HDOs) to accomplish this end as a patient portal. Ultimately, a patient portal should encompass clinical and nonclinical functionality. Most of the stand-alone portals are a combination of these sets of functionality. As tethered portals mature, they will no longer just be linked to EHRs, but will become tethered to megasuite vendors' offerings that include clinical, financial and administrative functionality. These portals can encourage greater patient involvement and better patient/provider communications. The best patient portals are designed to benefit the HDO as well as the patient, and can build loyalty between the two. Patient portals should focus on:

- Making care more convenient by offering services such as online portal enrollment, appointment scheduling options, access to payer/plan eligibility and coverage information, prescription renewal/refill requests, preregistration functionality, referral requests and self-payments

- Improving the patient experience by offering patient/provider secure messaging, e-visits for nonacute healthcare issues and mobile support for those devices they commonly use

- Supporting health and wellness by providing timely access to lab and test results, medical decision aids, reviewed medical content, and communities of interest

- Providing support and tools for the patient's support network: family, close friends and unlicensed caregivers

In the U.S., the importance of a patient portal has been emphasized by being added to the meaningful use Stage 2 criteria. Ideally, a patient portal will include both clinical and nonclinical functionality; although, until recently, more attention had been paid to the somewhat easier-to-deliver nonclinical functionality. Positioning of this technology reflects the situation in the U.S. It's the country most advanced in using patient portals, and emphasizes the clinical functionality of the portals. In other countries, government health ministries are the main driving force behind patient portals. The primary form of patient portal outside the U.S. is a regional or national system that provides patients with access to a summary of their medical data and recent interactions — that enables them to renew prescriptions, book appointments and have e-visits. Examples of countries and regions that have pioneered patient portals include Denmark, Estonia, Sweden, Andalusia (Spain) and Lombardy (Italy), the U.K. and Australia.

Today, many U.S. enterprise and ambulatory EHR system vendors provide or are building a clinical portal that can be used to provide patients with access to their test results. Some vendors provide

additional functionality that can be used for more provider-patient interactions — for example, secure communication, prescription refill/renewal requests, e-visits, lab and diagnostic test results, medication lists and patient education. While patient portal technology is mature, usage remains limited, with only a few leading HDOs effectively leveraging their vendors' patient portals to improve care and patient satisfaction.

Drivers for patient portals include rising healthcare consumer expectations of digital connectivity with their providers, efficiency benefits (especially for HDOs that are paid per patient), and, likely, reimbursements for e-visits, and, in some countries, political pressure on governments to make visible improvements to the patient experience. Although activists continue to raise concerns about privacy and security, this is not likely to significantly inhibit the use of portals. Barriers include lack of reimbursement for their use, difficulties in patient authentications and, in some areas, lack of access to computer systems.

User Advice: Patient portals can be extensions of EHR systems or stand-alone systems. HDOs that have multiple EHRs or whose EHR does not have adequate portal functionality should consider using distinct portal platforms to construct Web-based composite applications. They are linking them to clinical applications (using service-oriented architecture [SOA] techniques — APIs and Web services — to reuse application and system logic and data). However, expectations need to be set. Appropriately interfaced portals require clinicians to step outside of their regular workflows and use a "different" system, and clinical data may not be available for automated clinical decision support or care management functionality.

Portals that are tethered to an EHR have the advantage that the patient-clinician interactions are part of the normal EHR workflow, but only have access to the clinical record contained within the system.

HDOs should, at the very least, have a short-term plan for adding a clinical patient portal to provide access to test results. More importantly, they should have a longer-term plan to extend interactive capabilities, including patient-provider communication and e-visits. Although vertical platforms or portal platforms can be useful, especially if the organization has multiple clinical applications, the functionality of a portal provided by the enterprise EHR system tends to fit clinician workflow better and is, therefore, better used. The patient portal strategy should also be aligned with a self-service kiosk strategy.

Business Impact: Initially, clinical patient portals primarily provide patient access to results, and can increase patient satisfaction and improve brand loyalty. As more-robust interactive functionality is built in, HDOs can expect improvements in clinician productivity. In addition, organizations can improve the quality of care delivered by using the clinical patient portal to improve communication between patients and providers.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alere (Wellogic); Allscripts; Carefx; Cerner; Epic; InterSystems; Kryptiq; Medicity; Medseek; Orion Health; RelayHealth; Siemens

Recommended Reading: "Six Ways HDOs Can Improve the Patient Experience"

"Top Actions for Healthcare Delivery Organization CIOs: Use IT to Better Engage and Influence Patients"

"Case Study: Henry Ford Health System's Enterprise Portal"

EDISs as Integrated Modules of EHR Systems

Analysis By: Thomas J. Handler, M.D.

Definition: Emergency department information systems (EDISs) provide clinical documentation, order management, status alerts, charge capture, diagnostic coding and the incorporation of data from patient-monitoring devices in the emergency department (ED). This Hype Cycle entry covers EDISs that are formal modules of enterprise electronic health record (EHR) systems — and that leverage the EHR system's decision support and other process-assistive capabilities, such as rule/workflow engines — rather than existing as stand-alone systems.

Position and Adoption Speed Justification: The value of automation in the ED (often called accident and emergency [A&E] outside of the U.S.) is well-understood, and deployment continues to increase. Patient safety and patient throughput improvements, as well as the ability to accurately document — and, thus, charge for — all ED services rendered, are driving incremental growth. Recognition that, for many healthcare delivery organizations (HDOs), more than 40% (and in a few cases as many as 80%) of hospital admissions come through the ED has prompted many HDOs to seek a solution that is fully integrated, rather than interfaced with the enterprise EHR system. Given the current state of technology, it has proved impossible to transfer computer-usable data between different clinical systems to the level required by inpatient EHR and ED systems. Note that stand-alone EDIS applications have been available for some time and have achieved mainstream, although not universal, adoption. This entry recognizes the stage at which EHR-integrated EDISs are "good enough" from the clinician's point of view to serve in place of or replace a stand-alone EDIS.

At this point, most if not all enterprise EHR system vendors have more-than-adequate integrated ED solutions, although some modules are relatively new. Several EHR vendors have gotten to the point at which the vast majority of their clients are using their integrated ED solutions. Based on Gartner's research, many HDOs that initially chose stand-alone EDISs have replaced them, or are considering replacing them, with their EHR systems' ED modules. The functionality gap between stand-alone and integrated ED systems is shrinking, and the advantages of an integrated solution will push HDOs to adopt the integrated solutions at a more rapid pace.

User Advice: Vendors of enterprise EHR systems continue to improve their EDIS modules. Most now have modules that are competitive with the best of the stand-alone systems. HDOs that are considering an EDIS and have already selected an enterprise EHR vendor should evaluate the vendor's current ED release. If it is sufficiently functional, then they will be best served by

implementing the EHR system's ED module, rather than a stand-alone product, because integration has substantial value for the cohesive management of the patient. The ability to incorporate ED information into the EHR system — and, thus, eliminate the need for a separate database of ED records — must be weighed against the completeness of the EHR vendor's ED system.

