

Hype Cycle for Healthcare Provider Applications and Systems, 2010

Gartner Industry Research Note G00205364, Thomas J. Handler, M.D., 27 July 2010, RA2 05062011

Gartner tracks applications and systems that assist care delivery organizations in their pursuit of improving care quality and customer satisfaction, lowering costs, and managing growth. Achieving these goals requires a balance of automation, analysis, insight and strategic innovation.

ANALYSIS

What You Need to Know

In many ways, healthcare in 2010 is much the same as it has been for the past decade. In the face of the ever-growing cost of healthcare, healthcare delivery organizations (HDOs) are asked to improve clinical and financial outcomes, and address growing demand, with limited resources – human or otherwise. However, new models of healthcare delivery, such as accountable care and the patient-centered medical home, that emphasize quality and coordinated care are expected to change the landscape in the near term. Global government stimulus programs, such as the U.S. American Recovery and Reinvestment Act (ARRA), Canada's Health Infoway and China's Guidelines on Deepening the Reform of the Healthcare System, have dramatically boosted interest in not only purchasing clinical applications, but also deploying them in such a way as to achieve meaningful use.

Like last year, one of the trends implicit in this Hype Cycle is the move toward the concept of the real-time enterprise. Progress in healthcare tends to be slow and methodical, yet many applications are evolving to provide real-time management/decision support data. These include computer-based patient record (CPR) systems; location, condition and sensing applications; and dashboarding used for performance monitoring. Efforts to automate and optimize care, retain physicians, better serve and communicate with existing patients, and attract new ones will take on a new sense of urgency. Initiatives will be undertaken to account for things, people and processes within the enterprise, as well as to understand them in considerably more depth – workflow, workforce, outcomes, revenue, costs, customers, medical devices and so on – to get the most out of them and adapt them to new purposes. This year, there is greater emphasis than ever on obtaining patient engagement. Recognizing that healthcare is not just something done to a patient, but that the patient must be an active participant in the decision and care process, significant efforts will be made to encourage and increase secure access by patients and providers to the personal healthcare information assets housed by HDOs. These initiatives will depend on new levels of technical sophistication and interoperability within and outside the enterprise – among customers, patients, providers, their affiliates, payers and their systems.

HDOs should use this Hype Cycle as important input to their strategic planning processes, to avoid technologies that are not ready or not appropriate, and to put in place the right systems at the right time. Gartner divides organizations into three categories based on their use of technology and willingness to take technology risks. Type A (pioneer) enterprises

believe that technology is strategic and are aggressive early adopters of technologies, seeking tactical gains and knowledge useful in making future moves. Type B (mainstream) enterprises adopt technologies when those technologies have proved useful. Selections are based on strategic planning and other enterprises' experiences. Type C (follower) enterprises are cautious and motivated by finances, adopting technologies only when necessary and only when those technologies are strongly (financially) justified. Generally speaking, Type C organizations should only consider adopting technologies that have reached the Slope of Enlightenment. With sufficient business drivers, Type B organizations might consider technologies approaching the Trough of Disillusionment, and only Type A organizations should seriously consider technologies before or just past the Peak of Inflated Expectations. For other technologies important to HDOs, see "Hype Cycle for Telemedicine, 2010" and "Hype Cycle for Healthcare Provider Technologies and Standards, 2010."

The Hype Cycle

This Hype Cycle (see Figure 1) tracks some applications and systems that are of value to HDOs. Each "dot" on this Hype Cycle represents a technology profile, in which the technology is defined, its position and adoption speed are justified, and user advice is provided, along with a benefit rating and an assessment of market penetration and relative maturity. These attributes serve to position the technology or standard on the Hype Cycle and also serve as direct input into the associated Priority Matrix (see Table 1, Table 2 and Table 3 for a more detailed explanation of Hype Cycle phases and technology profile attributes). Appropriate use of these models will help HDOs, healthcare payers and government healthcare agencies make better decisions when considering healthcare applications and systems. For the purposes of this report, we are analyzing the market penetration and adoption rates for the industrialized countries of the world. Because of the wide variation between countries in the maturity of healthcare applications, it is not possible to define a single position for each dot that applies across the world. We have, therefore, chosen to position the dot to reflect the status of the most advanced country or region, and, in cases where there is significant discrepancy between the positioning of the most advanced country and other countries, we have provided an explanation.

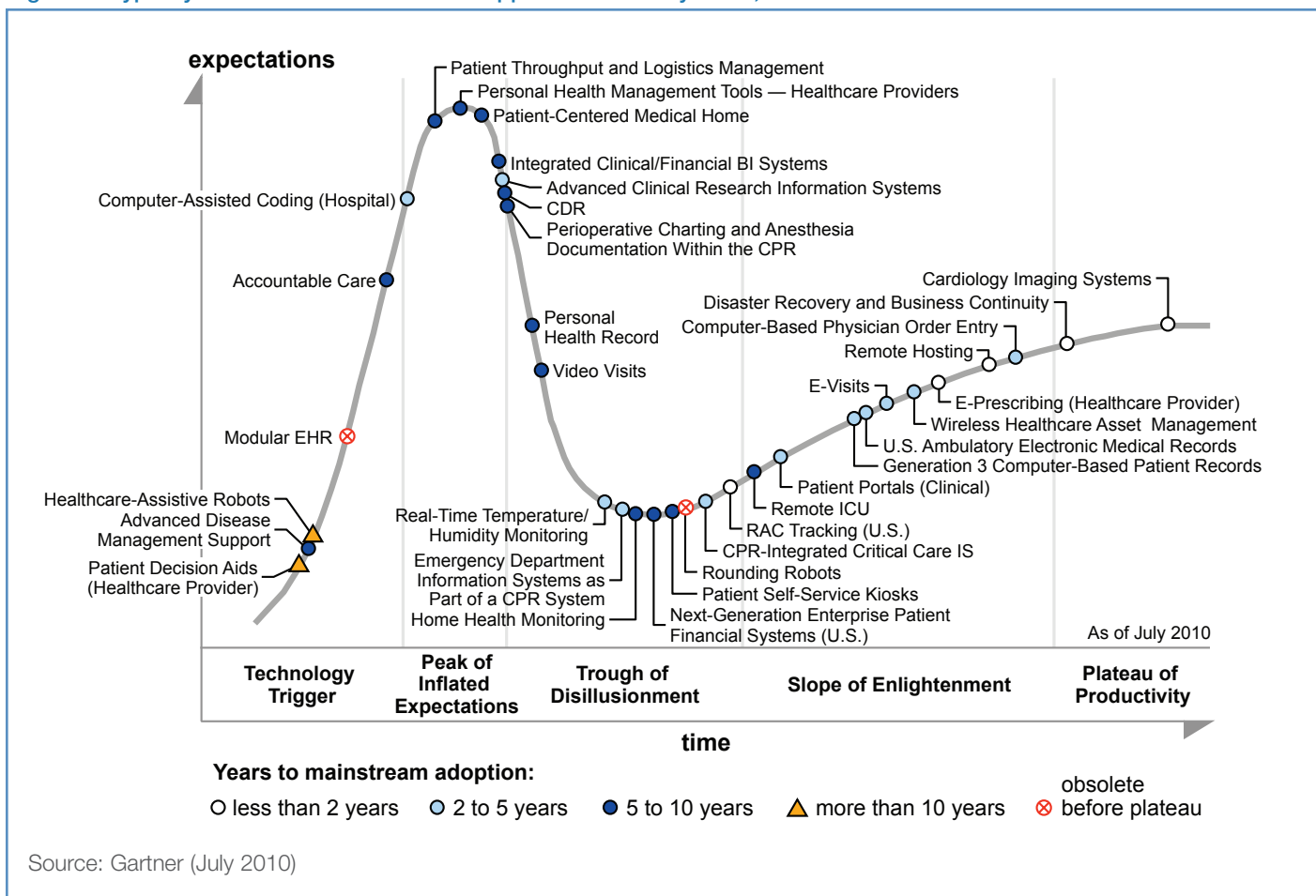
Gartner's Hype Cycle model helps organizations understand the maturity of technologies and applications between initial commercialization and broad market acceptance. Every Hype Cycle includes five phases:

- *Technology Trigger* – A breakthrough, public demonstration, product launch or other event that 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 the Plateau of Productivity.

One important use of the Hype Cycle is the ability to detect trends and plan for future possibilities. Past Hype Cycles have correctly pointed out that more-integrated capabilities within the CPR system, more analytics and more patient-direct focus of IT were coming. With the introduction of the concepts of accountable care organizations and the patient-centered medical home, the 2010 Healthcare Provider Application Hype Cycle identifies movement toward coordinated care and the importance of attempts to rein in the costs of healthcare delivery, while delivering higher-quality care. This year's Hype Cycle continues to demonstrate the importance of the concept of the real-time enterprise in healthcare, as more applications are evolving to provide real-time management/decision support data. Generation 3 CPR systems have better decision support capabilities. Wireless healthcare asset management, temperature/humidity monitoring, and patient throughput and logistics permit more-efficient control of the physical environment of a healthcare organization. Lastly, dashboards are extending applications and moving to real-time performance monitoring.

There are 34 profiles in this year's Hype Cycle for Healthcare Applications and Systems. Healthcare typically is slow to adopt new technology, so it should not be surprising that almost one-half

Figure 1. Hype Cycle for Healthcare Provider Applications and Systems, 2010



of the applications and systems will not see mainstream adoption for five to 10 years, and two are expected to take 10 years or more. Sixteen are anticipated to achieve at least 20% market penetration during the next two to five years or sometime between 2012 and 2015.

Applications that are within the Technology Trigger phase include advanced disease management support and patient decision aids. Conversations with leading healthcare CIOs and chief medical information officers (CMIOs) appear to validate the belief that, within the next decade, more of the responsibility of disease management will transition from healthcare insurers to HDOs. Already, leading organizations, such as Kaiser Permanente and Geisinger, are focusing on adherence to clinical guidelines, clinical decision support and outcome measurement for several chronic disease states. There has been some talk among leading academics about the importance of offering consumers access to patient decision aids – interactive rule-based systems that enable patients to evaluate their treatment options – but this is at the earliest level of awareness and interest.

Somewhat further along is a new entry, Accountable Care, which represents a potential change in the way healthcare is delivered and reimbursed – one that requires more transparency in quality metrics, and where the HDO is more at risk if costs are greater or if the quality of care delivered is lower than expected. Another new entry is Computer-Assisted Coding, an immature technology that holds great promise for improved efficiency and revenue cycle management. Several applications and systems that are approaching or hovering about the Peak of Inflated Expectations phase will empower customers and patients, and provide for innovative ways of fostering collaboration. The patient-centered medical home, personal health management tools, personal health records, perioperative charting and anesthesia documentation within the CPR, advanced clinical research information systems, and integrated clinical/financial business intelligence (BI) systems are aimed at better supporting existing patients and attracting new patients with increased access, better tools, increased collaboration and focused medical content. Also present are systems designed to better monitor and control the organization's physical plant, such as U.S. Medicare Recovery Audit Contractor (RAC) tracking and real-time temperature/humidity monitoring.

Figure 2. Priority Matrix for Healthcare Provider Applications and Systems, 2010

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Generation 3 Computer-Based Patient Records	Accountable Care Patient-Centered Medical Home	
high		Advanced Clinical Research Information Systems Computer-Assisted Coding (Hospital) Computer-Based Physician Order Entry E-Visits	CDR Home Health Monitoring Integrated Clinical/Financial BI Systems Patient Throughput and Logistics Management Video Visits	
moderate	Cardiology Imaging Systems Disaster Recovery and Business Continuity E-Prescribing (Healthcare Provider) RAC Tracking (U.S.) Remote Hosting	CPR-Integrated Critical Care IS Emergency Department Information Systems as Part of a CPR System Patient Portals (Clinical) Real-Time Temperature/Humidity Monitoring U.S. Ambulatory Electronic Medical Records Wireless Healthcare Asset Management	Advanced Disease Management Support Next-Generation Enterprise Patient Financial Systems (U.S.) Personal Health Record Remote ICU	Healthcare-Assistive Robots
low			Patient Self-Service Kiosks Perioperative Charting and Anesthesia Documentation Within the CPR Personal Health Management Tools — Healthcare Providers	Patient Decision Aids (Healthcare Provider)

As of July 2010

Source: Gartner (July 2010)

Those applications and systems concentrated in or about the Trough of Disillusionment are made up of enterprise and departmental systems required to advance the enterprise and improve the automation of the complex and challenging clinical workflows within an HDO. Applications and systems that are within the Trough of Disillusionment, or “Sliding Into the Trough” as it were, will experience their share of failures, vendor consolidations and funding issues. It is often during this phase that products, services and initiatives are improved through focused pilots and trial feedback. Such is the case for real-time temperature/humidity monitoring, home health monitoring and patient self-service kiosks. Others represent immature products that still need more proof to reach the Plateau of Productivity. These include two of the newer enterprise CPR modules – integrated critical care and integrated emergency department (ED), and next-generation enterprise patient financial systems.

Applications and systems that are within the Slope of Enlightenment or “Climbing the Slope” are typically second- and third-generation products that users have become increasingly comfortable with, and products that do not require the same level of vendor attention and service to use day to day. As more and more HDOs are and have been implementing advanced clinical automation, it should be of little surprise that most of the applications in this region of the Hype Cycle are clinical in nature. Remote ICUs and patient portals have finally progressed through the Trough of Disillusionment. Generation 3 CPR systems, e-visits, e-prescribing and computer-based physician order entry (CPOE), and ambulatory electronic medical records (EMRs) in the U.S. have matured and are approaching the Plateau of Productivity. Desire for more-predictable control over costs and operations can be seen by the increased acceptance of wireless healthcare asset management and remote hosting.

The Priority Matrix

The Priority Matrix (see Figure 2) is a companion to the Hype Cycle graphic. It maps a technology’s benefit to its time to maturity. This table 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 technology, and when will the technology 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.

Generation 3 CPR systems can deliver transformational value within the next few years, and the accountable care model and the patient-centered medical home technologies will likely transform healthcare delivery in the next decade. Products like advanced clinical research information systems, computer-assisted coding,

CPOE and e-visits are considered “warm” profiles that have high value for CDOs during the next two to five years. These products enable new ways of doing business and could result in cost savings or increased revenue. It will take five to 10 years or more for other high-value applications, such as CDR, government data interoperability, home health monitoring, integrated clinical/financial BI systems, patient throughput and logistics management, and video visits to begin to offer concrete implementations and deliver value. HDOs should look for incremental value now by adopting products such as cardiology imaging systems and business continuity systems, as well remote hosting and RAC tracking – systems that impact clinical productivity and overall efficiency. HDOs willing to look out to the slightly longer term (two to five years) can begin planning now for more integration of clinical systems by tracking and considering replacing stand-alone systems with newer integrated modules from their enterprise vendors – such as critical care, ED, e-prescribing and ambulatory.

Off the Hype Cycle

The entries Generation 2 Computer-Based Patient Record Systems, Patient Self-Service Portals (Scheduling/Billing) and ERP SOA were removed from this year’s Hype Cycle. In the U.S., nearly all enterprise CPR products have reached, or soon will reach, the Generation 3 level, and the vendors are no longer selling or marketing the Generation 2 products. Furthermore, most HDOs recognize that they need the advanced functionality of a Generation 3 product. We have said that Generation 2 CPRs would become obsolete before the Plateau of Productivity, and we believe that they have done so this year. Lastly, we have positioned all applications and systems based on the most advanced regions, which for CPRs is North America. However, it must be noted that there are still Generation 2 products being sold outside of North America. The Patient Self-Service Portals (Scheduling/Billing) entry is no longer on this Hype Cycle. This has evolved in a manner that has made these portals past the plateau or obsolete. Viewing a bill, enabling someone to make a payment and requesting an appointment are mundane functions that are often performed now. The more-dynamic functions, such as scheduling an appointment, a test or even a surgery, are separate and distinct phenomena that may not happen for hospital visits but will for ambulatory visits. If collaborative care occurs as expected, there may well be a need for enterprise and cross-enterprise scheduling. As for ERP SOA, this has become too much of an eclectic set of vendor-specific activities to capture as a single trend.

On the Rise

Patient Decision Aids (Healthcare Provider)

Analysis By: Tom Handler

Definition: Patient decision aids are interactive systems based on decision rules that enable patients to evaluate their treatment options. These tools are developed for conditions in which there isn’t a single, evidence-based, definitive treatment option, and, therefore, the patient’s personal preference is an important factor in the decision-making process. Note that these aren’t disease management applications or personal health management tools.

