Hype Cycle for Real-Time Health System Technologies, 2020

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This Hype Cycle represents technologies that are pivotal to the realization of the real-time health system vision. It is an essential reference for healthcare provider CIOs for assessing the value and impact of the technologies that facilitate the next-generation healthcare delivery organization.

Table of Contents

List of Tables

List of Figures

Analysis

What You Need to Know

The real-time health system (RTHS) is a conceptual, operational and technology paradigm for the next-generation healthcare delivery organization (HDO). The RTHS transforms the HDO into an enterprise that is aware, collaborative and smart. The RTHS assimilates real-time operational intelligence to achieve business objectives.

This Hype Cycle is a purposeful collection of RTHS innovations, from embryonic to mainstream, that form a reference model for framing a digital strategy and composable business and IT architecture. Since its inception, the RTHS Hype Cycle has focused on technologies that have enhanced the situational awareness surrounding the patient, converting it into actionable intelligence. Advances in interoperability, the Internet of Things (IoT), artificial intelligence (AI) and real-time analytics have begun to move the RTHS closer to a healthcare delivery smart machine — one that evolves with its learning opportunities (see "The Hospital Will Become a Smart Machine").

The Hype Cycle

Each innovation profile on this Hype Cycle describes a technology that is essential to the RTHS. Every profile includes a justification for position and adoption, a benefit rating, and an assessment of market penetration and relative maturity, along with targeted user advice. Each profile also references a representative set of vendors that can deliver on its value proposition.

These profiles combine to form new digital capabilities that optimize and orchestrate care delivery and the materialization of a next-generation healthcare delivery organization vision (see "Industry Vision: The Real-Time Health System Transformation").

This year's Hype Cycle recognizes the steady evolution of technologies that characterize and define the RTHS. Next-generation command centers have started to provide enterprise-level visibility into departmental patient events and workflows. Interest in care team collaboration and patient throughput and capacity management has never been higher and is driven in part by the COVID-19 pandemic. These technologies have benefited from significant advances in interoperability, new industry rules and the increased availability of open APIs.

The digital twins in healthcare profile is new this year. The digital twin is a useful way of thinking about and expressing the characteristics and behavior of a purpose-built IT ecosystem, such as the RTHS industry vision encapsulates. The RTHS is an early example of a healthcare provider digital twin.

The digital health platform (DHP) profile is also new. The DHP is an architectural approach that delivers packaged business capabilities by refactoring functionality from internal and ecosystem partner applications. RTHS use cases will increasingly be architected through a DHP approach. This is in contrast to an increasingly inflexible EHR-centric architecture. This transformational profile describes how the HDO can foster innovation at pace by making digital business and IT choices

based on the composable nature of vendor capabilities, openness, modularity, and value, versus market dominance.

Figure 1. Hype Cycle for Real-Time Health System Technologies, 2020

Hype Cycle for Real-Time Health System Technologies, 2020

Source: Gartner
ID: 467856
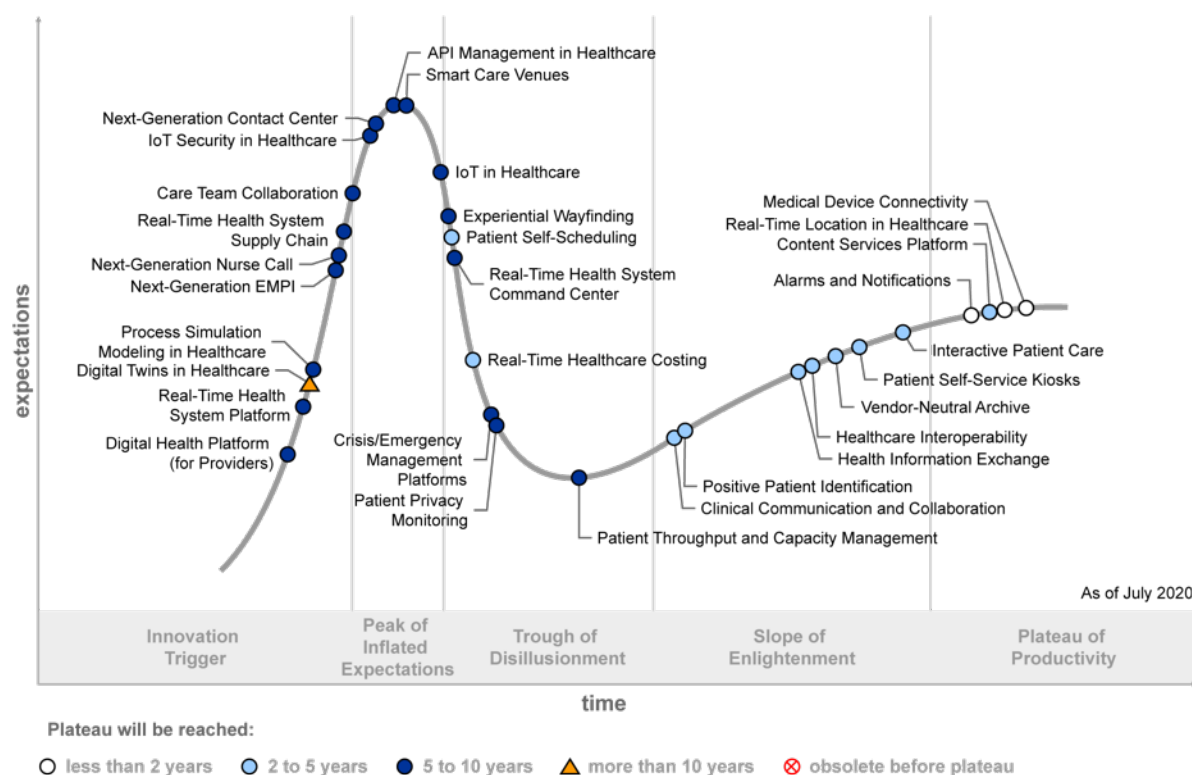
The Priority Matrix