Although integration with an enterprise EHR system is an important consideration, it may not be feasible for all HDOs in all countries, and localization issues should not be underestimated. HDOs whose chosen EHR vendors do not offer an EDIS application or offers one that operates on a separate database, schema or platform should evaluate niche products. Niche applications should be evaluated on their proven ability to interface with the HDO's EHR and ancillary systems. In addition, the HDO should seek client references from organizations that are similar in terms of number of hospitals, ED patient volume and trauma center certifications (if applicable). HDOs choosing niche products as tactical, short-term solutions should view EHR system integration as the long-term strategy. CIOs and chief medical information officers (CMIOs) need to establish a process and criteria by which IT, administration and their critical care clinicians will evaluate whether and when an EHR vendor's ED capabilities are acceptable, and plan a move to the integrated system. To aid this, ensure that IT governance and committee structures adequately represent emergency care.

Regardless of whether an HDO is considering a stand-alone or EHR-integrated EDIS, it should also examine potential bolt-ons for both revenue enhancement and diagnosis/treatment decision support. Examples include Picis' Lynx and The Sullivan Group's Risk Mitigation Module 2.0.

Business Impact: ED automation affects clinician productivity, patient safety, administrative efficiency, and revenue cycle management for hospitals and trauma centers.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Allscripts; Cerner; Epic; InterSystems TrakCare; McKesson; Meditech; Siemens Healthcare

Recommended Reading: "Essential Evaluation Criteria for Emergency Department Information Systems"

EHR-Integrated Critical Care IS

Analysis By: Vi Shaffer

Definition: A critical care information system (CCIS) serves the specific requirements of intensive care/"step-down" units. This entry tracks the penetration of CCIS when integrated into hospital/ enterprise electronic health record (EHR) systems. Such a CCIS operates with an enterprise EHR system from an integrated database on the same technology platform, database and schema. It can leverage the EHR system's decision support and other process-assistive capabilities, such as rule/ workflow engines. It is configured using the EHR tools.

Position and Adoption Speed Justification: We are assessing this position relative to the U.S. adoption of EHR-integrated CCISs. Penetration of EHR systems is progressing rapidly, and we can readily track how the integrated approach is faring versus best-of-breed systems. The CCIS is often one of the later setting-specific capabilities an EHR system vendor builds, and because of this, it has been one of the later in-hospital settings to be fully automated in the integrated EHR system. It is also one of the more difficult because of patient severity and the associated intensity of therapy and nursing care required. Due to these special challenges, intensive care unit (ICU) needs have sometimes been addressed by stand-alone systems. However, it is very important to have patient care continuity with other acute care (and emergency departments) settings and processes, especially as continuity becomes more and more dependent on electronic information viewing, data synthesis and clinical decision support.

ICUs have a high volume, frequency and variety of data from many sources. Because of this, it is a setting that can realize a disproportionate benefit from EHR system capabilities. The frequency and nature of documentation required for a critically ill patient mean that a CCIS must have display and documentation design, system performance and response times that are different from the minimum requirements to serve clinicians' usability requirements on a hospital ward. Medical device interoperability is also required to draw elements, like vital signs, into the clinical data repository, while relieving nurses of manual effort. The CCIS must have care-continuity processes associated with it, especially as clinicians become more and more dependent on electronic viewing, data synthesis and clinical decision support (CDS).

Although only a handful of EHR suites fully support critical care at this time, the market share leaders do, and thus penetration is increasing steadily. Such support is one hallmark of vendor maturity in software development that correlates strongly with market share success.

Of course, CCIS carries a risk for the first health systems deploying a vendor's system and also for the first in any country to deploy it — especially where the issues of language and care practices require more localization. Similar to the situation in emergency departments, if ICU medical and nursing leadership have not been effectively engaged to confirm the readiness and buy in to the benefits to patient care of an integrated system approach, they will resist abandoning a best-of-breed CCIS approach.

User Advice:

- Include CCIS functionality among the evaluation criteria for a hospital/enterprise EHR system — it is one of the markers that distinguish a more mature/advanced vendor.

- Consider how the CCIS might align with plans for ICU remote monitoring. This has been a stand-alone market dominated by Visicu, now part of Philips. However, Cerner and Epic, for example, are extending their capabilities in this direction.

- Combine CCIS investments with a sustained specific performance improvement effort at the enterprise level. Enterprise and ICU medical leadership should leverage data from the EHR/CCIS together with other sources to create an enterprisewide ICU management dashboard that includes quality, utilization, cost and patient experience measures.

- Understand that the chief medical officer (CMO), ICU medical directors and nursing leadership must take charge of the change management issues and deal with resistance over fear of loss of control or stand-alone vendor loyalty, as with emergency department systems.

- Develop specific plans for CCIS uptime — a CCIS *must* have associated care-continuity processes.

- Consider a stand-alone CCIS if your healthcare delivery organization (HDO) does not have the money or strategic intent to implement a Generation 3 EHR system during the next few years. Good ones are still available, but support is not strong in every country. However, CIOs must be aware of the risk: the number of competitive vendors and/or their financial strength will probably decrease as integrated CCISs take more share of market, particularly if CCIS is a dominant source of revenue and their market share comes largely from the U.S. or other countries aggressively pursuing Generation 3 EHR systems.

Business Impact: The role of the ICU in high-acuity, high-risk, high-cost patients is pivotal in managing hospital quality, cost and patient throughput. Critical care is one of the most complex settings to automate, but is also one where the benefits of electronic systems can be particularly high, but not on their own (which is why we rate the benefit of these systems as moderate). Important benefits include 24/7 monitoring of process conformance and early alerting to subtle, but significant, changes in patient status through complex multivariate algorithms and display of trends in the patient's acute physiology score, which can signal a worrisome change in patient status. Such information can also aid in assessing readiness for discharge to a ward bed (which improves throughput and can reduce the incidence of emergency department diverts), or increased severity that suggests a new intervention or change in therapy is required. CCISs reduce the workload of paper documentation, particularly among nurses, and should facilitate information sharing and handoffs among the many clinicians seeing a critically ill patient.

There is often a great deal of quality and utilization improvement that an HDO can make in its ICU/step-down environment. Leveraging data from the CCIS makes the front-end data gathering of these efforts less costly and less exhausting. The EHR, and creating more-complex, multivariate alerts and clinical decision support, have high potential for this high-cost, high-risk setting, which is often a pivotal part of ensuring services lines like cardiac are profitable. However, to reap these benefits requires data analysis and quality improvement investments beyond just the CCIS.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Allscripts; Cerner; Epic; InterSystems (TrakCare); Meditech

Recommended Reading: "Critical Care Information Systems: Structure, Function and Future" by William F. Bria, Violet Shaffer and Richard Kremsdorf, pp. 2,388-2,398 in Irwin & Rippe's "Intensive Care Medicine: Seventh Edition."