Position and Adoption Speed Justification: Although this technology has potential, there has been essentially no movement during the past year. However, there has been attention to increase patients' participation in their own care in terms of greater financial contributions, as well as greater involvement in care planning. However, because physicians are more time-constrained than ever and rarely have the time to comprehensively review treatment options with their patients, there is a need for these types of systems to help patients make better decisions.

Patients don't always understand all their options and might not have considered (in a structured way) how their personal preferences might or should affect their decisions. If their doctors don't have time to discuss options in detail, patients will need to turn elsewhere as they make 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. 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. Few, however, consider that, if they initially seek help from a surgeon, they're more likely to get a surgical solution. Software to assist patients in making these difficult decisions will improve care and patient satisfaction, provided that their clinicians are also active participants. Adoption may be driven by patients' increased financial liabilities, and because they're increasingly being asked to play a more-active role in the care they receive.

At this point, 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?

There's also uncertainty regarding whether patients will accept and use these systems. In addition, there are still questions about the technology itself. Should these decision aids be part of a computer-based patient record system, and, therefore, have access to patient-specific content, or will they be stand-alone systems that are for a single diagnosis? In any case, it's essential that the patient's physician be included in the process. In the past year, there hasn't been much traction with these tools, because questions remain regarding whether they're even good enough yet.

User Advice: Early adopters might consider small pilots of this technology, but recognize that there will be risks (including the possibility of medical or legal ramifications), because these tools remain unproved. Type B and Type C organizations (mainstream and laggards, respectively) are best advised to wait several years for these products to mature.

Business Impact: The successful rollout of patient decision aids may help with branding and patient loyalty, but it's too early to determine more-concrete business effects.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Health Dialog; myOptumHealth; Revolution Health

Advanced Disease Management Support

Analysis By: Tom Handler

Definition: Advanced disease management systems are designed to support provider efforts in managing the course, progress and outcome of care for significant disease processes – chronic and acute – through a continuum of care that spans settings and time. This functionality is best handled as a component of a computer-based patient record (CPR) or electronic medical record (EMR) system. Significant disease processes are those that are high-volume, high-risk or high-cost, such as diabetes or cardiac conditions.

Position and Adoption Speed Justification: Misaligned incentives are one of the key barriers to the adoption of advanced disease management support by healthcare delivery organizations (HDOs). Also needed is better incorporation of disease management tools in health IT records and CPRs – at local and national levels. Until providers are given incentives to adopt or are penalized for failure to implement disease management programs, adoption will be slow. Disease management has been largely under the purview of healthcare insurers or government sponsorship, often through the use of third-party vendors and a combination of technology and nurse-based programs that work directly with patients. The relationship between the physicians who manage patient care and the third-party vendors has ranged from cordial to hostile – but, in most cases, the relationship hasn't been collaborative or very effective. As more HDOs implement CPR systems and EMR systems, access to digital healthcare data and advanced clinical decision support tools will greatly enhance the provider's ability to conduct disease management. Healthcare providers are beginning to recognize the importance of disease management. Governments and other healthcare payers are demanding more accountability for quality care. A few progressive organizations are taking a much more proactive approach in leveraging their clinical systems to do the same. For example, one of Kaiser Permanente's stated reasons for implementing an integrated CPR system was to be able to track and implement treatment of its diabetic patients in near real time. The end result will be increased clinical quality, and in addition, costs should decrease. Although there will always be a need to work collaboratively with healthcare insurers, over time, more disease management will transition to HDOs.

User Advice: Incentives are slowly changing, and provider organizations shouldn't depend on healthcare insurers for disease management. HDOs, especially those with appropriate risk contracts, need to begin assuming more of this role themselves. This will involve ensuring that the proper technology and clinical content are available. HDOs need to move toward full clinical automation as quickly as they can. Although disease management can be conducted without a CPR or EMR, the capabilities of these systems clearly facilitate disease management. For disease management to be successful, it's important to have a framework that facilitates the development of up-to-date clinical content.

Business Impact: Provider organizations that assume disease management responsibilities will provide better care more efficiently.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Healthcare-Assistive Robots

Analysis By: Vi Shaffer; Jonathan Edwards

Definition: Mobile robots move and navigate in an autonomous or semiautonomous (that is, via remote control) manner, and have the ability to sense or influence their local environments. Assistive robots are likely to be functional and humanlike in their appearance and capabilities. Their envisioned healthcare applications include assisting nurses and other care providers with routine, repetitive or physically strenuous tasks (such as safely lifting an object or person) in hospitals, and serving as home health aides to patients with physical- or chronic-disease-related challenges. This profile separates the longer-term, high-impact use of robotics from other current and evolving robotic technologies in healthcare, such as robotically assisted surgery systems, the current generation of rounding robots, pharmacy-prescription-dispensing robots and robotic technologies for the delivery of items to specific locations.

Position and Adoption Speed Justification: At the high end of the market, Sony and Honda have developed human-looking robots that can walk, run, jump, and respond to gestures and voice commands. A number of academic institutions are also experimenting with medical applications of this technology. These are still research prototypes, however, and they are not yet available at commercially viable prices, but they indicate the level of physical performance and responsiveness that will be available in the next decade.

The persistent shortage of healthcare professionals (such as nurses) and certain needs (particularly of a growing senior population in many countries) – including the physically demanding aspects of many healthcare services, infection control and the potentially therapeutic benefits of socially assistive robotics – make healthcare a potentially large global market in which to focus these technologies. However, since healthcare-assistive robots are only at an experimental stage, their potential has yet to be realized.

User Advice: The CIOs of leading-edge healthcare delivery organizations should consider the use of robots for simple, repetitive or potentially dangerous tasks. They should also watch for the more-sophisticated robots described herein and recognize that it will be many years before they become commercially viable.

As assistive robots start to reach price levels that are comparable to a person's salary, leading-edge health system CIOs should prepare for mobile robots to appear as new endpoints in healthcare IT networks – and possibly for their need to be represented in IT systems as “virtual” providers with unique identifiers and workflows.

Business Impact: The impact of assistive robots will be in assuming functions that directly supplement the healthcare (and social services) labor force, or provide innovative, new healthcare

services. To become successful, vendors will need to document the cost-effective improvements in the healthcare professional's efficiency and workflow, or the total cost of care delivery for the same or an improved outcome. Vendors may also enhance the patient's quality of life – for example, by creating the ability for him or her to live more independently, thereby reducing or delaying the need for assisted living and nursing home facilities, or by improving rehabilitation and return-to-work results.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Honda; iRobot; InTouch Health; Mitsubishi; MobileRobots

See <http://viterbi.usc.edu/news/news/2009/can-robots-help.htm> for a video that shows examples of assistive robotic use in the treatment of autism and other medical applications, courtesy of the University of Southern California.

Modular EHR

Analysis By: Wes Rishel

Definition: U.S. draft regulations for certification of electronic health records (EHRs) under the American Recovery and Reinvestment Act of 2009 (ARRA) have given new currency to an old notion, that healthcare delivery organizations (HDOs) could assemble a complete EHR by mixing and matching modules from multiple vendors. Such an idea, when applied in moderation, is really nothing new. It reflects the usual situation in large HDOs, and there are many opportunities to expand existing capabilities by integrating third-party packages.

However, some advocates within the U.S. and other jurisdictions are enthusiastically promoting a very piecemeal, “best of breed to the extreme” approach. They are joined by some high-end providers of technology that market their products as an “ecosystem” for modular health applications. This technology profile addresses the hype around the extreme approach by defining a “modular EHR” as a complete computer-based patient record (CPR) system or electronic medical record system composed of separately developed modules for the primary functions of a medical record system – namely, documentation, computer-based physician order entry, point-of-service collection of clinical data and decision support.

Proponents of this approach point to the success of iPhone apps and the rapid development of mashups using protocols that more or less conform to the notions of representational state transfer (REST).

Position and Adoption Speed Justification: This is not the first time the modular EHR concept has traveled through the Hype Cycle. The current iteration still has “legs” in terms of expansion of the hype. Like many interesting ideas, however, the experience of early-adopting HDOs that try it will lead to substantial reductions in expectations. New conceptual terms will come out for the more realistically defined notions, and they will advance toward the

Plateau of Productivity. But the fundamental notion that HDOs can go to an iTunes-like purveyor of EHR modules and snap together the basic pieces of an EHR will once again die in the Trough of Disillusionment. It's likely some future new technology will lead to yet another cycle of hype around the piecemeal construction of EHRs by picking from modules from a competitive marketplace.

The robust marketplace for iPhone apps (and increasingly Android apps) is not to be ignored. However, we see no evidence that anyone is stringing together multiple independent iPhone apps to create new workflows, particularly with the level of data fidelity that is necessary to ensure the accuracy of clinical decisions and quality measurements.

Whether the modules are smartphone applications or based on other technologies, the problems of creating workflows among different vendor applications with high data fidelity are well beyond the competence of all but a few HDOs that have a good supply of highly competent personnel and sufficient clout with vendors to get modifications on the HDO's schedule.

It seems more likely that a broad market of CPR app modules for any platform will consist of satellite apps for well-established CPR products and stand-alone apps that have validity only until the ideas are proven and incorporated into CPR systems. Examples of the former include iPhone extensions being developed by Epic and Cerner, and the announced collaboration between Microsoft and Eclipsys creating tight linkages between Amalga UIS and Sunrise Clinical Manager. Examples of the latter include ePrescribing and situation-specific dosing applications. As valuable as the latter apps might be, no physician would choose to re-enter data in order to use them if the same function were integrated into the CPR and integrated directly into a workflow.

User Advice: The vast majority of HDOs should plan to buy the central functions of a CPR or EMR from a single vendor. Consider mashups for other forms of application integration with external modules for applications that are outside of the primary workflow, such as applications for aggregating quality measurements, applications for extra-enterprise interoperability, and applications to fulfill requirements for using electronic data interchange (EDI) for billing and other administrative functions. Consider using modular add-ons when they are provided by the CPR vendor or are not dependent on faithful reproduction of detailed clinical data across the interface.

Leading-edge HDOs that have a proven track record of self-developing applications are in a better position to acquire modules from vendors or open-source projects, and maintaining successful workflows with high data fidelity.

Business Impact: Modularity within reasonable bounds will assist HDOs in expanding their available functionality, maintaining a cooperative spirit with physicians that are enthusiastic about smartphone apps and maintaining a good image with the general public. Adapting the assembly of modules as an alternative to selecting and implementing cohesive CPR or EMR systems will only create confusion and delay, except for a few highly self-sufficient HDOs.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Cerner; Eclipsys; Epic; Microsoft

Accountable Care

Analysis By: Tom Handler

Definition: An accountable care organization is a type of healthcare delivery organization (HDO) that, together with a related set of providers (including both primary care physicians and specialists), can be held accountable for the cost and quality of care delivered to a defined population. The goal of an accountable care organization is to provide efficient and high quality care. To deliver this, accountable care organizations need to provide the full range of care; they must also be able to plan budgets according to future resource needs, and provide valid measures of performance. The basic concept is that those accountable care organizations that reach certain predetermined quality and cost targets will receive financial rewards, while those that don't meet the metrics might actually be penalized.

Position and Adoption Speed Justification: Quality and cost remain two of the biggest concerns facing healthcare today. Governments, businesses and healthcare insurers continue to seek a solution that will reduce healthcare costs (or at least slow down the ever increasing burden of healthcare) without negatively impacting the quality of care. Moving toward appropriately reimbursing accountable care organizations seems to hold great promise; however, there are a number of questions that must be answered before there can be much progress. For example, will an accountable care organization be a formal, incorporated organization – or a more loose affiliation of clinicians and HDOs? In some cases, the accountable care organization will be the HDO; in others, perhaps, a new organization. Another important question is, who will set the minimum performance standards and how will they be measured? Currently, there is a great deal of talk – but little action. If incentives are tied to accountable care, then adoption will quickly follow. However, changing reimbursement alone will not be enough. Organizations that comprise the full range of care, in terms of both venues and employed physicians, are in the best position to become accountable care organizations. Other HDOs will need to form alliances – to ensure that they have the correct range of clinicians (primary care and specialists), as well as both inpatient and ambulatory venues. HDOs will also need to have advanced clinical systems (and analytics) in place to be best prepared for the new forms of reimbursement.

User Advice: It appears likely that reimbursement for clinical care will, ultimately, be tied to quality and efficiency, and that accountable care organizations will be created and offered incentives. HDOs need to be prepared for this eventuality; those already employing the required spectrum of clinicians, and with the necessary range of venues, are in the strongest position. Others need to be working to establish trust relationships (with a variety of clinicians) in order to create the correct environment for accountable care.

At the same time, HDOs need to implement enterprise computer-based patient record systems – to implement the care pathways, guidelines and clinical decision support necessary for high quality care. Organizations must start implementing clinical analytics, to ensure that they are delivering the care required of accountable care organizations. From an IT perspective, large HDOs are in a somewhat better position. Others need to not only implement the clinical systems, but also create a strategy for interoperability between the disparate systems being used – by the different organizations that have banded together to form an accountable care organization.

Business Impact: Accountable care has the potential to transform HDOs; they must be able to deliver high quality care efficiently, as well as providing the metrics to document that quality. HDOs that are prepared for this change will have a significant advantage over those being less proactive – assuming that accountable care organizations come to fruition. The end results will be better, less costly, care; and better financial health of the HDO.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

At the Peak

Computer-Assisted Coding (Hospital)

Analysis By: Vi Shaffer

Definition: This entry refers to computer-assisted coding (CAC) that is specifically for hospital/acute care services. CAC is defined by the American Health Information Management Association (AHIMA) as computer software that includes natural-language processing (NLP) capabilities. CAC automatically identifies medical concepts/terms within clinical documentation provided by healthcare practitioners; considers the context in which words are used; assigns disease classifications and procedure codes; and generates a set of medical codes for review, validation and use, based on clinical documentation provided by healthcare practitioners. At minimum, this presents precoded charts for medical coders to scrutinize, although some applications do apply some coding assistance that can be seen by clinicians at the time of clinical documentation.

Position and Adoption Speed Justification: CAC's early successful application had been primarily for radiology, which presented a simpler CAC challenge than does hospital acute care services. This is because hospital coding incorporates a far wider variety of services, documentation and rules. Work is also under way to develop CAC for physician evaluation and management (E&M) coding. We believe that current development efforts under way in the industry, persistent interest by hospitals in innovations to reduce administrative costs to collect, the increased use of electronic medical records in hospitals, and migration to the International Classification of Diseases, 10th Revision (ICD-10) coding system each contribute to making the prospects for viable and reliable hospital CAC brighter. The persistent challenges of having or training enough coders, coding accuracy, and increased

audit scrutiny of billing appropriateness from the U.S. Centers for Medicare & Medicaid Services (CMS) and others also help drive the appeal of accurate defensible CAC. Although there will be a great deal of skepticism and caution in the market for some time, once it is really proven at multiple hospitals, its use should take off in the market.

Note also that there are quite a number of partnering and integration relationships among the vendors we list here. For example, 3M teams with CodeRyte to integrate CodeRyte CAC technology with 3M's Codefinder software; Ingenix Web.Strat encoder is connected with A-Life's Actus; and Dolby's Fusion Speech is "powered by" Nuance's SpeechMagic and offers Dolby's Fusion CAC "powered by" Artificial Medical Intelligence's EMscribe Dx. Partnerships and potential other business combinations will continue to be an important part of assembling CAC solutions.

User Advice: Revenue management executives and CIOs will find it tricky to evaluate the relative value and readiness of different CAC approaches. This is quite difficult because of all the "black box" type of heavy-lifting intellectual property that goes into NLP, interpretation of content and linkage with codes. The proof of CAC readiness, value and the relative value of alternatives is in the proof out of the early-adopter healthcare delivery organizations (HDOs): What happened to those claims generated with CAC assistance? Did the coders have to make large numbers of adjustments, or did the CAC appear very accurate? What happened to accounts receivable (AR) and days in AR? Did payers reject these claims more or less than before, and how did they fare relative to claims audits? CIOs, chief medical informatics officers (CMIOs), and health information management (HIM) and revenue management directors should monitor progress in CAC and NLP currently. Adopt CAC applications as they emerge and are proven, recognizing that the strongest players will continue to improve accuracy and effectiveness – the more they see data, apply their methods and scrutinize results, the more these systems will evolve.

CMIOs should lead efforts to incorporate advances in NLP and CAC within computer-based patient record systems to assist in coding efficiency and other improved usefulness of clinical documentation.