"Magic Quadrant for Global Enterprise EHR Systems"

Healthcare Provider E-Visits

Analysis By: Thomas J. Handler, M.D.

Definition: E-visits are asynchronous digital consultations enabled by Web-based application software that permit structured, secure messaging between a patient and a provider (typically, but not necessarily, a primary care physician) for a well-defined and narrow range of consultations, such as for nonemergency questions, prescription refills, nonurgent diagnostics and routine chronic disease management (for example, reporting of glucose levels). Because they are often structured messages, e-visits are distinct from email.

Position and Adoption Speed Justification: Shortages of physicians, the difficulty of scheduling a visit, the growing acceptance of online services and the need to reduce costs have led to increased interest in e-visits by healthcare providers, payers and governments. This is further fueled by the desire of clinicians to grow their revenue, improve efficiencies and increase patient satisfaction, as well as the need to spend more time on complex, rather than simple, encounters. Moreover, patients and physicians are frustrated by endless "telephone tag" and are increasingly recognizing the value and convenience of the asynchronous capabilities of email or secure messaging.

Many electronic health record (EHR) vendors in the U.S. have added secure messaging capabilities to their clinical systems and patient portal offerings, permitting clinicians to take part in e-visits as part of their normal workflows. In the U.S., pilot programs have evolved into more-complete application rollouts. Adoption by U.S. healthcare delivery organizations (HDOs) is increasing as they recognize benefits and because some leading health insurers, such as Aetna and Cigna, reimburse some forms of e-visits. One of the largest implementations of e-visits is in the Kaiser Permanente organization. Kaiser recorded a sixfold increase in the use of e-visits from 2005 through 2007. At the same time, physician office visits per member decreased 26%. Henry Ford Health System in Detroit also has a mature e-visit program.

The positioning of e-visits on the Hype Cycle reflects the situation in the U.S., where adoption is more prevalent than in most other markets. Other countries are further behind. In Europe, the Danish national health portal has offered an e-visit service for the past few years, although it does not appear to be heavily used. There is limited usage of e-visits in several other European countries. In the Asia/Pacific region, e-visits remain in their infancy. Adoption will increase worldwide once EHR vendors include secure messaging, reimbursement for e-visits becomes more common, and healthcare payers and providers accept e-visits as a cost-effective substitute for certain types of face-to-face consultation.

In general, the adoption of e-visits will follow the adoption curve of patient portals integrated with EHR systems, because e-visits are typically conducted through patient portals.

User Advice: HDOs should recognize that e-visits will likely become as ubiquitous as office visits and phone calls. It is important to set aside regular time slots for e-visits, rather than just squeeze them in between regular patients or after hours. Consumer surveys and the popularity of medical advice websites demonstrate consumer interest in interacting electronically with clinicians. HDOs must ensure that their e-visit solutions are well publicized and run efficiently, so that their patients will preferentially use the organization's e-visit solutions, rather than other websites. Although some

stand-alone products may initially be less expensive and easier to implement, secure messaging should become part of, and integrated with, the organization's EHR strategies.

To increase patient satisfaction and decrease risks, HDOs must set expectations with patients, provide guidance on use, and create and enforce policies. These policies include ensuring that healthcare consumers understand what is appropriate for an e-visit and what turnaround time they can expect. To this end, HDOs should consider using response time SLAs with clinicians. Clinicians must recognize that the messages should be considered a part of the legal medical record. It is essential for HDOs to correctly compensate clinicians for e-visits. At the very least, if the number of encounters is a performance metric, then clinicians should receive appropriate credit — likely some fraction of a traditional visit, because an e-visit should take less time and effort.

Business Impact: A well-implemented e-visit program can enable cost reduction, increased patient satisfaction and engagement, better care coordination, enhanced brand loyalty, and improved clinician productivity.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: athenahealth; Allscripts; Carefx; Cerner; eClinicalWorks; Epic; Kryptiq; McKesson (RelayHealth); Medfusion; Medgate; Medseek; Orion Health; PatientKeeper

Entering the Plateau

Real-Time Healthcare Temperature/Humidity Monitoring

Analysis By: Vi Shaffer

Definition: This technology deals with real-time temperature and humidity monitoring (THM) uses, such as monitoring refrigerators holding pharmaceuticals, vaccines and bone/tissue samples. THM leverages technologies such as active RFID, Wi-Fi networks, and battery-powered temperature and humidity sensor tags. This includes software to display location and alerts to out-of-range data, as well as data-logging and reporting capabilities.

Position and Adoption Speed Justification: THM is one illustration of what is now a rapidly expanding array of location- and condition-sensing-based applications leveraging wireless and sensor/tag technologies. In this Hype Cycle, we also track wireless healthcare asset management (WHAM), the most prevalent application to date. We track these two in the Hype Cycle as quite different examples of the many new and creative monitoring, compliance and control applications these technologies will spawn. THM also points out that what's been termed "real-time location services" (RTLSs) isn't at all limited to location-tracking uses. THM uses technologies common to RTLS, and uses location information. It is not primarily a location, but rather a condition service. So, we use the term "location- and condition-sensing" technologies. This year, we have added an entry for LCST application platforms in this Hype Cycle to reflect the clear market direction toward

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preference for platform vendors providing many applications across multiple sensor and network technologies and uses.

After a rather brief time moving past the Trough of Disillusionment, this application has been climbing steadily apace with WHAM, and will become commonly used by health systems because of its practical advantages and relative ease of deployment. It now has documented use in many hospitals in the U.S. and many other countries around the world.

THM is a straightforward and relatively low-cost application, compared with some of its sister applications and the "really big apps" CIOs have been dealing with lately (EHRs, revenue cycle system replacement). It does not require pervasive Wi-Fi, because its value is in monitoring stable, rather than mobile environments. Battery-powered sensors can be placed without hard-wiring. Tags can be placed on walls for monitoring room conditions, or in refrigerators for the safety and protection of medications, tissue samples and the like. Tags can also be used for placing sensor probes in liquids that have similar properties to the monitored item. THM has the advantage of clarity and simplicity in its business case and ROI — because of helping to meet regulatory/accreditation requirements, replacing manual processes that waste the time of nurses, pharmacists and other staff, and preventing waste, damage, spoilage and patient safety issues. What makes this application viable, in particular, is that the communication infrastructure (in most cases Wi-Fi) is pre-existing; the ROI does not work if the cost of the Wi-Fi is part of the project. The rapid rise in popularity of this application is because Wi-Fi is becoming prevalent in hospitals and other healthcare facilities where this solution is needed.

WHAM and THM now commonly go hand in hand in new deployments, with a single-vendor platform selected (applying a variety of sensor technologies) for these and additional uses. Vendors that had focused on THM have expanded to WHAM, and vice versa.

User Advice:

- There is still more risk in figuring out which vendors will ultimately thrive in this still-evolving arena than in deploying this application. Keep a careful eye on vendor viability, but the return is attractive and the cost of changing vendors not as high as with "heavier" applications, like swapping out your EHR vendor.

- Add THM to your shortlist of applications to consider that are lower-risk, have a quicker time to value, enhance safety and compliance, and save nursing time. Look for other areas of hospitals and clinics where this capability could be easily applied (dietary, pharmacies, blood banks, incubators, IT server rooms, warehouses, and so on).

- Where clinical engineering (CE)/biomed does not report in to IT, this department may have primary responsibility. The expanded use of sensor/network applications and platforms is another reason why IT and CE must plan and operate more closely, if not fully integrate under the CIO.

- Note the importance of a total cost of ownership (TCO) evaluation. Vendors providing a THM solution that requires a separate network infrastructure skew the business impact/ROI. The cost

of installing a separate communication infrastructure would, in general, not be justified for this single application.

- Develop an enterprise framework to have a consolidated view of the LCST platform uses and best practices you can apply across a health system, given the wide potential of location- and condition-sensing technologies. Also keep the IT governance and clinical steering committees abreast of application advances and the changing vendor landscape. You may end up with more than one platform, because some vendors are more focused on the patient throughput and capacity management applications than on these routine task and location-related uses.

Business Impact: THM eliminates the need for manual monitoring and recording of temperature and humidity for medications, tissue and other biomedical items. When combined with good processes, it can prevent healthcare delivery organizations (HDOs) from administering damaged goods, tissue spoilage or creating other patient safety/efficacy risks through accurate and timely alerting, and aids in Joint Commission compliance. The companion benefit is a reduction in staff time spent on monitoring, reporting, analyzing and correcting noncompliance issues.

The growing number of case studies from multiple vendors describing successful implementations that have yielded greater accuracy, "rescue" of tissues and cost/time savings is classic evidence of an application's progress. For example, health systems have found the manufacturers' temperature readings on refrigerators to be inaccurate, creating more risk than previously understood. At this point, vendors should be prepared to help you estimate and explain the ROI for your enterprise's particular characteristics.

There are other hospital conditions that can be monitored such as carbon dioxide levels, light, pressure, oxygen levels, motion, power loss and open/close conditions. These also are likely to reach the Plateau of Productivity in a five-year window, although one must scrutinize which types of technologies are appropriate for which applications (such as battery-assisted passive RFID). Longer-term advances will likely include more patient monitoring of vital signs, as well as light, color, movement or smell monitoring that will enhance the observation and monitoring abilities of clinicians.

All of these move HDOs closer to the "real-time health system" management paradigm of the future, and enable megaprocess management, monitoring, re-engineering and predictive risk modeling and failure prevention.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Awarepoint; Ekahau; Intelligent InSites; Stanley Healthcare; Tempsys

Recommended Reading: "Four Questions Hospital Administrators Must Ask Before Implementing RFID Asset Management"

"When to Track IT Assets With RFID or Barcodes"

"Hype Cycle for the Internet of Things, 2012"

Remote ICU

Analysis By: Vi Shaffer

Definition: The remote intensive care unit (ICU) is an application that combines audio, video, patient records and image access with customized decision support. It enables remote critical care specialists to monitor and direct patient care 24/7 from a central command center.

Position and Adoption Speed Justification: The ICU is a high-cost, high-demand, high-risk setting. Variance in care delivery is high, and intensivists and experienced critical care nurses are in short supply. These factors have led hospitals to explore the use of remote ICUs.

The remote ICU model continues to be largely a U.S. approach. Therefore, our Hype Cycle position and market penetration estimates are for the U.S. market only, and the denominator only includes hospitals with adult ICUs (differences in neonatal and pediatric ICUs' intensivist staffing/delivery models have made the business case for remote monitoring less compelling). Such systems are being used by over 400 Hospitals' ICU beds through something of more than 40 remote monitoring centers, with most of the centers running Philips' "eICU" system, previously Visicu. Market penetration is still growing somewhat, but there is little mystery in how to get value from this approach. A number of U.S. healthcare delivery organizations (HDOs) have been documenting benefits for more than a decade, and are pleased with the approach. Although the technology is still not considered an essential "standard of care," there is fairly low risk from the largest vendor's technology and services.

While total penetration is on the small end of the 20% to 50% penetration market needed to reach the Plateau of Productivity, we were tempted to remove it from the Hype Cycle this year and will probably do so in 2014 or 2015. We would consider resurging this topic later with a different definition and/or position measurement criteria if/when the EHR vendors' integrated solutions (e.g., Cerner's CareAware Virtual) gain more traction in the U.S., or international markets evidence greater overall interest. This category is one of those examples of investment in very targeted quality improvement. While it is not the only way to significantly improve critical care, it is a proven (if costly) way. The barriers to much greater adoption at this point reflect several realities — health systems are very busy with other things, remote ICU plans must be championed by the ICU leadership if it is to be accepted, and not all hospitals are equally committed to making these types of more-radical change and commitment to changing the way they do business. One health system CEO said, "We don't even try to tell ICU docs how to practice because people die there."

User Advice: U.S. HDOs should consider the remote ICU in any adult ICU or long-term acute care setting where full-time intensivist coverage is not available, or as a cost-effective alternative. To succeed, remote ICU systems must have ICU physician leadership and support for the initiative, and the related changes in medical practices and processes. Responsibilities, handoffs and coordination between on-site and remote ICU staff must be clearly determined and managed.

Access to one or more vendors capable of providing remote ICU systems is not an option for HDOs in many countries. Therefore, interested medical leaders outside the U.S. must consider the service challenges and true viability of vendor options. HDOs can also consider designing their own technology aspects of the "bunker" setup, and leverage a critical care information system as part of a do-it-yourself approach.

Business Impact: The remote ICU is one way to help hospitals improve their adherence to evidence-based medicine practices, monitor the most critical patients more frequently, and improve overall ICU utilization and patient throughput, thereby opening up capacity and avoiding emergency department diverts. It can have a significant impact on outcomes and reduce costs per case in the average ICU. These systems also can improve the working lives of clinicians and help more rural hospitals provide a level of care that exceeds the local talent available. However, there is continuing controversy over the "bang for the buck" of current configurations, and continued interest in an IT systems approach that is more integrated with the EHR system and its decision support. ICU improvement can also be achieved by strong leadership with optimal use of the capabilities of an EHR system, and through persistent ICU benchmarking and quality improvement efforts.