Business Impact: Strong CAC will increase coding accuracy, create objective defensibility, save on the cost of coding, the risk of unfavorable payment recovery audits, and potentially speed the time to payment. So far, real-world examples are few and early in their study. For example, Eastern Maine Medical Center, which is piloting one vendor's offering (as part of a larger document management effort focused on improving coder productivity, accuracy and morale), has so far slightly reduced the number of coders and obtained a nearly 30% coder productivity gain, and seen a notable drop in AR. CAC will ultimately contribute to a significant redefinition in the resources required for billing per record, and should also provide more upfront support to deflect the revenue risk of initiatives like U.S. CMS's Recovery Audit Contractor program.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: 3M (Health Information Systems); A-Life Medical; Artificial Medical Intelligence; CodeRyte; Dolbey; Ingenix; Intelligent Medical Objects; Nuance; Plato Health Systems; QuadraMed

Patient Throughput and Logistics Management

Analysis By: Vi Shaffer

Definition: Patient throughput and logistics (PTL) management is a next-generation evolution that springs from earlier bed board/bed management applications, as well as current patient and healthcare asset location systems. However, this differs substantially, because a PTL application offers more-sophisticated functions. These systems aim to deliver value by providing real-time, hospitalwide visibility into operations, patients and resources. PTL 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. Features and functions, as well as the amount of consulting support provided, will vary among the vendors moving in this direction. 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. Technologies such as radio frequency identification (RFID) for person and asset location; voice over IP for “everywhere” communications; and evolving software, reporting and decision support are all part of the bundle. In order to offer significant value, PTL applications also require interoperability with multiple other applications. Designed to fit with workflows, they will also enable substantial evidence-based process re-engineering and contribute to evidence-based facility design.

Position and Adoption Speed Justification: The importance of optimizing patient throughput and resource/capacity management is well-understood by most healthcare organizations. This is gaining even more visibility as plans for new construction have been constrained by recently constrained capital in some countries, while increases in demand continue. The best way to reach a new plateau will be by leveraging a combination of information assets. In the U.S., The Joint Commission has set standards related to patient flow, which has also helped stimulate interest in new approaches.

Bed boards in emergency departments (EDs) 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 PTL are, however, still quite early in their evolution. Some vendors are now articulating a product vision farther along these lines and are beginning to deploy more functionality (such as algorithms and analytics) toward that vision. We are starting to see pockets of results. For example, Mercy St. Vincent Medical Center in the U.S. has recently cited its improved operational performance and eliminated waste (with representative vendor StatCom). Most vendors are still just deploying earlier generation functionality, such as visual alerts within bed boards, and experimenting with uses of patient/provider location awareness and logistics.

Although this has been an application area being pursued by niche specialists who are delivering the earliest applications, its potential relationship with the computer-based patient record (CPR), ADT and other core systems makes this an area of future interest for the healthcare megasuite vendors. The competitive landscape is likely to continue to evolve substantially during the next few years. The ultimate winners will be those with a more complete overall solution orientation. PTL is going to be hard to develop and then document the return on investment (ROI). It will also require some basic changes in CDO responsibilities at the manager and executive levels, and PTL will yield optimal benefit as an enterprisewide (at least a multihospital) strategy. Thus, we see a long adoption curve ahead, with substantial potential benefits in the end.

The vendors we list here illustrate those that have the potential to more fully flesh out this application area by extension from either bed management or real-time location system platforms.

User Advice: Optimizing throughput and logistics, balanced with the mission of optimizing patients’ safety and clinical/experiential outcomes, must become a top operational core competency of the healthcare delivery system. Appoint a senior leader to be responsible for PTL at the health system level, at least to oversee your hospitals. This is challenging, because 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. In addition, many large integrated delivery systems have not yet created the leadership and culture of “systemness” that will enable them to direct innovations and best practices in areas such as PTL across the enterprise. CIOs should keep a close eye on the emerging applications and vendors.

Many hospitals can benefit from the current generation of bed boarding/awareness applications. Early adopters will want to begin experimenting with PTL concepts (including both bed management systems and RFID patient-tracking pilots – we’ve listed both types of representative vendors that could evolve in this direction). Consider near-term investment in RFID for improved asset tracking and management for its stand-alone benefits. Align the potential timing of interest in emerging PTL applications with your organization’s history of success with potentially high-impact, innovative management and IT initiatives (as well as tolerance for the inherent risks). Consider vendors’ ability to deliver bed board and RFID applications today, and carefully scrutinize specific action plans to advance in the PTL arena. For example, look for evidence of both hospital operations track record and fairly sophisticated logistics expertise among the vendor’s staff. The vendor landscape for this brand-new applications arena will probably be cloudy for some time.

Business Impact: While many in healthcare become more focused on ambulatory services, chronic disease management strategies, and sharing EHRs, there is still much work to do in making hospitals more efficient, maximizing resource use and optimizing patient throughput. Comparing hospital length of stay (LOS) among acute care hospitals is a standard benchmark point, and focusing on performance improvements that result in LOS reduction is one of the first initiatives of management turnaround experts for financially challenged organizations. But over the years, LOS has dropped overall, and variation has been reduced in the U.S., for example. In a recent published interview, Harvey Fineberg, the president of the Institute of Medicine, the health arm of the

U.S. National Academy of Sciences, focused on patient flow and resource use as a strong opportunity for improvement, saying: “Where we’re perhaps not making as uniform progress is on scheduling the flow of patients through hospital beds, emergency rooms, and operating rooms so that we can spread the use of those fixed facilities in a way that provides the care that patients need in a more reliable and efficient manner. This is going to take a lot of cooperation from physicians and surgeons, from hospital administrators. It’s going to take operations and engineering expertise to analyze specific situations in individual hospitals. But there’s a lot of efficiency to be achieved....” (source: excerpt from “Conversations on Health Care Reform: Harvey Fineberg of the Institute of Medicine,” McKinsey Quarterly, May 2010).

PTL applications, offer the strong long-term potential to very significantly improve patient flow and resource use for complex healthcare delivery organization processes (along the lines of Dr. Fineberg’s observation and relating this effort to experiences in the manufacturing sector). Therefore, we rate the potential benefit as high. We recognize, however, that the few offerings in this arena are new and largely unproven. When combined with the complex process re-engineering and likely cultural resistance to change, gaining this high impact will be elusive for most health systems.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: AeroScout; Eclipsys; GE Healthcare; McKesson; StatCom; TeleTracking Technologies

Personal Health Management Tools – Healthcare Providers

Analysis By: Tom Handler

Definition: Personal health management tools (PHMTs) are online applications that provide interactive functionality to assist consumers in managing their health and disease processes. These applications typically include health education information on prevention (such as routine screenings, nutrition and exercise) and diseases (such as identification, common treatments and pharmaceuticals). Interactive tools enable consumers to establish programs to manage their health by keeping track of diet, exercise and routine care, and to monitor typical chronic illnesses, such as asthma and diabetes. PHMTs typically are extensions of patient portals or personal health records (PHRs) – the richer the underlying dataset, the more effective the tools.

Position and Adoption Speed Justification: Healthcare consumers have been interested in online PHMTs for a long time, although most of what’s been available were simplistic weight or health status calculators. With the growth in chronic care and increasing Internet usage, 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 an even greater need for better PHMTs, particularly in populations where chronic illnesses or complex medical conditions are present. As PHRs become more

prevalent, as they contain more clinical information, and as more organizations roll out more-robust patient portals, there’s greater hype about the potential benefits of PHMTs. Still, there haven’t been many advances in the presence or utility of these products. Initially, the more-complex PHMTs are likely to be provided by healthcare payers or 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. However, this will take some time.

User Advice: Healthcare delivery organizations (HDOs) should consider rolling out PHMTs for subsets of their patients for which the self-management of chronic or complex medical conditions would be beneficial. Although these applications may initially be provided by healthcare payers, ultimately healthcare providers must be active participants – at the very least by vetting the quality of PHMTs, if not by actually creating them. 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. 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: myOptumHealth; TriZetto (CareKey); WebMD

Patient-Centered Medical Home

Analysis By: Tom Handler

Definition: The patient-centered medical home (PCMH) refers to a new U.S. healthcare delivery model between individual patients, their personal physicians and, as appropriate, the patient’s family. 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 in care delivery
- Enhanced access to care
- Payment changes to fund the medical home

Position and Adoption Speed Justification: While there is a great deal of discussion about the PCMH model, adoption will initially be slow because it requires changing reimbursement models from government and private healthcare payers. Some industry leaders (and demonstration project participants) will adopt or are adopting 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 either to push or inhibit further changes. 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 Centers for Medicare & Medicaid Services (CMS) PCMH interest are all forces driving the acquisition and employment of independent physicians and practices. These forces help propel PCMH. 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.

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. The PCMH model is also not uniformly considered to be a significant value to the patient. Its goals are admirable. However, the costs for IT enablement and provider practice changes may prohibit the investment in 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. Without incentives in place to encourage the PCMH model, it will have a limited, if any, impact.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Integrated Clinical/Financial BI Systems

Analysis By: Vi Shaffer

Definition: Integrated clinical/financial business intelligence (BI) systems for healthcare delivery organizations (HDOs) target large communities of users with dashboards; standard reports; and Web-based, interactive database query to an online analytical processing (OLAP)-optimized data warehouse. They are distinct from traditional HDO enterprise data warehouses for financial/business-oriented purposes. They are also distinct from the "shadow" database solutions for clinical data viewing provided by several computer-based patient record (CPR) vendors (e.g., Cerner PowerInsight Explorer, Epic Clarity). The systems tracked here combine traditional data sources (such as general ledger, HR, cost accounting and claims/revenue data) with rich clinical data systems. The growing use of CPR systems is a trigger for this application. Its purpose is to provide insights for management of the HDO, and analyze and improve core business/clinical processes and all associated outcomes (clinical, financial and experiential). Of note is the interest in drawing some data streams together via Health Level Seven (HL7) rather than the traditional extraction, transformation and loading (ETL) process to obtain near-real-time data for dashboarding and to enable concurrent corrective actions.

Position and Adoption Speed Justification: Most HDOs are still in the early stages of planning and justifying this next enterprise data warehouse investment. The opportunity and demand to integrate a detailed clinical dataset into a BI system is triggered by the growing penetration of CPR systems, public reporting/compliance and pay-for-performance initiatives, and by increased health system focus on enterprise performance metrics and management. In addition, the hype around accountable care organizations and patient-centered medical homes is pointing out the need for information to assess the performance quality, cost, and profitability of bundles of provider services that have not been traditionally operated, much less assessed, together. During the past year, major vendors and entrepreneurs in this field have made progress in accelerator assets or in HDO projects, and there is a great deal more vendor marketing around BI and data warehousing in healthcare (for example by IBM, Microsoft, Oracle and SAP/Business Objects). By year-end 2012, we expect the majority of HDOs that already have CPR systems and computer-based physician order entry (CPOE) live as of July 2010 will include some kind of new investments in this area in their strategic plans.

Many HDOs are unsure of what direction to take with BI; how to build corporate sponsorship and demand; how to understand needs; how to structure oversight; and what professional services, application and technology partners to use. However, the technology, although far from trivial, is far easier than leveraging BI for effective enterprise performance and change management. Executive actions, not just sponsorship, will differentiate one HDO's BI benefits from another's, and more examples of impact will move the majority toward purchases. While vendor-developed "productized" options will mature over time, we predict that ambitious HDOs, particularly the larger ones, will self-develop, often with some external support from solution architects, professional services firms and/or application vendors. This is because an ambitious health system will usually outpace vendors in how it wants to use the data and will not want to be bounded in data sources, uses or choice of tools.

The large and eclectic list of representative vendors – including consulting, product, platform and vendors and other “accelerators” – reflects the range of approaches HDOs can take, and illustrates the still-entrepreneurial state of this emerging market. For HDOs where clinical research is a large business, this initiative may be linked – technically and in terms of justification – with the demand for an advanced clinical research information system, for which the increasing prevalence of clinical data via the CPR system is also a trigger.

User Advice: BI isn’t just about being prepared to know; it is about being prepared to act on that knowledge. As in other industries, a fatal flaw in BI is failure to recognize that success (meaning high or transformational impact on the business) requires leadership endorsement, culture change and a willingness to lead, as well as appropriate funding, oversight, management and staffing of the integrated BI core competency center. At the operational level, it also requires substantial attention to data stewardship within feeder systems (often led by the chief medical information officer [CMIO] for clinical data) and information governance (led by the chief quality officer):

- Match your magnitude of BI investment and its timing to the ambition of your organization for innovation and performance leadership so that you don’t end up with a rich but underutilized asset.
- Educate executives that all BI/enterprise data warehouse (EDW) systems’ benefit realization is an iterative process and this is not an IT project, although substantial upfront IT investments are required. Success requires a heavy dose of conviction, a certain amount of speculation and a large dose of communication and champion building by IT and executives.
- For optimal impact, HDOs must develop information governance and responsibilities (steering committee, workgroups, etc.) that blend with corporate and IT governance structure while discussing technical solutions.
- Assign clear data stewardship responsibilities (including roles for medical records and medical informatics) to deal with data quality issues in source systems.
- Develop change management competencies; identify and support clinical champions.
- Be prepared to invest adequately in enterprise data warehouse and analyst staff, recognizing the differences in competencies between transactional and EDW systems and between clinical and business analytics.

Business Impact: Used aggressively, integrated clinical/financial BI systems will improve the resource use, patient throughput, quality and patient satisfaction for an integrated delivery system (IDS). Superior competency in BI, including active daily use of dashboards and leading rather than lagging key performance indicators, will be a differentiating core competency of the agile, optimized IDS of the future. However, unlike many automation/transaction systems, BI investments by themselves have little or no inherent business value, and the return on investment (ROI) is

difficult to “sell.” Rather, the value is the organizational capability to act rapidly and effectively on the insights provided. Therefore, although we rate the benefit high, we do so with the caveat that impact requires the combination of technology, dedicated leadership and the intent and ability to change.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cerner; Datawatch; Dell; Dimensional Insight; Eclipsys; Emerging Health IT; Health Care DataWorks; IBM Cognos; IBM Global Business Services; Information Builders; InforSense; Infosys; InterSystems; McKesson; Microsoft; Oracle; QlikTech; Recombinant Data Systems; SAP (Business Objects); Siemens Medical; Teradata; Tibco Software (Spotfire)

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 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 the combination of commercially available components that may in part be brought together by a commercial solution provider, or it can be mostly designed and developed by the institution itself.

An ACRIS:

- Includes an enterprise data warehouse (EDW) that is able to bring in data from computer-based patient record (CPR) systems and other clinical sources. The more common availability of CPR systems greatly increases the availability of valuable data in systems that are primarily designed to support care rather than research.
- Enables acquisition of data and puts it into a common frame of reference; data is currently scattered in hundreds of databases (including registries) throughout the institution.
- Includes a data model that meets the unique needs of academic medical center (AMC) clinical research, including the requirements for genomics and translational research.
- Ensures compliance with patient privacy and security mandates, and the organization’s institutional review board requirements.

Includes tools that enable, for example:

- “Mining” patient data, including that contained in transcribed and other unstructured reports
- Automatic correlation of data with medical knowledge in published research, providing more effective/efficient secondary research

- 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
- Cohort identification
- Creation of research study data marts from enterprise and other clinical trial data
- Facilitation of researcher workflows, including support of the scientific method, grant preparation, internal/external collaboration and documentation

ACRIS is not a single “packaged solution” a healthcare delivery organization (HDO) can just go buy, but certain vendors (examples are listed here) are central to the enterprise’s research ecosystem or can be viewed as value-added components.

Note that the EDW and other tool investments may be shared between the ACRIS and an enterprise business intelligence (BI) system that assembles data from some of the same sources but for the purposes of performance management. However, the requirements for clinical research are very different from – and even more complex than – the requirements for BI.

Position and Adoption Speed Justification: 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 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 will fuel speed in adoption, and grant awards will fuel investment.

The demand for ACRIS, as we define it here, is triggered by two forces: increased adoption of commercial CPR systems, which make more clinical data available, and the rapidly advancing interest in (and funding for) genomics and translational research. Funders of research expect – and increasingly require – an ACRIS in place. In the U.S., for example, the National Institutes of Health (NIH) has championed this in its Clinical and Translational Science Awards (CTSA) program to establish 60 leading research centers. (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 launched analogous and complementary initiatives.