Success with this model of care involves much more than technology. Where implemented successfully, it includes significant attention to protocols, increased "virtual rounding" for the most severely ill patients, and invoking more-sophisticated predictive algorithms and decision support. It also involves the commitment to constantly scrutinize processes, as well as clinical, financial and experiential outcomes. The potential benefit of remote ICU monitoring for any HDO depends largely on how effectively an organization's ICUs are managed, whether quality improvement is a focus of leadership, and whether they have strong intensivist leadership and coverage, experienced critical care nurses, and a team approach to care.

As hospital patient severity continues to increase, effective intensive care is essential to the financial health and quality of the acute care hospital, and to key service lines. This intelligent remote monitoring center model could also be expanded to become a wider enterprise acute care telemedicine and patient/event-monitoring capability, presuming scale, lowered technology costs, and different staffing model.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Cerner; Epic; iMDsoft; Philips

U.S. Ambulatory Electronic Medical Records

Analysis By: Thomas J. Handler, M.D.

Definition: Ambulatory electronic health record (aEHR) systems are specifically designed for the ambulatory care environment. An aEHR system includes an integrated set of modules that fully captures and promotes the interaction between a patient and a physician, and also includes clinical

decision support. An aEHR must support reporting requirements, such as quality and usage measures by demographic categories, such as age, insurance type, gender, race and ethnicity.

Position and Adoption Speed Justification: Positioning on the Hype Cycle is based on the U.S. market, where adoption of these systems has been much lower than in many other countries. Furthermore, this positioning is based on systems that provide full functionality (including documentation, e-prescribing and clinical decision support) and not adoption of products with less functionality (many practices have digital result reporting). The penetration of aEHR systems in the U.S. varies widely by market segment, with most large practices/clinics (those with more than 50 physicians) having already implemented an aEHR system, and as few as 10% to 15% of small practices (five or fewer physicians) having fully implemented a system. Good progress is being made, and as of April 2013, Medicare reports that 291,000 eligible providers were paid for reaching meaningful use figures under the U.S. American Recovery and Reinvestment Act of 2009 (this number is significantly higher than last year). These efforts will continue to push practices to adopt aEHR systems. The trend of larger practices forming from mergers of smaller practices, and of healthcare delivery organizations (HDOs) acquiring smaller practices, is also accelerating adoption. Still, by all measures, several markets — notably, the U.S., Canada and Hong Kong — are lagging far behind many other industrialized countries, such as the U.K., Israel, Australia, New Zealand, the Netherlands and other northern European countries.

User Advice: Ultimately, all HDOs (whether small practices or large integrated delivery systems [IDSs]) will need to implement an aEHR solution because of government mandates or because they support the practice of 21st century medicine. When correctly implemented, the proof of these systems' abilities to reduce unnecessary practice variations and deliver more evidence-based care is compelling.

HDOs pursuing an aEHR solution need to make it a top priority to integrate their practice management (that is, appointment scheduling and accounts receivable) systems with a new aEHR system. Furthermore, true integration of physician offices and clinics within an IDS into the enterprise EHR system is far preferable to acquiring a third-party aEHR system and attempting to interface it to the enterprise EHR solution. This is especially true for specialties (such as obstetrics and surgery) that tend to admit a high percentage of their patient populations to hospitals, or make frequent use of hospital services (such as oncology). It will be even more important for IDSs that begin to take on risk under accountable care or similar programs.

HDOs should not underestimate the effort it will involve to get satisfactory physician adoption. Although clearly beneficial, aEHR systems can be difficult to implement and use. HDOs need to plan for the reality that there will be some short-term reduction in productivity after implementation, and satisfactory adoption may never be realized until physicians rework their practice workflows to make the best use of the aEHR system. Attention needs to be paid to ensuring that clinician productivity is not adversely impacted by the system in the long term.

Business Impact: Implementing an aEHR system can positively impact most areas, including clinician productivity, patient safety, and revenue cycle management for physician offices, clinics and other ambulatory care providers. When done correctly, there can be a great increase in the

quality of care delivered, improved patient satisfaction and safety, and improvements in revenue and the efficiency of the practice.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: athenahealth; Allscripts; Cerner; eClinicalWorks; Epic; GE Healthcare; Greenway Medical Technologies; McKesson; NextGen Healthcare

Wireless Healthcare Asset Management

Analysis By: Vi Shaffer

Definition: Wireless healthcare asset management (WHAM) applications involve the transmission, storage and analysis of geospatial location information sent in real time from a small wireless locator device attached to the healthcare asset being tracked. The locator devices communicate via wireless communications protocols such as RFID, Wi-Fi, ultrasound, infrared and ZigBee.

Position and Adoption Speed Justification: This entry tracks WHAM use for mobile medical assets, such as intravenous infusion pumps, wheelchairs, pulse oximeters, specialized surgery tables and equipment, and computers on wheels. Some health systems have also begun applying wireless tagging/location to stationary medical equipment for more comprehensive inventory and maintenance management. In more-advanced iterations, WHAM software vendors provide: (1) inventory/maintenance management support, (2) additional reporting and analysis of equipment utilization patterns that enhance the fast location and replacement/overstock cost-avoidance benefits of this application, and (3) the integration of multiple types of communication methods, e.g., ZigBee and Wi-Fi, into a single application.

For this year's Hype Cycle, Gartner reflects the expansion in the number of applications and how this has changed the expectations for vendors competing in the WHAM arena by adding the location- and condition-sensing technologies (LCST) technologies entry.

WHAM has become an increasingly routine component of cost and patient care quality management. It is on the IT checklist for new hospital construction. With substantial pressure to reduce hospital costs — on top of patient safety issues and nursing frustrations, this is one of the more prominent and useful innovations that has emerged. It is one of the earliest in sensor technologies and is lower cost when combined with infrastructure investments in pervasive hospital wireless networks. The increasing number of mainstream (not just early adopter) health systems with documented ROI, and a landscape of more mature and financially viable vendors, is driving WHAM's fairly smooth move to the mainstream. The total cost of ownership typically includes tags, batteries, sensors, receivers, software/support, staff training and support, and managerial oversight to ensure its full potential impact is realized.

Vendors continue to vie for market leadership and push en masse for more widespread adoption, while expanding their footprints of applications and supported sensor technologies. Additional

rounds of financing, acquisitions, mergers, alliances, as well as boards of directors and CEOs bringing in healthcare-IT experienced executive leaders to take companies to new levels are common. This will continue. Gartner research has indicated that healthcare will be one of the lead industries in gaining high value from LCST.

User Advice: The management necessity to drive much more waste, delay and poor quality out of healthcare is driving healthcare delivery organizations (HDOs) toward a real-time health system management model that is highly dependent on real-time infrastructure, information and intervention abilities. Rather than looking at this quite profound change only incrementally and use by use, leaders should consider what vendors can best advance with them.

- Be mindful of the long-term business viability of vendors. CIOs also need to consider what organization structure, roles, responsibilities, and new/evolved skill sets will be required, and plan for change.

- Plan to support an increasing array of real-time location/sensing/presence data, clinical process monitoring, dashboards and alerts.

- Because of the confluence of technology and information management needs for the real-time health system, IT departments should develop closer collaboration or plan for structural integration with the clinical engineering/biomedical device department. (This is a direction Gartner first predicted in 2005. Gartner's most recent survey data indicates that about 28% of U.S. integrated delivery systems [IDSs], for example, now nest clinical engineering within the office of the CIO, and that this will be true for the majority of medium/large IDSs by 2016.)

- The jostling of the vendor leader board and ownership will continue for at least the next few years. Pick a vendor with market traction, and scrutinize for good business sense and financial viability, as you confirm functionality and track record of delivery/support.

- Larger hospitals and IDSs should be leveraging this application.

- Factor WHAM use into network planning.

- Various approaches are working in the field, and there is no one definitive winner as of now, although Wi-Fi appears to have the largest installed base, partly because it has a wide range of other productive uses (and HDO familiarity with the technology). Technologies are also combined, like Wi-Fi/RFID, RFID/infrared. In this evolving marketplace, there are vendors that provide applications, and sensor technology specialists who provide and develop innovative technologies for apps vendors, and others more focused on logistics approaches or analytics leveraging this real-time data. Hosted and cloud-based services/software as a service (SaaS) models are also available.

- Look for vendors that are extending their system value toward equipment inventory optimization, maintenance management and regulatory compliance, as well as extending into condition-sensing arenas. Don't limit evaluation to just real-time location, which will happen if the decision is left to a departmental niche, rather than a hospitalwide or enterprisewide plan.

Business Impact: WHAM helps improve timely accessibility to, and utilization of, mobile equipment. It should reduce the organization's total cost (including new purchase and rental costs)

for equipment such as infusion pumps and wheelchairs (two of the most commonly tracked assets), and other biomedical and IT equipment. WHAM location and management can also improve timely delivery of care (such as in the operating room and in urgent situations), reduce unproductive clinical and engineering time spent looking for misplaced hospital equipment, reduce equipment hoarding, and stop equipment from clogging patient hallways. Additionally, it can assist biomedical equipment technicians in locating equipment for scheduling preventive maintenance, repair and replacement. The application could also aid in ensuring that equipment moving from patient to patient has gone through appropriate decontamination, which is an issue evaluated by accrediting bodies such as The Joint Commission. More experienced vendors are also looking for additional value for their customers — examining what patterns and inventory optimization techniques the information generated from WHAM can help develop which tags and technologies to use for what will continue to evolve. Active tags may be needed for high-value assets. In contrast, "bread crumbing" with real-time location systems (RTLSs), and other needs, use the same reader data from passive tags implemented as zonal solutions being read as assets, or as people pass through a defined point in the facility. RFID is also being combined with GPS to better keep track of assets located outdoors or in larger geographical areas.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Awarepoint; CenTrak; Cerner; Cisco; Ekahau; GE Healthcare; InfoLogix; Intelligent InSites; McKesson; Sonitor Technologies; Stanley Healthcare; TeleTracking Technologies; Versus Technology; Vizbee; WaveMark

Recommended Reading: "Four Questions Hospital Administrators Must Ask Before Implementing RFID Asset Management"

"When to Track IT Assets With RFID or Barcodes"

"Hype Cycle for the Internet of Things, 2012"

E-Prescribing

Analysis By: Thomas J. Handler, M.D.

Definition: Electronic prescribing (e-prescribing) involves the use of purpose-built application software and connectivity tools that enable physicians to create and send prescriptions electronically to retail pharmacy systems, external databases or printers. In some countries, this term is used to refer to the process of creating a medication order in the acute care setting, but that is not how it is being used in this Hype Cycle entry.

Position and Adoption Speed Justification: E-prescribing can be divided into two components:

- The one used by legally authorized clinicians to actually create prescriptions

- The network that allows bidirectional connections between the ordering clinician and a retail pharmacy

The positioning of this entry on the Hype Cycle is a combination of the two components, although it should be noted that the bidirectional networks are less mature. In addition, the positioning is based on U.S. adoption, which has trailed behind many other countries in the automation of ambulatory practices.

Using a computer to create a prescription has been shown to:

- Significantly reduce the numbers of incomplete or illegible prescriptions

- Reduce medication errors, especially when combined with clinical decision support

- Improve efficiency for clinicians and the overall practice

- Increase adherence to formularies

- Lower medication costs

- Increase mobility

Additional advantages through the use of e-prescribing networks include:

- Greater compliance, because patients no longer have to bring in prescriptions and then wait or come back to pick them up

- Improved efficiency of retail pharmacies

- Fewer transcription errors and, therefore, improved patient safety

- Increased physician knowledge of patients' other medications

- Better understanding of patient compliance (for example, notification if a patient fails to request and pick up a regular refill)

Many countries in Europe and Asia/Pacific have high usage rates of ambulatory electronic health record (aEHR) systems that generate paper prescriptions, and for those areas, e-prescribing would be off the Hype Cycle. Considering increasing EHR adoption and meaningful use criteria, if this entry was just examining U.S. adoption of digital prescription creation, then the technology's position would be on the Plateau of Productivity, even when considering smaller practices. Note, however, that, as a result of regulatory issues, controlled substances are still not prescribed using automated systems.

In addition, this entry includes the network component (which is a requirement of e-prescribing in the U.S., and which is less mature, especially when it comes down to the two-way communication). Many physicians are able to directly send prescriptions to patients' pharmacy of choice; however, this means less information coming back to the physician, including what medications have been prescribed by other physicians, and whether the patient has actually picked up the medication (or requested a standing refill). Outside the U.S., government agencies are developing the infrastructure needed to transmit prescriptions electronically to pharmacies, or to databases from which the

pharmacies can retrieve them. These government agencies are also promoting the concept of a "medication record" that uses this data, and which the patient can view. Few governments have fully implemented e-prescribing. The more advanced governments in this regard include Israel, Sweden, Denmark and some regions of Spain. The main challenges to widespread e-prescribing include getting pharmacies and ambulatory EHR vendors to modify their applications.

User Advice: Integrating e-prescribing with the ambulatory patient record is an essential long-term strategy; stand-alone e-prescribing tools should be avoided. To help reduce IT investment costs, practices may require a tactical approach in which e-prescribing is the first application to be installed in a vendor's ambulatory EHR system — with others added in a modular fashion over time. In a best-case scenario, physicians will be able to access the complete record of care — which includes medical history, current symptoms, diagnoses, treatment plans, test orders and results — when prescribing new medications and renewing existing ones.