As with integrated clinical and financial BI systems, these advanced clinical research systems have been a bit delayed by the combination of the recession and the focus on meaningful-use criteria. However, during the past few months, Gartner’s client inquiry level about strategic options for both has increased, and we expect to see ACRIS investments incorporated into the strategic plans of more research-oriented health systems or academic medical centers from 2010 to 2012.

User Advice: CIOs and chief medical informatics officers (who play important data stewardship roles) need to build an effective framework for working with clinical research, which can be extremely challenging for both sides of the relationship. The architecture and investments to bring the data desired for research and health system performance management can be spread across both purposes, as long as doing so doesn’t bog down either.

To collaborate, clinical research leaders need to learn and comply with privacy and security requirements and breach reporting, become part of IT governance, and participate in the IT prioritization process. Unlike operational clinical platforms for BI, which may not need to meet tight regulatory guidelines for deidentification for internal use, research platforms need to implement more-restrictive U.S. HIPAA policies for data distribution and patient privacy protection. HDOs will need to find solutions to the changes in 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.

CIOs and IT staff, in turn, need to increase their familiarity with institutional review board requirements and the processes and language of clinical research. Some cross “traditional” IT and research domains, but many will be 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, such as the standards for controlled medical vocabularies in Unified Medical Language System (UMLS) and related common standards: Management and Education Services for Healthcare (MESH); International Classification of Diseases, 9th Revision (ICD-9) and 10th Revision (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 Informatics for Integrating Biology and the Bedside (i2b2) Center, directed by Partners HealthCare (in Boston, Massachusetts), which is developing a scalable informatics framework, provides a forum to bridge clinical research data and vast basic science data banks. 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. <http://en.wikipedia.org/wiki/>

MEDLINE http://en.wikipedia.org/wiki/Bibliographic_database http://en.wikipedia.org/wiki/United_States_National_Library_of_Medicine http://en.wikipedia.org/wiki/National_Institutes_of_Health <http://en.wikipedia.org/wiki/Entrez> http://en.wikipedia.org/wiki/Information_retrieval Our recommendations are:

- National or provincial ministries of health that are directing government-owned health systems should incorporate governance and investment in an ACRIS infrastructure into their electronic medical records and interoperability policy and planning. Specific clinical research-related information requirements and stewardship issues can be directed to a task force or working group.
- AMCs that are serious about positioning their clinical research business for the future should continue to invest in both the CPR and the ACRIS but bring their planning, governance and investment strategies closer together.
- 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. Systems that provide cross-institutional queries include caBIG/caGrid, and i2b2/Shared Health Research Information Network (SHRINE).
- CIOs at institutions making major research-related enterprise IT investments should consider adding an epidemiologist or biostatistician onto the IT or medical informatics team and assigning that position responsibility for supporting researcher workflow needs.
- Ultimately, aim to leverage, as much as possible, IT-related resources for ACRIS and the integrated clinical/financial BI/EDW, recognizing that the needs and tools of each do not suffice for the other.

Business Impact: Stimulating clinical research and clinical effectiveness research through an ACRIS is a major part of obtaining optimal value from IT investments. AMCs that do not invest in an ACRIS will have increased difficulty competing for research contracts and grants and will face diminished stature and funding within five years. In the U.S., CTSA and National Cancer Institute guidance is to conduct more collaborative studies and to share knowledge produced between funded research sites. This is a fundamental change in the expectations set for clinical research leadership.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: IBM; InforSense; Microsoft; Oracle; Recombinant Data; SAS; Teradata

Readers are referred to the following for further information:

- Clinical Data Interchange Standards Consortium (www.cdisc.org)
- Cancer Biomedical Informatics Grid of the U.S. National Cancer Institute/National Institutes of Health (<https://cabig.nci.nih.gov/>)
- Informatics for Integrating Biology and the Bedside Center (www.i2b2.org)

CDR

Analysis By: Wes Rishel; Tom Handler

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. CDRs frequently collect data from a larger number of sources than operational systems such as a computer-based patient record (CPR) system. Our definition does not tie the CDR to any particular enterprise. It could collect data from multiple systems in a single practice, it could collect across an entire healthcare delivery organization (HDO), or it could contain data from multiple healthcare organizations. National cloud-based personal health records are one variety of CDR.

Although some would claim that their CDRs are equally suitable for any application, the reality is that CDRs have purpose-specific architectures and support some uses better than others. Two broad categories of CDR are: (1) transactional clinical data repository (TCDR), which stores data using a data model and schema that supports high-volume updates being applied directly to the database; and (2) access-oriented clinical data repository (ACDR), which stores data using a data model and schema that optimizes for retrieval. TCDRs are often used for health information exchanges, for report repositories and as a basis for specialized applications self-developed by HDOs. ACDRs support a wide variety of applications, including results display, near-real-time monitoring and retrospective analysis. Data warehouses that maintain patient and event-specific granularity are ACDRs. Many data warehouses, however, preaggregate data to optimize performance, so those would not fall in the ACDR category.

These categories of CDRs do not absolutely determine their use. A TCDR can serve as the basis for a dashboard, and an ACDR can receive data updates through direct entry by users. However, each typically has performance deficits when used at cross-purposes.

Because a CDR is intended to support multiple uses, we do not categorize the database within any single application as a CDR. This is a change from previous Gartner usage, where we used the term “CDR” to describe the database within a CPR system.

Position and Adoption Speed Justification: One important driver of the adoption of CDRs is the need to combine clinical and administrative data in a single database and to use it for purposes beyond simply the transactions of specific clinical and administrative processes. The extended purposes include dashboards that monitor caregiving processes in near real time and collecting data for

specific quality measures. The need for a CDR is particularly acute in HDOs that cannot achieve the ideal of a single enterprisewide CPR supporting all hospitals and all practices, or where collaborative quality monitoring efforts extend across multiple HDOs.

Academic medical centers are often early adopters of CDRs.

User Advice: CDRs by themselves are not complete applications. They are toolkits that often come packaged with some application software. An HDO may achieve first value through bundled application software or by using the CDR as a toolkit for self-developed applications. Either way, 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. 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: 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: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Carefx; dbMotion; Microsoft

Perioperative Charting and Anesthesia Documentation Within the CPR

Analysis By: Tom Handler

Definition: The perioperative charting and anesthesia documentation functionality, as part of an enterprise’s computer-based patient record (CPR) system, is used by nurses, surgeons and anesthesiologists to document preoperative, intraoperative and postoperative care.

Position and Adoption Speed Justification: Traditionally, these tools have been supplied as stand-alone specialty niche products, and their adoption has been growing. However, the market is in the early stages of transition as more care delivery organizations (CDOs) implement CPR systems and want to provide point-of-care clinical functionality (regardless of the care venue) as an integrated product, rather than as a series of interfaced solutions. Traditionally, these tools have been somewhat low in priority for enterprise CPR vendors; however, more are beginning to enhance and/or develop their capabilities in this area. Patient safety initiatives, a desire for unified medical records, and operational ease and efficiency are drivers. The immaturity of CPR modules and the relative robustness of niche vendor functionality inhibit growth. While the vendors are working on these modules, there has been only a little movement in terms of product maturity or adoption, and most modules do not yet have sufficient maturity to displace the stand-alone niche systems. There still is not a great demand for these tools because CDOs 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).

User Advice: 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. Therefore, CDOs seeking OR documentation should carefully assess the business drivers of these systems – and, if possible, wait until their enterprise CPR systems have sufficient functionality. If there is sufficient need for a solution in the short term, then selecting a stand-alone system may be necessary.

Business Impact: Aside from the benefits of legibility, access to complete medical records and the potential for better clinical analytics, which can accrue from the automation of all clinical documentation within a CPR system, there has been little documented evidence that perioperative charting and anesthesia documentation within a CPR will result in significant increases in patient safety, clinician productivity or cost savings. It will save on chart storage and abstracting costs, but will likely be more of a standard of care, and will not result in huge clinical or cost benefits.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cerner; Epic; GE Healthcare; McKesson; Meditech

Sliding Into the Trough

Personal Health Record

Analysis By: Wes Rishel

Definition: Personal health records (PHRs) are electronic applications through which individuals can use, add to, manage and share their health information (and that of others for whom they are authorized) in a private, secure and confidential environment. The PHR enables consumers to accumulate data originating in the systems of many healthcare organizations (HCOs). As consumers transition from payer to payer and from provider to provider, the PHR is potentially the one place where they have continuous access to their healthcare information. (Note that HCO is a broad term that includes healthcare delivery organizations – HDOs – along with health insurers, other payers and public health organizations.)

The information within the PHR is entirely under the control of the individual described by the record, or that person’s proxy, and might be described as being “owned” by the individual. This emphasis on ownership is strong in many countries and has been widely accepted in the U.S. healthcare provider community, particularly since the American Recovery and Reinvestment Act (ARRA) of 2009 defined the PHR in this manner at Title XIII (D) Section 13400(11). In keeping with this approach we use a different term when an HDO offers its patients access to their data in the HDO’s computer-based patient record (CPR) system.

Many U.S. health insurers still use the term PHR for a system that enables consumers to use the Web to access information controlled by the insurer.

Often a single “record” (that is, a place where the data is stored and managed) serves as a platform for multiple applications, each providing different functions that allow consumers to enter or use the data from a specific point of view. For example, diagnosis, laboratory and pharmacy data in the record might be used by one personal health management tool (PHMT) provided by a major academic medical center to guide consumers to specific educational materials; by another PHMT to assist consumers in finding clinical trials of interest; and by a third to assist seniors in estimating what might be their best Medicare pharmacy plan.

Some operators of PHRs that underlie multiple PHMTs use another terminology. They describe their products using terms such as “health information ecosystems,” and use the term PHR to describe the PHMTs. Gartner relies on the underlying notion of the common record and the ARRA in choosing the definition it uses.

Position and Adoption Speed Justification: Certain ideas can be in a Hype Cycle for more than a decade, cycling repeatedly through the left side of the curve. This generally means that the idea is believed to fill some need and that no developer has been able to bring a product to market that fulfills that need. The PHR is such an idea. No one can deny the importance of consumers’ engagement in their health and healthcare, or the power of the Web to create transparency and enable consumers’ control of important life functions, although no PHR product has come close to establishing such profound value. In the U.S. the consumer’s relationship to specific healthcare providers or payers is particularly ephemeral, but the situation exists in most countries where healthcare is provided by province, country or other sub-national entities. Most countries also seek to empower consumers to control their own information to the extent that this is possible.

Despite these strong reasons why effective PHRs would be desirable, consumers’ use of PHRs remains abysmally low. There are several barriers to adoption to consider. These include: (1) finding PHMTs that prove broadly attractive to consumers themselves; (2) technological and business problems in establishing any interoperability between PHRs and a patchwork of HDOs; (3) problems matching identities across HCOs in many countries; (4) problems vetting the identity of users of PHRs; (5) difficulty defining and mounting PHR projects of national scale; (6) difficulty achieving semantic interoperability, even on simple items such as diagnoses and allergies; (7) a tendency to define the PHR and the PHMT as a single product, creating economic barriers to entry for innovative PHMTs; and (8) concerns about the credibility of data that has passed from one healthcare provider to another under control of the patient.

There are signs of progress that have caused us to advance the PHR on the Hype Cycle. These include successful academic projects that demonstrate improvements in managing chronic disease through PHMTs based on PHRs, the requirement under the U.S. ARRA to provide patients with their data electronically, and developing arrangements to offer PHR software in Canada, Germany and the U.K.

Nonetheless, we don’t expect to advance PHR to the Slope of Enlightenment until we see solutions to all the barriers beginning to result in substantial consumer uptake. Once that threshold is crossed for a few subpopulations in a country, consumer demand will likely accelerate progress up the Slope.

It would be desirable if PHR products were adopted to provide a unified, moderately interoperable personal health record across national boundaries. This will be very difficult to achieve because of technological standards and public policy concerns about where data is stored.

User Advice: The interest of politicians and policymakers in demonstrating a modern attitude toward the Internet virtually guarantees that HCOs in most countries will have to deal with third-party PHRs at some level. This, in turn, will increase transparency in care processes. HDOs must prepare their clinicians culturally to deal with this issue. Not doing so would cause policy and care-quality issues to be blamed on “the technology.”

The HDOs that should immediately pursue working with the “ecosystem” PHRs are those that invest to maintain a “leading edge” reputation among consumers, or which have a business model of attracting patients from geographically diverse locales. However, they should not consider PHRs to be a short- or medium-term substitute for the level of patient engagement that can be achieved through a clinical patient portal.

U.S. HDOs that are not inclined to be first movers should, nonetheless, prepare to be ready to provide encounter data to the PHR of the patient’s choice no later than 2014.

HDOs in other countries should undertake the same preparations, but the timing of this activity will vary based on national policies in their countries.

Business Impact: If all the goals of PHRs were met equally, PHRs would substantially contribute to changes at the transformative level, enabling innovative care processes to arise across the Balkanized collection of entities that comprise the healthcare system. This could profoundly improve the level of patients’ engagement in maintaining their own health and create a level of transparency that would enable consumers and payers to make insightful economic choices among care alternatives.

However, during the next 10 years we only expect moderate impact, perhaps rising to high by the end of the period. Many of the putative benefits of the PHR will arise instead through consolidation of HDOs or the direct inter-HDO sharing of patient data. The PHMTs that have the most fundamental impact on improving chronic care will arise through the tighter bonding of clinicians and patients that arises from CPR-based patient portals.

Innovative PHMTs based on PHRs will develop and may affect how consumers make buying decisions, just as the Web has had a more profound impact on how people buy air travel than on how it is delivered.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Google; Microsoft; Revolution Health; WebMD

Video Visits

Analysis By: Jonathan Edwards

Definition: A video visit is the use of videoconferencing technology for remote consultations between clinicians and patients. Video visits are often used in conjunction with devices such as digital stethoscopes, otolaryngoscopes and digital cameras that enable the remotely located physician to zoom in or out in real time. Although most video visits are scheduled in advance by coordinators, there is a growing move toward allowing patients to schedule visits themselves. Most video visits use dedicated video carts, but the use of desktop video for healthcare is growing fast.

Position and Adoption Speed Justification: Video visits are best-suited for medical disciplines in which the caregiver normally does not need to touch the patient – for example, rehabilitation and mental health – and for triage purposes, to assess whether a face-to-face visit is needed. Their value is compounded when patient transportation is difficult because of distance, frailty of the patient or security (for example, prison inmates). Some large healthcare delivery organizations (HDOs) with these challenges are making routine use of video visits. Various business models are emerging, including:

- A single geographically dispersed organization creates a central coordination function for video visits. Examples include the U.S. Department of Veterans Affairs and the University of Texas Medical Branch.
- An organization collects membership fees from independent hospitals in exchange for facilitating video visits. One example is the Ontario Telemedicine Network.
- An academic medical center provides leadership in facilitating video visits with rural hospitals to cut travel time and avoid inappropriate referrals. One example is the University of Arkansas Medical Center.

However, outside such pioneering organizations, many of which are both providers and payers of healthcare and, therefore, do not have the challenge of getting reimbursed by healthcare payers, video visits are proving slow to take off, and the barriers to adoption remain high, such as:

- Designing a service that meets the needs of clinicians, patients and HDOs
- Setting up an infrastructure for scheduling, coordinating visits and providing technical support

- Establishing a mechanism for reimbursement
- Changing cultures and working practices to ensure that clinicians and patients are comfortable using video

Only in some large organizations or networks have HDOs been able to cooperate to get enough scale to justify these investments.

One barrier that continues to diminish is the lack of sufficient broadband coverage (including network infrastructure and affordable Internet access). During 2010, government agencies in many countries, including the U.S., the U.K. and Australia, have been spending money on general broadband coverage and to set up dedicated healthcare networks. The U.S. Federal Communications Commission (FCC) runs a Rural Health Care Pilot program, launched in 2007, which is spending up to \$417 million on 62 projects serving 6,000 care facilities in 42 states. The grants pay for the deployment of high-speed broadband telemedicine networks to be used for telemedicine. Most of the FCC money has yet to be awarded. In March 2010, the FCC announced its National Broadband Plan, which includes a section on telemedicine; however, because the FCC only has a secondary role in healthcare, many of the FCC's recommended actions will need to be taken by U.S. government healthcare agencies, such as the U.S. Department of Health and Human Services. In the U.K., BT announced in February 2010 that it is launching a national videoconferencing service over N3, the secure broadband network that it has developed and is managing for the National Health Service (NHS). Whereas in the past, NHS organizations have set up and managed their own local videoconferencing services, the BT service will be managed centrally by BT. Another country whose government is investing in broadband networks for telemedicine is India, where government agencies are collaborating with leading private-sector HDOs, including Apollo Hospitals.