Business Impact: For physicians' offices, e-prescribing enables clinicians' productivity, operational efficiency, patient safety and patient/customer satisfaction. Healthcare payers have documented increased formulary compliance and prescription of generic drugs among physicians who use electronic prescription-writing applications.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Allscripts; Cerner; eClinicalWorks; Epic; GE Healthcare; Greenway Medical Technologies; McKesson; NextGen Healthcare

Computer-Based Physician Order Entry

Analysis By: Thomas J. Handler, M.D.

Definition: Computer-based physician order entry (CPOE) refers to a physician's direct input of orders (medication and nonmedication) into an acute care (inpatient) automation system. We use physician order entry (POE) to emphasize that the ordering clinician — not someone operating on her behalf — needs to interact with the system. Outside of the U.S., the medication aspect is often called e-prescribing or electronic medication management (EMM).

Position and Adoption Speed Justification: Note that the position of this technology on the Hype Cycle relates to the U.S. market, which is the most advanced in the world in the use of this technology. In the U.S., there are few debates regarding whether to implement CPOE. The U.S. American Recovery and Reinvestment Act of 2009 has dramatically increased interest in and implementation of CPOE, because it is a requirement to receive stimulus dollars — and, ultimately, to avoid financial penalties. Gartner considers a hospital to be fully utilizing CPOE when more than 75% of all potential medication and nonmedication orders are directly created by a physician using a computer system. Meaningful use criteria are much lower, which can account for the wide variability in numbers related to U.S. adoption of CPOE. Some claim it is as high as 90%; Gartner estimates it closer to 40%. It is expected that CPOE in the U.S. market will be beyond the Plateau

of Productivity next year. In other countries, adoption of CPOE is rising, but remains much lower, especially for medication orders. Outside of North America, medication order entry is only minimally used. Cost, the maturity of products (especially in terms of the localization of language, as well as drug-drug and drug-allergy databases) and clinician resistance to clinical decision support all hinder the adoption of these products. Note that is has taken more than a decade to nearly reach the plateau for U.S. hospitals. There is extensive use of nonmedication order entry in Europe and more advanced Asia/Pacific countries.

Successfully implementing CPOE most often requires prior success with various other enterprise electronic health record (EHR) components. As a result, CPOE adoption typically lags EHR adoption. CPOE can be more difficult to implement for healthcare delivery organizations (HDOs) with a large proportion of credentialed but nonemployed physicians, but there are increasing numbers of successes even in those organizations.

User Advice: Most, if not all, HDOs should have implemented, or be seriously considering implementing, CPOE. As with EHR systems, it is best to approach these systems as part of a clear clinical transformation program effort, and to ensure that there is a clinical IT governance structure in place that includes a formal clinical decision support committee. Successful organizations have established a chief medical informatics officer function to ensure that deployment, adoption and content life cycle management work are accomplished.

Even before implementation begins, HDOs can begin working on evidence-based order sets and better decision support. In some regions, proprietary and/or standard medication lexicons will need to be created to ensure that proper clinical decision support (such as drug-drug and drug-allergy checking) can be implemented.

Business Impact: CPOE represents an opportunity to reduce practice variability, and it is rapidly becoming an indispensable capability in practicing state-of-the-art medical care. CPOE can lead to substantial improvements in physician efficiency and dramatic reductions in the rate of medical errors associated with the ordering process. The associated clinical decision support can further improve the quality of the clinical care process. The use of order sets is enabling HDOs to encourage best-practice medical care that's in line with recommendations arising from the practice of evidence-based medicine. As more HDOs are held accountable for improving the quality of care delivered, CPOE will become indispensable. In the U.S., meaningful use criteria require adoption of CPOE and, if met, will equate to increased revenue. However, if not met, then penalties will accrue.

Benefit Rating: High

*Market Penetration:* 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Allscripts; Cerner; Epic; InterSystems (TrakCare); McKesson; Meditech; Siemens Healthcare

Recommended Reading: "Magic Quadrant for Global Enterprise EHR Systems"

"2007 CPR Generation Criteria Update: Order Management"

Generation 3 Electronic Health Record Systems

Analysis By: Thomas J. Handler, M.D.

Definition: Generation 3 electronic health record (EHR) systems, which used to be called computer-based patient record (CPR) systems, are used by healthcare delivery organizations (HDOs) to provide automated support for their acute care and ambulatory clinical activities (see "Gartner's 2007 Criteria for the Enterprise CPR"). These systems support the activities of all clinicians and interact with other caregiver automation systems to provide support for the clinical care process.

Position and Adoption Speed Justification: This positioning is relative to the U.S. market, where Generation 3 EHR systems have been available the longest, and where implementations are proceeding fastest, in part due to government incentives, the prospect of future penalties for nonuse, as well the large number of U.S. hospital mergers and acquisitions with resulting rollouts of standard configurations. Determination of penetration is an estimate (based on information obtained from leading vendors and Gartner clients) of how many hospitals are fully using an EHR system (more than 75% of all potential medication and nonmedication orders, and physician and nursing documentation is directly done using the EHR system; this bar is considerably higher than Meaningful Use criteria) As of April 2013, more than 3,800 hospitals have received stimulus dollars under the U.S. American Recovery and Reinvestment Act (ARRA) of 2009, which is a definite increase over last year. EHR activity is increasing globally with many governments encouraging use, hospitals recognizing the potential of EHR systems and with more Generation 3 products available. There are global enterprise EHR vendors (those with a presence on more than one continent), but in some geographies local products take precedence.

Gartner's Generation 3 EHR systems have been available for more than eight years. Implementing such a system can take two years or more, and the follow-up activities to optimize the performance and clinical use of the system require many additional years. There is less discussion about the value of EHR systems, and more recognition that they are mandatory. Generation 3 capabilities, such as clinical decision support, computerized physician order entry and clinical workflow, are essential components of 21st century medical practice.

User Advice: Generation 3 enterprise EHR systems are no longer "nice to have," but rapidly becoming mandatory from government incentives, recognition of the importance and benefits of evidence-based practices and patient safety initiatives, or because of the realization that 21st century medical practice requires the use of a sophisticated transformational product. When correctly implemented, the proof of these systems' abilities to reduce unnecessary practice variations and deliver more evidence-based care is compelling. To take full advantage of the EHR system, HDOs should approach these systems as part of a clear and ongoing clinical transformation program effort (requiring process re-engineering, ongoing clinical decision support and workflow evaluations, as well as clinical content life cycle management). If this is to succeed, there must be a strong clinical IT governance structure in place that includes a formal clinical-decision-support committee.

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Successful organizations have established clinical informatics roles including a chief medical information officer (CMIO) whose function is to ensure that deployment, adoption and content life cycle management work are accomplished. Anticipate that the entire effort might as much as double organizations' IT budgets as percentages of operating expense totals because of access, infrastructure, security, data center and uptime/business continuity investments related to the EHR system. HDOs with a Generation 3 system already in place should focus on clinical optimization activities, such as creating order sets, defining clinical workflows, improving clinical decision support and creating an effective knowledge management mechanism to track advances in evidence-based medicine. Those without Generation 3 systems need to begin the process of obtaining them.

Business Impact: A Generation 3 EHR system can automate support for a wide variety of clinical activities that affect virtually all caregivers and patients. It can reduce the rate of medical errors, eliminate unwarranted practice variations, improve operational efficiency and compensate for the shortage of skilled healthcare workers by streamlining previously manually intensive workflows. While the envisioned benefits are many, they are not immediately apparent. Too often those who are ill-informed think that all that is required is to get clinician adoption. The truth is that it takes substantial time and effort to obtain the full value of an EHR system.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Allscripts; Cerner; Epic; InterSystems TrakCare; McKesson; Meditech; Siemens Healthcare

Recommended Reading: "Gartner's 2007 Criteria for the Enterprise CPR"

Appendixes

Figure 3. Hype Cycle for Healthcare Provider Applications and Systems, 2012
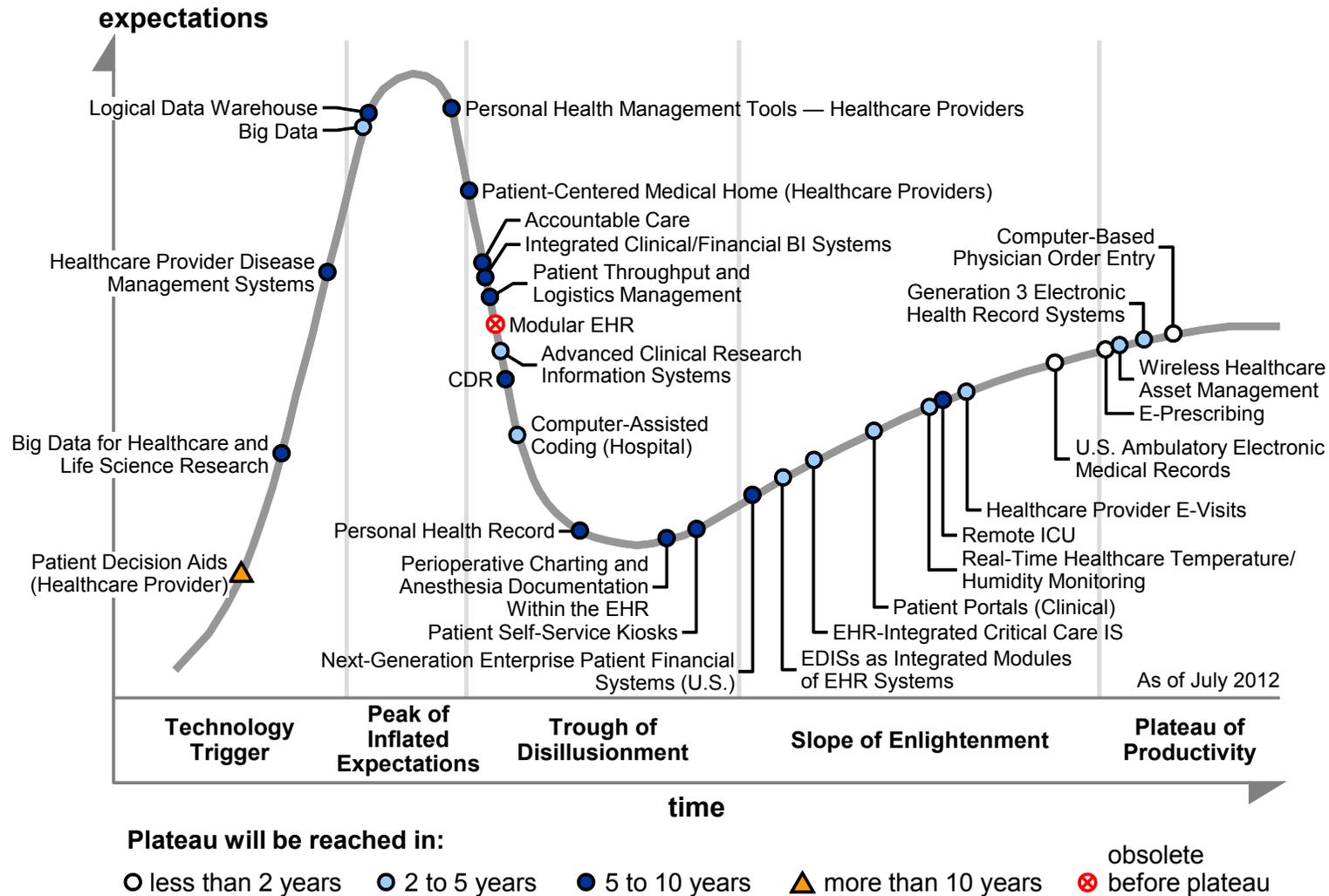
Source: Gartner (July 2012)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2013)

Table 2. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2013)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	■ In labs	■ None
Emerging	■ Commercialization by vendors ■ Pilots and deployments by industry leaders	■ First generation ■ High price ■ Much customization
Adolescent	■ Maturing technology capabilities and process understanding ■ Uptake beyond early adopters	■ Second generation ■ Less customization
Early mainstream	■ Proven technology ■ Vendors, technology and adoption rapidly evolving	■ Third generation ■ More out of box ■ Methodologies
Mature mainstream	■ Robust technology ■ Not much evolution in vendors or technology	■ Several dominant vendors
Legacy	■ Not appropriate for new developments ■ Cost of migration constrains replacement	■ Maintenance revenue focus
Obsolete	■ Rarely used	■ Used/resale market only

Source: Gartner (July 2013)

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Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Predicts 2013: For Healthcare Delivery Organization IT Leaders, Great Potential Will Produce Greater Responsibility"

"Predicts 2013: U.S. Healthcare Payers Face Challenges From Regulatory Reform and Market Disruption"

"Cool Vendors in Healthcare Providers, 2013"

"Agenda Overview for Healthcare, 2013"

"Understanding Gartner's Hype Cycles"

More on This Topic

This is part of an in-depth collection of research. See the collection:

- Gartner's Hype Cycle Special Report for 2013

GARTNER HEADQUARTERS

Corporate Headquarters
56 Top Gallant Road
Stamford, CT 06902-7700
USA
+1 203 964 0096

Regional Headquarters
AUSTRALIA
BRAZIL
JAPAN
UNITED KINGDOM

For a complete list of worldwide locations,
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