Desktop video is being improved by advances such as scalable video coding, the rapid advancement of consumer video and the incorporation of video into unified communications.

User Advice:

- HDOs should explore how to collaborate to create sufficient scale to justify the development of an infrastructure for video visits. To help justify the infrastructure investment, HDOs should explore additional uses of video, including medical education, clinician-to-clinician meetings, interpretation services, rounding robots and administrative meetings.
- Government healthcare agencies that serve large numbers of citizens in isolated areas, or large prison populations, should consider establishing regional or national video visit programs.
- HDOs should assemble evidence of value and should lobby healthcare payer organizations to establish appropriate levels of reimbursement for video visits.

- HDOs should include video visits in a “patient of the future” strategy that includes home and mobile monitoring, e-visits, remote image readings and personal health records. They should plan for an eventual future where patients and clinicians will interact via video through the desktop.
- HDOs should closely track the rapidly evolving market for room and desktop videoconferencing systems to take advantage of reductions in price and improvements in quality, interoperability and security.

Business Impact: Video visits can reduce travel time and cost for patients and clinicians, can help HDOs make better use of clinicians’ time, and can enable a more rapid and effective delivery of care to patients in isolated locations.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: American TeleCare; Attend Anywhere; Cisco; Eceptionist; Emblaze-VCON; GlobalMedia; IBM; InTouch Health; LifeSize; Polycom; Tandberg; Vidyo

Real-Time Temperature/Humidity Monitoring

Analysis By: Vi Shaffer

Definition: This entry covers real-time temperature and humidity monitoring (THM) for healthcare-specific uses, such as monitoring refrigerators holding pharmaceuticals, vaccines, and bone and tissue samples. It is a relatively new application leveraging technologies such as active radio frequency identification (RFID), in combination with in-hospital Wi-Fi networks and battery-powered temperature and humidity sensor tags. The application includes software that displays locations on hospital/clinic maps and alerts to out-of-range data, as well as data logging and reporting capabilities.

THM is one of the newest in what we expect to be a rapidly expanding array of location- and condition-tracking applications leveraging Wi-Fi (wireless) and tag technologies. We selected it for inclusion in this Hype Cycle as a good example 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. Thus, we have coined a new term, “location- and condition-sensing” (LCS) technologies. We expect there to be other conditions (including more patient monitoring, as well as light, movement and low battery power) as healthcare delivery organizations (HDOs) move further into “real-time enterprise” management.

Position and Adoption Speed Justification: Sensor/RFID technologies for various uses are becoming more common. THM is a relatively straightforward and low-cost application, compared with some of its sister applications (such as wireless healthcare asset or patient/provider tracking). It does not require pervasive Wi-Fi, and has value for 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 having similar properties to the monitored item.

This functionality may be provided as a stand-alone application or as part of an integrated, multiuse platform. It also has the significant advantage of clarity in its business case because of helping to meet regulatory/accreditation requirements, as well as clarity in its return on investment, such as replacing manual processes taking the time of nurses, pharmacists and other staff, and preventing waste, damage, spoilage and patient safety issues).

There are a slowly growing number of case studies from multiple vendors describing successful implementations that have yielded greater accuracy, “rescue” of tissues, and cost/time savings. We projected in last year’s Hype Cycle that this might get faster traction than wireless asset tracking/management because of its relative ease of implementation and appeal for nursing. We still think so, but the recession and continued focus on core clinical system deployments (and on their “meaningful use” in the U.S.) slowed down adoption of numerous niche vendor ideas in 2009, with wireless asset tracking gaining traction. We still see vendors leveraging this application as one way of gaining a footprint in hospitals that can then be expanded.

User Advice:

- There is more risk in figuring out which vendors will survive and thrive in this still-evolving arena than in deploying this application by itself, so keep a careful eye on vendor viability.
- Add this to your shortlist of applications to consider that are lower-risk, have a quicker time to value, enhance both 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, etc.).
- IT should work with compliance and clinical representatives to assess the current monitoring process and level of regulatory compliance to determine the potential benefits and ROI of this application.
- Keep the IT governance and clinical steering committees abreast of the rapidly advancing set of location- and condition-sensing application ideas coming to market.
- Develop a coherent enterprise approach to prioritization of applications and management of a centralized real-time information platform.
- This is yet another opportunity to work with the clinical engineering and facilities departments to develop a joint planning process and exploit business benefits and management synergies from LCS technologies.

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 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. We were struck by one healthcare system's recent story. It decided to begin sensor monitoring several new refrigerators at installation and discovered substantial variance among units, in some cases to noncompliant levels between what the refrigerators' own temperature settings were showing and what the more-accurate THM system reported. In this case, the difference was quite critical to preventing damage, spoilage and patient safety issues.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: AeroScout; Centrak; InfoLogix; Intelligent InSites

Emergency Department Information Systems as Part of a CPR System

Analysis By: Tom Handler

Definition: Emergency department information systems (EDISs) are integrated sets of applications that automate 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 technology profile covers EDISs that are formal modules of computer-based patient record (CPR) systems – operating on the same architecture, data model and database, and that leverage the CPR system's decision support and other process-assistive capabilities, such as rule/workflow engines – rather than existing as stand-alone systems.

Stand-alone EDIS applications have been available for some years and have achieved mainstream, although not universal, adoption. This profile recognizes the stage at which CPR-integrated EDIS systems are “good enough” from the clinician's point of view to serve in place of or replace a stand-alone EDIS.

Position and Adoption Speed Justification: The value of automation in the ED 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 as many as 40% of hospital admissions come through the ED has prompted many healthcare delivery organizations (HDOs) to seek a solution that is fully integrated, rather than interfaced with the enterprise CPR 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 CPR and ED systems. An increasing number of CPR system vendors (including the market leaders in “Magic Quadrant for U.S. Enterprise CPR Systems”) have adequate integrated ED solutions. Both the number of vendors with credible live systems and the number of satisfied referenceable clients are moving ahead. However, some modules remain immature, and

some vendors do not yet offer an integrated ED module. Based on Gartner's research, some HDOs that initially chose stand-alone EDISs have replaced them, or are considering replacing them, with their CPR systems' ED modules. The functionality gap between stand-alone and integrated ED systems is shrinking, and the advantages of an integrated solution will push HCOs to adopt the integrated solutions at a more rapid pace.

User Advice: EDIS modules of CPR systems continue to improve. HDOs considering an EDIS that have already selected an enterprise CPR vendor should evaluate its current ED release. If it is sufficiently functional, then they will be best served by implementing the CPR system's ED module, rather than a stand-alone product. The ability to incorporate ED information into the CPR system – and, thus, eliminate the need for a separate database of ED records – must be weighed against the completeness of the CPR vendor's ED system.

Although integration with an enterprise CPR system is an important consideration, it may not be feasible for all HDOs. These include HDOs that have not yet selected a CPR vendor, those whose chosen CPR vendor does not offer an ED application, and those whose CPR vendor does not provide an ED system and CPR system on the same technology platform. These users should evaluate niche products. Niche applications should be evaluated on their proven ability to interface with the HDO's CPR 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 CPR 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 a CPR 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.

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: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cerner; Eclipsys; Epic; GE Healthcare; McKesson; Meditech; Siemens Healthcare

Home Health Monitoring

Analysis By: Jonathan Edwards

Definition: Home health monitoring is the use of IT and telecommunications to monitor the health of patients in their homes and to help ensure that appropriate action is taken. Patients are given devices that measure variables, such as blood pressure, pulse, blood oxygen level, medication compliance and weight, and that transmit the data to clinicians. Experimental

devices are available for specialized observations, such as the physical and cognitive status of Parkinson's disease patients. Other devices are used for messaging – gathering information from patients on their symptoms and behaviors, and sending them information and advice. Some devices also include videophones. The devices send data through wired or wireless connections to a “hub” or “gateway” system in the home, which transmits the data to the outside world. Most often, data is transmitted through a regular telephone line, although some hubs require broadband connections. In some developing countries, where mobile phone service is easier to obtain than landlines, the data is transmitted through mobile phones.

Position and Adoption Speed Justification: Home health monitoring is appropriate for certain groups of chronically ill, homebound patients who need frequent monitoring. If implemented correctly, it can be a powerful tool for keeping patients at home, reducing the need to travel to appointments with clinicians, avoiding emergency room visits and delaying admission into inpatient facilities. The potential of home health monitoring to allow patients to live at home for longer before being admitted to a nursing home, and to support remote monitoring by the adult children of homebound patients, is highly appealing to patients, and therefore, a successfully implemented home health monitoring program will enhance the reputation of a healthcare delivery organization (HDO).

Technical barriers to adoption include the problem of exchanging data between monitoring devices and electronic medical record applications; these are gradually being reduced through the work of healthcare IT vendors, the Continua Health Alliance and other groups. Nontechnical barriers include legal and licensing restrictions, inconsistent reimbursement by healthcare payers, and the fact that home health monitoring requires new protocols for dealing with large volumes of information and new ways of staffing and information sharing, in particular greatly enhanced care coordination.

Many deployments of home health monitoring have been pilot projects, and these projects have generated a wealth of data about the clinical benefit of home health monitoring. However, there are few examples of standardized ongoing services. Most prominent is the U.S. Department of Veterans Affairs (VA), which has deployed home health monitoring widely to care for patients with high-cost chronic conditions, such as chronic heart failure, chronic obstructive pulmonary disease, diabetes, depression and post-traumatic stress disorder. The VA estimates that, by 2011, home health monitoring will cover 75,000 patients, enabling half of its patients who would previously have needed to live in nursing homes to remain living at home. The VA has recorded a 25% reduction in numbers of bed days of care, a 19% reduction in numbers of hospital admissions and mean patient satisfaction scores of 86% after enrollment in its home health monitoring program.

Other enthusiastic adopters of home health monitoring have been home health agencies in the United States, which receive a fixed fee per patient for one to two months after a hospital episode from the federal U.S. Medicare program and, therefore, have a financial interest in using technology to reduce their costs of care. There is an especially strong interest among hospital-owned home health agencies, since hospitals do not receive Medicare reimbursement for rehospitalizations and emergency room visits during the one- to two-month period. A 2008 survey estimated that 17%

of U.S. home health agencies use home health monitoring, and of these, 89% believe that home health monitoring improves the overall quality of services provided to patients. A limitation of these deployments is that they are short-lived, whereas the patients they are serving have chronic conditions.

U.S. attention to home health monitoring has been boosted by initiatives created and expanded under healthcare reform laws. These include value-based purchasing programs for chronic diseases (patient-centered medical homes), high-cost procedures (accountable care organizations), home health agencies and the “Independence at Home” demonstration program, which encourages the development of home care practices, including physicians and nurse-practitioners, as well as traditional home-care nurses.

In Canada, the Canada Health Infoway program and the Ontario Telemedicine Network are making significant investments in home health monitoring. In Europe, home health monitoring received a boost from the November 2008 European Commission (EC) Communication on Telemedicine, in which the commission addressed the problems of confidence, evidence, regulation, reimbursement and interoperability, committing itself to several actions and urging action from European governments. Since then, the EC has launched Renewing Health, which will evaluate nine regional home health monitoring deployments across Europe and will help them scale up to become national deployments. One European country that is showing strong activity is England, where many primary-care trusts are adding home health monitoring to existing programs of telecare (technologies for safety at home). Most of the English deployments are pilots, but a few have become mainstream services during the past year, including Nottingham with 800 patients and Cornwall with 520 patients. Other countries with mainstream services include Italy, Germany and Spain. In Asia/Pacific, home health monitoring is in its infancy.

User Advice: HDOs must identify ways to make home health monitoring economically viable for them to deliver and attractive for healthcare payers to fund. A successfully implemented home health monitoring program will have high visibility with patients and clinicians. The ability to care for patients at home and keep them out of skilled nursing facilities has great appeal to patients and their families. In competitive healthcare markets, this visibility will be an important factor in building up an HDO's brand value and attractiveness. Home health monitoring is particularly well-suited for closed health systems with tight links between the providers and payers of healthcare, and in situations where the healthcare provider takes on financial risk for the costs of patient care.

HDOs should recognize that home health monitoring devices will become commodities, and what will differentiate a home health monitoring deployment will be the software and associated decision support, as well as the infrastructure of care coordination that includes individuals trained and available to intervene in the case of alerts, and standard procedures for referral, assessment and patient education. HDOs should deploy home health monitoring as part of a program of chronic disease management and as a tool to help patients better manage their medical conditions. HDOs, research centers and trade associations must continue to demonstrate to healthcare payers the positive outcomes of home monitoring to get them to reimburse it more widely. Whereas clinical outcomes have proven relatively easy to measure, financial outcomes are more problematic.

Business Impact: The potential impact of home health monitoring is high. It can enable improvements in the quality and timeliness of care, improve the accessibility of care, reduce travel time for patients and clinicians, and permit elderly patients to remain at home longer before entering a skilled nursing facility. It can also reduce the number of hospital admissions, readmissions and bed days.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Aerotel Medical Systems; Alcatel-Lucent; American TeleCare; AMD Global Telemedicine; Bosch Healthcare; Broomwell Healthwatch; Cardiocom; Docobo; Honeywell HomMed; iMetrikus; Ideal Life; Intel; McKesson; Medgate; Medic4All; Philips Medical Systems; SHL Telemedicine; Telbios; TeleMedCare; Tunstall Healthcare Group; Viterion Telehealthcare; Wipro

Next-Generation Enterprise Patient Financial Systems (U.S.)

Analysis By: Vi Shaffer

Definition: This entry covers a next-generation/replacement set of hospital/enterprise patient financial systems (PFSs) that address the unique needs of the U.S. market. This is the core workflow system for downstream revenue cycle management processes – claims/patient bill preparation, claims scrubbing, submission and payment reconciliation. The system helps prevent and rework rejections/denials and aids in receivables management. The PFS automates business office steps wherever possible, expediting processes through work queues and rules. Next-generation PFSs in general (but not always) include service-oriented architecture; advances in rules, workflow and contract management; 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 transaction links with payers. Systems should support any level of business office consolidation or decentralization, and the ability to change among operating models; some (but not all) meet billing needs for both hospital and physician practice/ambulatory settings.

Position and Adoption Speed Justification: The PFS is an essential application for U.S. hospitals and thus has virtually 100% market penetration, so this is the adoption curve for next-generation replacement systems. Progress has been made by several vendors in functionality and in the number of early-adopter implementations completed, but, in general, these new suites are still immature. Conversions carry higher risk for healthcare CFOs and CIOs because this is replacement functionality responsible for a healthcare delivery organization's (HDO's) revenue and cash flow.

The position and adoption assessment in this Hype Cycle is based on the U.S. midsize- to large-hospital (300 beds and up) and integrated delivery system market. The adoption trend was slowed first by the unreadiness of many vendor products, and then by the economic recession, a heightened emphasis and additional efforts around electronic health records (EHRs), and obtaining stimulus incentives for deploying them. Now, HDOs are looking at

the looming shadow of ICD-10 conversion. They do not want to be midstream in a new revenue management system deployment while dealing with that major change. Demonstrated proof so far is in short supply that these systems will: (1) get the hospital more cash than a well-functioning/well-managed legacy system; (2) enable more automation in workflows or other advances that significantly lower the cost to collect; (3) eliminate bolt-on products required with older systems; and/or (4) create more agility in responding to new requirements from payers.

Adoption speed and market share success will also be influenced by the vendors holding the largest legacy market share (for example, McKesson, Meditech and Siemens). Decisions and deployments will speed up a bit as vendors gain confidence in their products, increase migration sales efforts within their legacy customer bases or signal potential sunset windows. However, these vendors are facing challenges to sustaining market share, and we have long projected the significant market share disruption now under way as this market turns toward new systems. The particular force is strategic vendor relationships – if the HDO has chosen a different vendor for its computer-based patient record (CPR) system, and that vendor offers a competent and integrated PFS, the clinical system vendor has a reasonable chance of winning the business. We have written before about this, particularly observing Epic's sales traction in this product set.

User Advice: Moving to a new PFS is a major transition that HDOs undertake very rarely. Implementation requires substantial business process re-engineering, and it is often combined with a major corporate initiative to standardize revenue cycle management (RCM) processes and to consolidate business office – and call center – operations.

- Assess vendors' functionality and their readiness to deliver a predictable implementation for you.
- For large and ambitious HDOs relative to expanding markets and health services or taking on an accountable care organization role, look for the ability to provide integrated physician practice management and enterprise scheduling – and ensure the system can scale.
- Inventory and examine your current use of bolt-on and adjunct applications against the capabilities of next-generation systems.
- Ensure a system conversion is mapped against the requirements and timeline of conversion to ICD-10. It's best for many health systems to get past that first.
- Consider vendor remote hosting as a risk mitigation strategy.
- Allocate enough time and talent for the difficult work of re-engineering, and consider engaging an experienced outside professional services firm for support.
- If your HDO is risk-averse, and system performance, billing and collection key performance indicators are okay, then wait until after ICD-10 to transition.

- Hospital margins will always be tight. If your RCM performance is consistently in the bottom half against industry benchmarks, don't wait for a new PFS. Focus senior resources on the issue or consider outsourcing.

Business Impact: For a well-performing HDO, we rate these systems' potential impact as moderate. The best of these systems should help control the cost of RCM, enable a centralized business office/enterprise adoption of best practices, generate a reduction in the requirements for bolt-on systems to help oversee the RCM processes, and achieve strong key performance indicators.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

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

Patient Self-Service Kiosks

Analysis By: John Lovelock

Definition: A patient self-service kiosk is a computer device, often housed in a specialized cabinet, that enables two-way communication between a patient and a healthcare provider's systems. Kiosks can include various input devices and sensors, such as credit card readers; fingerprint, retinal and palm scanners; sphygmomanometers; weight assessment; oximeters; electrocardiograms; and devices to determine true body composition.

Position and Adoption Speed Justification: The use of patient self-service kiosks for check-in will eliminate labor-intensive manual steps in the patient-admitting process. Direct entry by the patient helps reduce transcription errors and improves overall data accuracy. The ability to give immediate status on outstanding account balances and copayments, as well as the ability to collect funds via credit card swipe, gives these devices an easily definable financial return on investment. Many patients prefer the experience of check-in via kiosk to traditional nurse check-in, citing lack of queues and increased privacy and ease. The limited requirement for interaction with existing systems, coupled with the fact that kiosks do not change clinical workflow, makes them quick and nonintrusive to implement.

It is possible to purchase kiosk hardware devices separately from software required for those systems to be used in a healthcare setting. Healthcare kiosk software is divided into two basic forms: display systems at an interface with clinical, business and financial systems; and robust healthcare-specific functionality that incorporates the attached clinical devices, such as blood oximetry or blood cuffs. Patient check-in software is the most common of the first, and emergency department triage systems fall into the latter category.

New devices entering the market are adding more options, most important additions are the output devices. Not only simple paper printers, but magnetic-stripe cards, color laser printers and pre-encoded tags are possible. Unfortunately, device manufacturers are focused on adding technology to the devices without accounting for end-user needs or expectations. Kiosks will not become a

requirement or differentiator in a healthcare delivery organization (HDO) setting until the systems evolve beyond the ability to simply display and collect data that is already available within the HDO and start to provide an interaction that meets the patient's expectations for transparency, completeness and intuitive use.

User Advice: Patient check-in stands out as the easiest application to implement and has the most clear business case in countries that have user fees associated with healthcare delivery. Users should be cautious when estimating cash flow improvements since some recent installations have failed to reach ROI expectations. Free-standing patient self-service kiosks are not the best solution for all healthcare organizations – patient check-in using mobile kiosks and tablets used by supervisors to assist and monitor check-in is proving to be a more viable solution for repeat patients or when extensive information is required from new patients. Consider total cost of ownership, ease of implementation, the possibility of theft, and support and maintenance in your evaluation of form factors for check-in devices. Although the devices are maturing and becoming much more reliable, clinical software vendor support and rich software functionality continue to lag.

Business Impact: Patient self-service kiosks can be used for patient check-in, emergency room admitting/triage, clinical workflow execution and revenue cycle management. Collection of copayment fees directly at the patient check-in kiosk is a simple change and makes significant cash flow improvement. The ability to monitor patient check-in and better manage queues can have direct improvements on utilization rates and patient satisfaction.

Benefit Rating: Low

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Conceptkiosk; D2 Sales; Fujitsu; Lifeclinic International; Medhost; NCR; Vecna Technologies

Rounding Robots

Analysis By: Jonathan Edwards; Vi Shaffer

Definition: Rounding robots are designed for higher-volume locations where patients are stationary and the robot/provider comes to them. They help establish personal rapport and trust between remote physicians and patients. In this technology, remote-controlled mobile robots are equipped with cameras, computer screens and microphones that permit physicians to see and communicate with patients. The robots essentially provide unaided mobile videoconferencing systems, as opposed to video carts that are pushed to the patient by a nurse.

Position and Adoption Speed Justification: Gartner has seen increasing interest in this technology during recent years, while interest in the use of video overall is also increasing in healthcare. Like video carts, rounding robots are justified by their ability to improve the efficiency of time-pressured physicians, ensure that hospital patients have access to specialists (such as neurologists for stroke care), help patients maintain contact with primary-care physicians and help large health systems provide outlying facilities with access to specialist physicians.

Healthcare delivery organizations (HDOs) have found value in their early uses of these robots, and more evidence from more settings is emerging. The technology is in use at approximately 250 hospitals in the U.S. and is being piloted in other countries, including the U.K. and Ireland. It is finding its way into mainstream community health systems, not only academic medical centers.

If these robots remain primarily mobile videoconference units, the current generation will likely become obsolete before reaching the Plateau of Productivity. The ability of the physician to remotely control the device has novelty value, but is unlikely to offer enough appeal to justify the additional cost over and above a portable video cart or a stationary video camera.

User Advice: Consider rounding robots as a technology that physicians may want to pilot, and consider the requirements of rounding robots, as well as in-room two-way video or video carts, in new construction. HDOs that decide to purchase robots need to make sure that enough devices are available and reliably maintained. The circumstance of physicians who are eager to use a technology that lacks sufficient availability can be worse than having no robots at all. Policies must be established to determine how access to robots will be equitably distributed, and how such encounters will be documented and billed. CIOs need to consider the communications and space requirements of rounding robots into their new construction and IT infrastructure plans, as well as into their medical device oversight responsibilities.

Business Impact: Rounding robots can create more-consistent care and improve patient throughput by enabling hospital-bound patients to be seen by physicians located outside the hospital. Rounding robots compete with investment in video carts. Like video carts, they enable video visits, telestroke and other forms of real-time remote consultation.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: InTouch Health

CPR-Integrated Critical Care IS

Analysis By: Vi Shaffer

Definition: This entry is for critical care information systems (CCISs), serving intensive care and “step-down” care units, that are integrated into Generation 3 computer-based patient record (CPR) systems. Integration means that the CCIS is operating on the same platform, data model and database, and that the CCIS can leverage the CPR system’s decision support and other process-assistive capabilities, such as rule/workflow engines.

CCISs address the extensive documentation and data viewing requirements in this environment serving patients of high acuity and extensive monitoring and complex therapies, represented typically by high volumes of data. A CCIS, among other features, enables electronic documentation directly from a flow sheet and a process for direct data capture from patient-monitoring devices. These systems are targeted for use by adult, pediatric and neonatal

intensive care units (ICUs), as well as by step-down (intermediate care) units, and sometimes other settings where high-acuity patients may be temporarily housed. These settings also require ICU-specific documentation starter kit templates.

Stand-alone CCIS applications have been available for some years and have achieved mainstream, though not universal, adoption. This technology profile recognizes the stage at which CPR-integrated CCIS systems are “good enough” from the clinician’s point of view to be used instead of and replace a stand-alone CCIS.

Position and Adoption Speed Justification: CPR-integrated CCIS is often one of the later distinct capabilities a CPR vendor builds, and one of the later in-hospital settings to become fully automated. It is also the most complex. ICUs have a high volume and frequency of data from many sources and, because of this, can benefit from more process integration, enhanced communication and complex multivariable monitoring and alerting. 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 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.

An increasing number of CPR vendors (including the market leaders in “Magic Quadrant for U.S. Enterprise CPR Systems”) have adequate functionality to be considered a CCIS at this time. Both the number of vendors with credible live systems and the number of satisfied, referenceable clients are moving ahead.

For the past decade, most healthcare delivery organizations (HDOs) implementing CPRs have been focusing first on other components of integrated clinical system adoption (computer-based physician order entry [CPOE], for example) and perhaps on functionality for the emergency departments, where integrated offerings have been available longer.

User Advice: Include CCIS functionality among your evaluation criteria for a hospital CPR system, and establish a process for evaluating the pros and cons of stand-alone vendors versus the benefits of integration with the CPR system. Remember that ICU physicians and nurses may feel loyalty for an incumbent vendor and a loss of control if a push toward an integrated vendor is done outside of their involvement. Also note that extra effort may still be required to persuade clinicians that a CPR-integrated CCIS is as good as – and that they will have as much design input and control as with – a specialized stand-alone system. The chief medical officer (CMO) and chief medical informatics officer (CMIO) should take some leadership here:

- Together with the CPR and CCIS, critical care is an ideal place to make an impact by applying performance management dashboarding across clinical, utilization, cost and patient experience metrics.
- Ensure IT governance and clinical IT committee structures adequately represent critical care.
- Identify those areas of process integration, automation and decision support that would benefit from an integrated approach (use examples from other HDOs provided by your CPR vendor).

- If the HDO does not have a CPR system or is committed to a vendor that won't have a good CCIS within three to five years, consider a stand-alone ICU system. There are good systems available for many countries. However, Gartner believes there is ultimately higher value to integrating the CCIS with the hospital CPR system.
- HDOs should consider how strong the stand-alone vendor marketplace will be in the future as a risk factor.

Business Impact: With lower-acuity patients continuing to move to ambulatory settings and shorter hospital stays, 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 a CPR-integrated CCIS can be particularly high. Important benefits include 24/7 assistance monitoring of process conformance and early alerting to subtle but significant changes in multiple patient risk variables signaling a change in patient status. Such information can also aid in assessing readiness for discharge to another setting or increased severity, suggesting a new intervention or change in therapy. 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 much process and outcome improvement that an HDO can make in the care of critically ill patients; leveraging data from the CCIS makes the front-end data-gathering steps of these efforts less costly and less exhausting. However, to reap these benefits requires data analysis and quality improvement investments beyond just the CCIS.

The increase in acceptable CPR-integrated CCISs will negatively impact companies offering stand-alone CCISs, although there is still a global market for them. CIOs should be aware that, as the number of CPR vendors offering a good, integrated CCIS option increases, the number of vendors offering systems and funds for continued R&D may decrease.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Cerner; Eclipsys; Epic; GE Healthcare; McKesson; Meditech

RAC Tracking (U.S.)

Analysis By: Vi Shaffer

Definition: The U.S. Medicare Recovery Audit Contractor (RAC) program was introduced by the Centers for Medicare & Medicaid Services (CMS) in late 2008. This was after a three-year demonstration program proved successful in returning hundreds of millions of dollars in overpayments to CMS. The program requires hospitals to provide clinical documentation to substantiate medical necessity of already-delivered services and allows Medicaid to recover inadequately justified overpayments.

For their efforts, the contractors are paid a percentage of the provider overpayments recovered, as well as an additional fee for underpayments identified.

A RAC tracking software application helps the healthcare delivery organization (HDO) manage the entire RAC process from initial auditor request through document delivery, resolution and, where applicable, an appeal. It should reflect the collaborative workflow, alerting and rules (such as prompts on looming deadlines), and other markers of effective RAC management. It should be designed to accommodate all the HDO's settings and services and be flexible enough to add additional RAC-like audits in anticipation of state Medicaid and private insurers potentially following similar additional auditing processes.

Position and Adoption Speed Justification: As expected, many HDOs went through a rapid selection process and have adopted some kind of IT application approach to RAC audit tracking – either a vendor purchase or something self-developed. This application will reach the Plateau of Productivity fairly quickly. However, because many HDOs are still early in their experience with RAC audit information requests and moving audits all the way through the various process steps using these software tools, we still rate it as moving just past the Trough of Disillusionment phase.

User Advice: RAC is one signal of the serious emphasis CMS is continuing to place on eliminating fraud and overpayment as part of controlling Medicare costs. HDOs are wise to take each of these initiatives very seriously and expect CMS to move more quickly on appropriate payment issues in the future. Because RAC did happen fairly quickly and is a significant threat to revenue, HDOs have needed to be prepared to quickly manage the inquiry/response process. Now, HDOs need to focus on a much more proactive and comprehensive strategy at the front-end of the care process to ensure accurate and complete patient data entry – for example, in the emergency department. Some HDOs involved in the RAC demonstration projects found as much undercoding as they did overcoding:

- By now, HDOs should have formed a RAC steering committee (as recommended by the Healthcare Financial Management Association), and be improving the eligibility/medical necessity checking process to ensure consistent compliance. This should include representatives from finance, compliance, care coordination, clinical documentation and health information management (HIM; medical records), as well as the chief medical officer (CMO) or a representative, and medical informatics if the HDO has a computer-based patient record system in place or pending.
- The chief medical informatics officer (CMIO) should be collaborating with HIM on improved processes and documentation via electronic medical records and other techniques of proactive revenue cycle management (RCM). These are as important as having a reliable RAC tracking system.
- Be prepared for RAC-type approaches to extend to other payers. Select a RAC tracking vendor that has anticipated this in its system design and can support multiple types of audits.
- Other vendors and consultants have developed assistance services such as risk assessments, and documentation error identification and prevention programs. HDOs struggling to be prepared and proactive should keep an eye out for return on investment (ROI) proof points on these, as well as making a RAC tracking software decisions.

Business Impact: CDOs not tending to revenue management with an eye to the techniques of RAC auditors will potentially lose millions of dollars. The RAC tracking application is a necessary investment for most CDOs, but by itself has moderate benefit by ensuring timely management and preparation for possible appeals. Comprehensive RCM and RAC management has much higher consequence.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Allscripts; HealthPort; Ingenix/CareMedic; Intersect Healthcare; MedAssets; MRO Corp; The SSI Group

Climbing the Slope

Remote ICU

Analysis By: Jonathan Edwards

Definition: The remote intensive care unit (ICU) is an application that combines audio, video, patient records and image access with customized decision support. The remote ICU enables remote critical care specialists (intensivists and nurses) to sit in a central command center, where they can monitor and direct the care of critically and acutely ill patients in multiple ICUs.

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 is used by approximately 40 multihospital healthcare delivery organizations (HDOs) in the U.S., comprising 200 hospitals and accounting for approximately 10% of U.S. adult ICU beds. Several HDOs have attributed significant improvements in quality of care and use of resources to their use of a remote ICU. During the past two years, the reduction in capital spending in the U.S., coupled with the prioritization by HDOs of electronic health record systems, has contributed to a slowdown in growth in new sales of remote ICUs. One significant recent announcement was Geisinger Health System, which is implementing the remote ICU during 2010.

There has been growth in the use of the remote ICU by existing customers. Some HDOs are using the remote ICU to extend coverage to hospitals outside their network by charging subscription fees. Others are using the remote ICU infrastructure to provide additional telemedicine services, including telestroke, teletrauma and telepharmacy.

The remote ICU is used exclusively in the U.S., because the remote ICU vendors have focused their efforts almost solely on the U.S. market. Therefore, our Hype Cycle position and market penetration estimates are for the U.S. market only.

Although a number of U.S. HDOs have documented substantial benefits from the remote ICU, it is not yet in the mainstream. Major barriers include a fear of change and the fact that few HDOs have an ICU management team that is willing to make the leap of faith required to purchase a remote ICU, and willing to make the changes in process necessary for a successful implementation.

Other barriers include physicians' fear of job loss or reduction in revenue, the unwillingness of U.S. healthcare payers to reimburse remotely delivered intensivist services, and the fact that, with a variable mix of patients, HDOs are not always rewarded for shorter ICU stays and higher quality. For a remote ICU to be effective, a hospital must have adequate automation systems at the host, as well as at the remote ICU. Operating and staffing remote ICU centers can be challenging, and some of the same benefits can be obtained from a critical care information system and the full decision-support capabilities of a computer-based patient record (CPR) system that includes critical care functionality.

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. There is a lower return on investment from using the remote ICU for step-down beds because of their lower patient acuity. HDOs outside the U.S. should wait until vendors clarify their strategies for bringing the remote ICU to their countries.

Business Impact: The remote ICU has the potential to help hospitals improve their adherence to evidence-based medicine practices, monitor patients more closely, and improve ICU use and patient throughput. As a result, it can improve outcomes, reduce cost per case, improve the lives of clinicians and help rural hospitals to retain patients. Some of these effects can also be achieved by optimal use of the capabilities of a CPR system.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Cerner; iMDsoft; Philips

Patient Portals (Clinical)

Analysis By: Tom Handler

Definition: Patient portals enable a secure online patient-provider relationship for interactions such as secure communication, prescription refill/renewal requests, e-visits, lab and diagnostic test results, medication lists, and patient education. Other functionality might include the ability to make copayments, perform self-service scheduling, make referral requests, access online forms, look up physicians, access medical decision aids, access reviewed medical content, receive personal health record support, access links to Web 2.0 functionality like communities of interest, and access mobile support. Some vendors and healthcare delivery organizations (HDOs) have incorrectly labeled these as tethered personal health records (PHRs). According to Gartner's definition and the definition of others, a PHR should be independent of any healthcare organization because patients may switch providers and would like their health information to move with them.

Position and Adoption Speed Justification: Today, many computer-based patient record (CPR) and electronic medical record (EMR) system vendors offer modules that can create a 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. Additionally, some HDOs are using distinct portal platforms to construct Web-based

composite applications and are linking them to clinical applications (using SOA techniques – APIs, Web services – to reuse existing application and system logic and data). Drivers for patient clinical 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. Although activists continue to raise concerns about privacy and security, this is not likely to significantly inhibit the use of portals. The use of patient portals for access to clinical information is more limited outside the U.S. One notable example is Denmark, whose national portal has permitted patients to access their medical data for several years.

User Advice: Patients are beginning to expect and demand improved patient portals. 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. Other functionality might include the ability to make copayments, perform self-service scheduling, make referral requests, access online forms, look up physicians, access medical decision aids, access reviewed medical content, receive personal health record support, access links to Web 2.0 functionality like communities of interest, and access mobile support. While 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 CPR system tends to fit clinician workflow better and is, therefore, better-utilized. The patient portal strategy should also be aligned with a self-service kiosk strategy.

Business Impact: Initially, clinical patient portals, primarily providing patient access to results, can increase patient satisfaction and improve brand loyalty. As more-robust interactive functionality is built in, HDOs can expect improvements in clinician productivity. Also, organizations can improve the quality of care delivered by utilizing 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: Carefx; Cerner; Eclipsys; Epic; Kryptiq; Medicity; MedSeek; Orion Health; RelayHealth; Siemens; Wellogic

Generation 3 Computer-Based Patient Records

Analysis By: Tom Handler

Definition: Generation 3 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. These systems support the activities of all clinicians and interact with other caregiver automation systems to provide support for the clinical care process. Unlike previous generations, Generation 3 CPR systems support the practice of evidence-based medicine, and provide the infrastructure necessary for an organization to optimize its clinical activities.

Position and Adoption Speed Justification: This positioning is relative to the U.S. market, which is primarily where Generation 3 CPR systems are currently available (although it should be noted that all Generation 3 CPR vendors intend to roll them out globally).

The first Generation 3 CPR systems appeared in late 2005. 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 will require many additional years. Capabilities such as clinical decision support, order sets, clinical workflow and knowledge management support the practice of evidence-based medicine. Despite the significant resources required to support these activities, the drivers (including quality, and, to a lesser degree, financial – for example, these systems should permit shorter lengths of stay) to install a Generation 3 CPR system are compelling. The prospect of stimulus money in the U.S. and elsewhere has greatly increased interest in these systems and is promoting their forward motion. Moreover, the vendors of enterprise CPR systems continue to advance their systems, and endeavor to have most of their client bases on the latest versions of their software. Most vendors are certifying their Generation 3 products to allow their clients the opportunity to receive stimulus dollars under the U.S. American Recovery and Reinvestment Act (ARRA) of 2009. This will mean more Generation 3 implementations over time.

User Advice: Ultimately, most (if not all) HDOs will find it beneficial to implement a Generation 3 enterprise CPR system. When correctly implemented, the proof of these systems' ability to reduce unnecessary practice variations and deliver more evidence-based care is compelling. However, it is essential to have a clear clinical strategic plan, and an informatics governance structure in place to best take advantage of the CPR system. Institutions that have Generation 2 CPR systems installed should work actively with their vendors to increase their ability to achieve Generation 3 status. 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.

Business Impact: A Generation 3 CPR 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.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Cerner; Eclipsys; Epic; GE Healthcare; McKesson; Meditech

U.S. Ambulatory Electronic Medical Records

Analysis By: Tom Handler; Wes Rishel

Definition: Ambulatory electronic medical records (EMRs) are computer-based patient record (CPR) systems that are specifically designed for the ambulatory care environment. An EMR should include an integrated set of modules that supports electronically receiving lab results and other reports; medical history and visit documentation; maintaining problem active medication and allergy lists; diagnostic coding; charge capture; manual and electronic prescription writing and transmission; medication reconciliation; physician entry of orders for test and consult requests; clinical decision support; clinician messaging; sending electronic patient care summaries; providing patients an electronic copy of their health record; e-visits; electronic transmission of disease, immunization and adverse event information to registries; population health; and the collection of quality measures in the clinic. Some countries will require reporting quality and usage measure by demographic categories, such as age, insurance type, gender, race or ethnicity.

Position and Adoption Speed Justification: Penetration of EMRs in the U.S. varies widely by market segment, with most large practices/clinics (those with more than 50 physicians) having already implemented an EMR, and as little as 5% of small practices (five or fewer physicians) having fully implemented a system. The trend of healthcare delivery organizations (HDOs) acquiring smaller practices will accelerate adoption. 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. This high-growth market offers considerable potential for improving patient safety in the outpatient setting. U.S. federal government initiatives (especially new funds under the American Recovery and Reinvestment Act of 2009) are facilitating significant renewed interest in EMRs, but the initial cost of the systems may not be the primary barrier to adoption. If usability, ongoing expenses and misaligned incentives are limiting the use of EMRs, then these new funds won't lead to a great increase in adoption. However, Gartner has spoken with a number of hospitals that are subsidizing community EMRs under U.S. congressman Pete Stark's relief act, as well as many other hospitals that are contemplating such endeavors. Physician concerns about the effect of EMRs on productivity and cost constraints – especially among the small, independently owned practices that represent a clear majority of the market – continue to be inhibitors.

User Advice: Ultimately, all HDOs will need to implement an EMR solution; however, for many, this will be years away. One thing all HDOs need to be pursuing aggressively now is an assessment of their clinical readiness to adopt an EMR. If the organization culture and clinical governance are not where they should be for EMR implementation, then the HDO should focus on change management efforts to correct this deficiency. HDOs that have determined that pursuing an EMR makes sense at this time need to make it a top priority to integrate their practice management (that is, appointment scheduling and accounts receivable) systems with a new EMR implementation. U.S. HDOs also should look for vendors that comply with emerging multiyear meaningful-use criteria. In addition, HDOs should look for a vendor with a proven track record of predictable delivery of good-quality, implementable new software releases. Furthermore, true integration, not just

interfacing, of the EMR with an enterprise CPR system is worthwhile for physician offices and clinics within an integrated delivery system, especially 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).

U.S. HDOs that are planning to provide or subsidize EMRs to community physicians must select certified products and should strongly lean toward products that include self-contained or tightly integrated practice management, vendor-assisted electronic interfaces for lab and other reports and medication profiles, e-prescribing, and a multienterprise patient identification and privacy capability for controlled information sharing. In addition, for many organizations, especially those with limited IT capabilities or those planning to roll out the EMR to many affiliated practices, significant consideration should be paid to those vendors with proven remotely hosted offerings.

HDOs should not underestimate the effort it will involve to get satisfactory physician adoption. While clearly beneficial, EMRs can be difficult to implement and use. HDOs need to plan for the reality that there will some short-term reduction in productivity after an EMR implementation. Attention needs to be paid to ensuring that clinician productivity is not adversely impacted in the long term by the EMR.

Business Impact: Implementing an EMR can positively impact most areas, including clinician productivity, patient safety, and revenue cycle management for physician offices, clinics and other ambulatory care providers. When an EMR is done correctly, there can be a great increase in the quality of care delivered, improved patient satisfaction and safety, and improvements in revenue and efficiency of the practice.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

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

E-Visits

Analysis By: Jonathan Edwards; Tom Handler

Definition: E-visits are non-real-time digital consultations enabled by application software that permit structured, secure messaging between a patient and a provider for a well-defined and narrow range of consultations, such as for nonemergency questions, prescription refills and routine chronic disease management (such as reporting of vital signs). Because they are structured messages, e-visits are distinct from e-mail.

Position and Adoption Speed Justification: Shortages of physicians, the difficulty of actually 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 visits. Moreover, patients and physicians are frustrated by endless “telephone tag” and are increasingly recognizing the value of the asynchronous capabilities of e-mail or secure messaging. Many electronic medical record (EMR) vendors in the United States have added secure messaging capabilities to their products, 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 e-visits. One of the largest implementations of e-visits is in the Kaiser Permanente organization. Sixty% of eligible Kaiser members (aged 13 or over) use the Kaiser patient portal My Health Manager, which includes e-visits and permits patients to order prescriptions and view their medical record online. Kaiser recorded a sixfold increase in the use of e-visits between 2005 and 2007. At the same time, physician office visits per member decreased 26%. Henry Ford Health Care 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., the most mature market for this application. 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 England, Scotland and Switzerland. In the Asia/Pacific region, e-visits remain in their infancy. Adoption will increase worldwide once EMR 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.

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 squeezing 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 EMR 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. 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: E-visit technology enables cost reduction, increased patient satisfaction and improved clinician productivity.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Cerner; Epic; Kryptiq; McKesson (RelayHealth); Medgate; Medseek

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 wirelessly via radio frequency identification (RFID), Wi-Fi, ultrasound, infrared, ZigBee or other appropriate technologies. Currently, healthcare delivery organizations are concentrating tracking efforts on the most valuable of the many mobile medically related assets, such as intravenous infusion pumps, wheelchairs, pulse oximeters, specialized surgery tables and equipment, and computers on wheels. In more-advanced iterations, software vendors would provide: (1) inventory/maintenance management support, and (2) additional reporting and analysis of equipment utilization patterns that enhance the fast location and replacement/overstock cost-avoidance benefits of this application.

Position and Adoption Speed Justification: Rapid location and management of many healthcare-related assets are important components of cost and quality management. This is one of the more prominent in an increasing number of applications enabled by infrastructure investments in networks and evolving sensor technologies. The availability of reliable, pervasive hospital wireless networks; the total cost of system ownership (typically including tags, batteries, sensors, receivers and software/support); and the maturity of vendors’ software and professional services for deployment, tracking and reporting are all influencing the adoption curve for this application. Adoption has been slowed by more-conservative spending during the economic downturn and by the press of other demands on IT. However, more-mainstream (not just typical early-adopter) sites are initiating implementations this year. Some pilots have demonstrated sufficient value to be turned into broader deployment plans. Solid documentation of return on investment from more organizations will be the main factor influencing WHAM’s slow but steady progress in reducing risk and achieving mainstream adoption.

The vendors continue to vie for market leadership, and push en masse for more widespread adoption, with individual company fortunes rising and falling, teaming alliances fairly common, and leaders expanding their applications’ capabilities and value propositions. This jostling will continue for at least the next few years and represents a significant part of a health system’s risk in trying to pick a longer-term partner.

Note that healthcare is ultimately expected to be one of the most significant industries for the use of location and condition sensing (LCS) technologies. We reflect this by highlighting three distinct applications incorporating LCS technologies in this Hype Cycle. There will no doubt be more in the future.

User Advice: Many applications and technologies are transforming healthcare into a “real-time enterprise” management model. Rather than only looking at this quite profound change incrementally and use by use, IT leaders should consider what roles, responsibilities, skill sets and organization structure will be needed to support an increasing array of real-time location/sensing/presence data, clinical system monitoring and alerts, as well as real-time business intelligence-generated key performance indicators and dashboards.

Focus attention on information governance to help get the organization’s arms around these accumulated changes.

Larger hospitals and integrated delivery systems should now assume they will be leveraging this application and factor WHAM use in network planning. Note that various approaches are available, and there is no one definitive winner as of now, although Wi-Fi appears to have the largest installed base.

This is an area of mutual opportunity between IT and clinical engineering. CIOs who manage the clinical engineering department can bring seamless oversight and added business value by leveraging this application for medical and IT inventory management and ensuring network support, security and optimization. If IT and clinical engineering are not structurally unified, create a joint planning, project, and support coordination team and process. WHAM is one area of work for this group.

Scrutinize the vendors’ business acumen and viability, along with their ability to define, develop and support new business applications quickly.

Look for vendors who are extending their value toward equipment inventory optimization, maintenance management and regulatory compliance. Don’t limit scrutiny to just real-time location.

Business Impact: WHAM helps improve timely accessibility to, and utilization of, mobile equipment. It should reduce the organization’s total cost 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.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: AeroScout; Aethon; Awarepoint; Ekahau; InfoLogix; Intelligent InSites; Patient Care Technology Systems; RadarFind

E-Prescribing (Healthcare Provider)

Analysis By: Tom Handler

Definition: Electronic prescribing (e-prescribing) involves the use of application software and connectivity tools that enable physicians’ offices and ambulatory clinics to create and send prescriptions electronically (including by online fax) directly to pharmacy systems, external databases, or to a printer.

Position and Adoption Speed Justification: E-prescribing has been shown to:

- Reduce medication errors.
- Improve efficiency.
- Lower medication costs.

In the U.S., stimulus money under the American Recovery and Reinvestment Act requires the use of e-prescribing, and private healthcare plans have subsidized e-prescribing solutions for physicians’ offices. It must be noted that in the U.S., the Medicare Prescription Drug Improvement and Modernization Act and the American Recovery and Reinvestment Act stimulus’ specifically require transmission of structured data to the dispenser in order to meet requirements labeled by them as “ePrescribing.” Furthermore, it is quite notable that the Drug Enforcement Administration has released its final rules for “ePrescribing” controlled substances, and that they are practical to implement. All of this will lead to quicker adoption of e-prescribing than might have been predicted previously. However, some organizations fail to recognize the complexity of e-prescribing implementations, and may proceed too quickly – with the unintended consequence of actually slowing adoption of this technology. Most electronic medical record (EMR) solutions now have robust e-prescribing modules.

Many countries in Europe and Asia/Pacific have high usage rates of EMR systems that generate paper prescriptions. Government agencies in those countries 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 respect include Israel, Sweden, Denmark and some regions of Spain. The main challenges to widespread e-prescribing include getting pharmacies and EMR vendors to modify their applications.

With the current adoption of e-prescribing globally, and the increased pace of adoption in the U.S., it is possible that e-prescribing’s position on the Hype Cycle will be beyond the Plateau of Productivity next year.

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 EMR 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: Early mainstream

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

Remote Hosting

Analysis By: Barry Runyon

Definition: Remote hosting is an arrangement whereby a healthcare delivery organization (HDO) contracts with a third party to host an application or system at the vendor's data center as an alternative to using its own premises. For HDOs, remote hosting agents are often their clinical or business vendors, or established system integrators. Remote-hosting contracts normally are long term and run from five to 10 years, although shorter three-year terms are not completely unheard of. The shorter the term, the stronger the exit strategy needs to be. In these arrangements, the remote-hosting agent provides the necessary server platforms, applications, network access and technical support. The client is generally responsible for licensing the software, and maintaining system configurations and provisioning for its users. The remote-hosting agent maintains the technical infrastructure, applies hardware and software upgrades, applies product and security fixes, and fields support calls. The remote-hosting agent also ensures that the hosted system is highly available and responsive by offering its services in Tier 3 and Tier 4 data centers, along with robust break/fix, backup and disaster recovery (DR)/business continuity (BC) capabilities. Moreover, the remote-hosting vendor is often held to enforceable service-level agreements (SLAs). The HDO is not outsourcing its IT department personnel in a traditional sense. For a monthly subscription fee, the hosting agent's support personnel serve as a nondedicated adjunct to the HDO's IT department. Gartner classifies remote hosting as a managed service, which, in turn, is a type of IT outsourcing.

Position and Adoption Speed Justification: One of the most compelling reasons for considering remote hosting is when the IT department cannot easily or affordably meet performance and availability requirements for mission-critical systems – particularly those that surround the clinical workflow. This could be the result of a shortage of qualified staff, weak change management procedures or inadequate facilities. However, remote hosting should not be viewed as a tactical or remedial approach to performance difficulties, but rather as a critical component of an overall IT service delivery strategy. An HDO should consider a remote-hosting option for mission-critical applications or systems when:

- IT is not viewed as a core competency by the enterprise
- Significant hardware and infrastructure upgrades are imminent
- There are data center capacity issues
- The enterprise infrastructure has not kept pace with automation
- The IT project backlog is large
- IT change management and operational best practices are lacking
- The enterprise has a weak DR/BC posture
- Operational funds are more available than capital funds

The trend is toward increased remote hosting by HDOs. Software vendors are pushing remote hosting as a preferred deployment model, and they are continually upgrading their data center facilities and associated infrastructure to keep pace. The economy has put some data center expansion plans on hold, and has made remote hosting more attractive for HDOs looking to continue the automation of their clinical and business workflows. Clinical vendors that do not have a remote-hosting offering could lose new sales and possibly market share – particularly among small to midsize HDOs. Some remote-hosting agents have begun to position their products as software as a service (SaaS). This will take some time, because in most cases their products will need to be rearchitected to run on a SaaS platform.

User Advice: Before engaging in a remote-hosting contract, establish the necessary skills to negotiate and manage such a contract. Understand that remote-hosting arrangements must be preceded by clearly expressed SLAs, and the means to monitor and enforce them. Look for vendors to supply performance dashboards to monitor SLAs. The most common SLA relates to end-to-end system availability, often referred to as the “end-user experience.” The customer's remote-hosting equipment, network routers, switches, circuits, operating system (OS) and layered products are often monitored using automated monitoring tools. Typically, if the monthly system availability for the remote-hosting services falls below a certain threshold (e.g., 99.5%), the service provider will credit the client's next monthly services fees to account for the downtime or period of degraded service. Draft separate SLAs for response time to interoperability and integration issues that can't be avoided through “best-of-suite products.” Limit local customization of clinical systems whenever possible so that they are more easily remote-hosted. Retain the rights to view the basic audit data that drives the service-level dashboard. Whenever possible, remote-host “best of suite,” rather than “best-of-breed” products to simplify the remote-hosting relationship.

Business Impact: Remote-hosting options from key clinical vendors and system integrators directly address HDO challenges regarding infrastructure complexity, capital budget constraints, staffing restrictions and project provisioning. Some of the traditional cultural and turf barriers to remote hosting are dissolving, and remote hosting is being considered on its business merit as well as its fit within the enterprise IT services delivery strategy.

Remote-hosting agents will get better at providing their services, and contract costs will likely become more attractive. In most cases, HDOs will enter into remote-hosting agreements to improve or to ensure service levels (that is, to address performance and availability issues and to fill in long-term staffing talent gaps), and very seldom as a cost-saving initiative. That is, of course, unless remote hosting precludes the necessity of constructing a world-class data center to house a new clinical or business system, or precludes the time and expense associated with ensuring an elaborate DR/BC contingency.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Cerner; CSC; Dell Services; Eclipsys; GE Healthcare; McKesson; Siemens; Xerox

Computer-Based Physician Order Entry

Analysis By: Tom Handler

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. This includes physician preferences, access to predefined order sets, context sensitivity concerning the patient, and having a clinical decision system check the orders as they're entered. As clinical decision support becomes more sophisticated with regard to medical best practices, and expands medical knowledge (such as analysis of genetics), CPOE will increasingly rely on automated clinical decision support as a tightly integrated function.

Position and Adoption Speed Justification: Much of the cost (and, to a degree, the quality of medical care) is directly related to medication and nonmedication orders. Therefore, CPOE is one of the highest-value aspects of implementing a computer-based patient record (CPR) system. However, successfully implementing CPOE requires prior success with various other CPR components; hence, CPOE adoption will always lag CPR adoption. CPOE is difficult to implement, especially for healthcare delivery organization (HDOs) with a large proportion of credentialed but nonemployed physicians. Still, CPOE represents an opportunity to reduce practice variability, and it is rapidly becoming an indispensable capability in practicing state-of-the-art medical care. 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; instead, the question has become one of timing – i.e., “when” should we rather than “should” we. The U.S. American Reinvestment and Recovery Act (ARRA) 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. In other countries, adoption of CPOE is much lower, especially for medication orders, because outside 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. There is extensive use of nonmedication order entry in Europe and the more-advanced Asia/Pacific countries.

User Advice: HDOs should have implemented, or be seriously considering implementing, CPOE. Those that haven't should focus on ensuring proper clinical governance structures (including the creation of informatics committees and hiring a chief medical information officer). Even before implementation begins, HDOs can begin working on evidence-based order sets and better decision support. In some regions, 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. U.S. HDOs must not allow their desire to receive stimulus dollars to cloud the reality of what the organizations and clinicians are ready to accomplish. If CPOE is not implemented correctly the first time, then the consequences will be felt for a very long time afterward.

Business Impact: 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.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Cerner; Eclipsys; Epic; GE Healthcare; InterSystems (TrakHealth); McKesson; Meditech; QuadraMed; Siemens Healthcare

Entering the Plateau

Disaster Recovery and Business Continuity

Analysis By: Barry Runyon

Definition: Disaster recovery (DR) is the technical component of a business continuity (BC) plan. Together, they represent the planning, policies, procedures, agreements, technologies, infrastructures, contingencies and coordinated activities that enable the recovery of critical business processes and IT systems, and operations from reasonably anticipated disruptions. DR/BC includes assessing enterprise risk, identifying critical systems, determining recovery time objectives (RTOs) and recovery point objectives (RPOs), and developing, implementing and testing DR/BC contingencies.

Position and Adoption Speed Justification: DR/BC will continue to compete unfavorably with clinical and revenue-producing initiatives, which, ironically, contribute to an even more critical and complex DR/BC requirement. Recent trends have been toward the insourcing of DR/BC – especially in larger enterprises.

Requirements for recovery times are now on the order of hours versus days. Compliance-mandated DR planning (e.g., the U.S. Health Insurance Portability and Accountability Act [HIPAA] and The Joint Commission) has done much to increase awareness, and healthcare delivery organizations (HDOs) have started including DR/BC as a component of new system purchases. Still, most HDOs have not gone far enough, and more often take disjointed approaches that represent a narrow view of a DR/BC solution. Sophisticated DR still represents a substantial investment that HDOs are reluctant to make, and hospital administrations are not yet convinced of the value proposition. Most recent DR activity in HDOs has been storage-facilitated (data replication to an alternate site), and assisted by new product innovations in the area of server and storage virtualization. The trend toward the remote hosting of certain critical business and clinical systems is improving the DR postures of many HDOs. Clinical application vendors, storage vendors and BC specialists continue to create more DR/BC options for HDOs.

User Advice: Keep DR a priority within the administration, board and enterprise as a whole through frequent championing, and plan progress updates. Hold key constituents and stakeholders individually accountable for progress toward the DR plan. Seek to become safer one critical system at a time, based on the findings of the business impact plan and other vulnerability assessments. HDOs should observe the 80/20 rule when it comes to DR spending – i.e., they should focus 80% of their DR management (DRM) spending on the top 20% of mission-critical applications, such as the computer-based patient record/electronic medical record (CPR/EMR) and related core clinical systems like laboratory, picture archiving and communication systems (PACSs), revenue cycle management (RCM) and ERP. Gartner’s DRM maturity model can be used as a self-assessment tool for DR programs and support processes, and for determining the investments required to reach the next level of DR preparedness. Most HDO DR/BC contingencies are storage-facilitated and leverage-owned facilities. Gartner research indicates that the more diverse the platform mix (which is common among healthcare providers), the more likely that recovery provider services will be an affordable risk mitigation approach. Exploit established enterprise LAN, WAN and storage fabric, along with server and storage virtualization technologies, for the timely backup and recovery of critical application data and processes. Begin the process of determining the infrastructure and service changes needed to support RTOs and RPOs of 24 hours or less for mission-critical applications. Evaluate clinical vendor offerings (outsourcing and remote hosting), or combine with on-premises contingencies for a comprehensive approach. Larger HDOs should consider establishing a “chief risk officer” position to centralize and coordinate all DR/BC planning and implementations. New DR/BC management tools based on such standards as the Hospital Incident Command System (HICS) will make it easier for HDOs to publish comprehensive and compliant recovery plans. DR/BC vendors will increasingly reference cloud computing or the cloud as a potential platform for deploying off-premises, scalable DR/BC services. While this won’t happen for some time, HDOs should keep abreast of vendor plans in this space. While many HDOs have become better at IT DR, they must do more regarding the planning and coordination activities that are necessary to recover the larger business.

Business Impact: Most DR plans remain just “plans” because they are focused on worst-case scenarios, rather than targeting the most likely failure scenarios. If the most likely disruption scenarios are planned for, then DR/BC can offer a significant return on investment. DR/BC does not seek to duplicate a loss, but rather to decrease the effects of the loss and increase the likelihood of enterprise survival. DR must be integrated with the procurement, compliance, clinical and business processes of the enterprise.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Cerner; Dell Services (Perot Systems); Eclipsys; HP; IBM; Iron Mountain; SunGard

Cardiology Imaging Systems

Analysis By: Tom Handler

Definition: Dedicated digital cardiology systems support the acquisition, distribution, storage and interpretation of cardiology images. These systems also tend to include reporting capabilities and may have scheduling and billing modules as well.

Position and Adoption Speed Justification: Cardiology imaging typically represents a substantial portion of a healthcare delivery organization’s (HDO’s) overall revenue, and this often provides an impetus to preferentially purchase these systems over others. The advent of new imaging techniques, as well as the trend toward increasing numbers of cardiology studies, is making the digital environment essential. Cardiologists need imaging systems if they are to remain efficient. Because it is important for HDOs to attract and retain cardiologists, ever-greater numbers are purchasing and implementing cardiology imaging systems. In the U.S., most HDOs have implemented a cardiology imaging system. Positioning on the Hype Cycle reflects the situation in the U.S., the most-advanced market. In Europe and Asia, penetration is lower. If those regions were plotted on the Hype Cycle, they would be just beyond the Trough of Disillusionment.

User Advice: Most HDOs will find it increasingly difficult to operate without cardiology imaging systems. HDOs must have these systems in their strategic plans. Although cardiologists tend to wield a great deal of power, it is important to place any cardiology solution in the context of an overall enterprise imaging strategy. There has been a great deal of consolidation in the imaging market, and now all the major picture archiving and communication system (PACS) vendors have acquired cardiology solutions as well.

Business Impact: Cardiology imaging systems improve HDO operational efficiency, and they strengthen ties with cardiologists and referring physicians. Because these systems generate huge amounts of data, CDOs need to take steps to have information life cycle management strategies to ensure that their underlying storage infrastructures will scale in a cost-effective manner.

Benefit Rating: Moderate

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Agfa HealthCare; GE Healthcare; McKesson; Philips Healthcare; Siemens Healthcare

Appendixes

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Figure 3. Hype Cycle for Healthcare Provider Applications and Systems, 2009

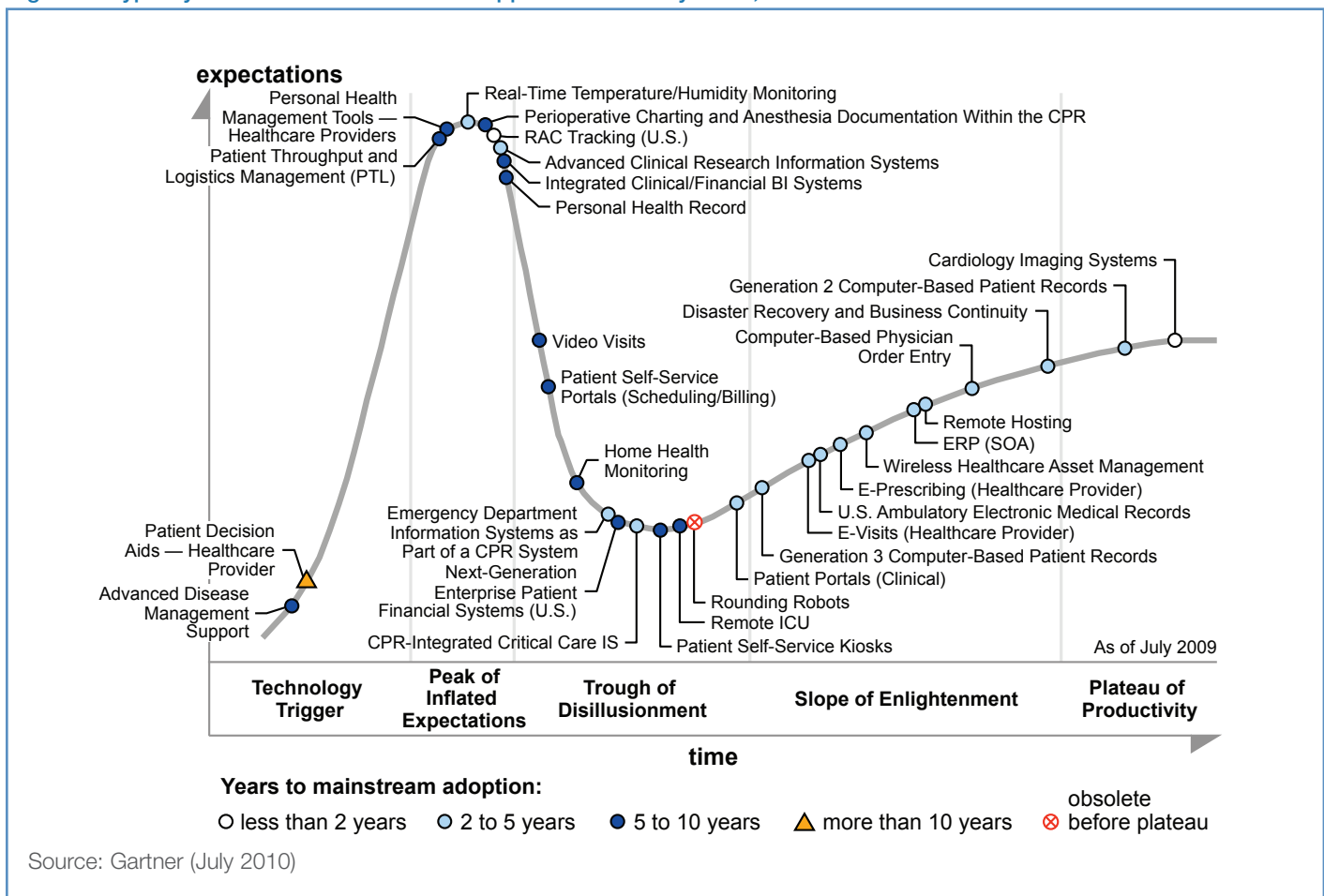


Table 1. Hype Cycle Phases

Phase	Definition
<i>Technology Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
<i>Peak of Inflated Expectations</i>	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.
<i>Trough of Disillusionment</i>	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
<i>Slope of Enlightenment</i>	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.
<i>Plateau of Productivity</i>	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.
<i>Years to Mainstream Adoption</i>	The time required for the technology to reach the Plateau of Productivity.
Source: Gartner (July 2010)	

Table 2. Benefit Ratings

Benefit Rating	Definition
<i>Transformational</i>	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
<i>High</i>	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
<i>Moderate</i>	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
<i>Low</i>	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings
Source: Gartner (July 2010)	

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
<i>Embryonic</i>	<ul style="list-style-type: none"> In labs 	<ul style="list-style-type: none"> None
<i>Emerging</i>	<ul style="list-style-type: none"> Commercialization by vendors Pilots and deployments by industry leaders 	<ul style="list-style-type: none"> First generation High price Much customization
<i>Adolescent</i>	<ul style="list-style-type: none"> Maturing technology capabilities and process understanding Uptake beyond early adopters 	<ul style="list-style-type: none"> Second generation Less customization
<i>Early mainstream</i>	<ul style="list-style-type: none"> Proven technology Vendors, technology and adoption rapidly evolving 	<ul style="list-style-type: none"> Third generation More out of box Methodologies
<i>Mature mainstream</i>	<ul style="list-style-type: none"> Robust technology Not much evolution in vendors or technology 	<ul style="list-style-type: none"> Several dominant vendors
<i>Legacy</i>	<ul style="list-style-type: none"> Not appropriate for new developments Cost of migration constrains replacement 	<ul style="list-style-type: none"> Maintenance revenue focus
<i>Obsolete</i>	<ul style="list-style-type: none"> Rarely used 	<ul style="list-style-type: none"> Used/resale market only
Source: Gartner (July 2010)		