The Priority Matrix maps an individual technology's benefit to its time to maturity. It is generated directly from the benefit rating and the time to plateau attribute values for each innovation profile on the Hype Cycle. The Priority Matrix answers two important questions: "How much value will an enterprise get from a particular technology?" and "When will the technology be mature enough to deliver that value at a manageable risk?" Investments that have higher and more near-term impact potential and have reached a reasonable level of maturity are located at the top-left sections of the Priority Matrix. Those that have a lower benefit and a longer time to value are situated on the lower-right sections of the matrix.

There are 31 innovation profiles on this year's Hype Cycle, 11 of which offer transformational value to the HDO. Transformational technologies that deliver value in the near term are uncommon. It takes time to deliver real transformational value to an industry. It will take five years or more before

these profiles see mainstream adoption, and even then, mainstream adoption is not assured. Transformational technologies catalyze a vision, and their evolutionary adoption materializes the vision.

Technologies are transformational when they change the way the healthcare provider does business, so by definition, they are less common. Transformational solutions often rely upon year-over-year advances in foundational technologies, such as interoperability, AI, IoT and analytics. Foundational technologies must, therefore, become more reliable, less costly and easier to integrate and deploy before they can facilitate the transformational solutions that leverage them.

A good deal of near-term value is provided by technologies that have lower benefit ratings, such as alarms and notifications, medical device connectivity, health information exchange, and positive patient identification. The RTHS paradigm gets its forward momentum from the steady adoption of moderate and high-value technologies that characterizes two-thirds of this Hype Cycle's innovation profiles.

Priority Matrix for Real-Time Health System Technologies, 2020

benefit	years to mainstream adoption			
	less than two years	two to five years	five to 10 years	more than 10 years
transformational		Clinical Communication and Collaboration Healthcare Interoperability Patient Self-Scheduling	API Management in Healthcare Care Team Collaboration Digital Health Platform (for Providers) IoT in Healthcare Real-Time Health System Command Center Real-Time Health System Platform Real-Time Health System Supply Chain Smart Care Venues	
high	Alarms and Notifications Medical Device Connectivity	Health Information Exchange Positive Patient Identification Real-Time Healthcare Costing	IoT Security in Healthcare Next-Generation Contact Center Next-Generation Nurse Call Patient Throughput and Capacity Management	Digital Twins in Healthcare
moderate	Real-Time Location in Healthcare	Content Services Platform Interactive Patient Care Patient Self-Service Kiosks Vendor-Neutral Archive	Crisis/Emergency Management Platforms Experiential Wayfinding Next-Generation EMPI Patient Privacy Monitoring Process Simulation Modeling in Healthcare	
low				

As of July 2020

Source: Gartner
ID: 467856

Off the Hype Cycle

In a continuing effort to clarify the scope of this Hype Cycle, we renamed several profiles:

- "API Management" to "API Management in Healthcare"

- "Experiential Wayfinding" to "Experiential Wayfinding in Healthcare"

- "Healthcare Real-time Location System" to "Real-time Location in Healthcare"

- "IoHT: Security" to "IoT Security in Healthcare"

- "IoT: Hospitals" to "IoT in Healthcare"

- "Process Simulation Modeling" to "Process Simulation Modeling in Healthcare"

On the Rise

Digital Health Platform (for Providers)

Analysis By: Mike Jones; Sharon Hakkennes

Definition: The digital health platform is an architectural approach that enables a healthcare provider to nimbly adapt their business and operating model in response to external disruption and change in business strategy. The DHP creates packaged business capabilities (PBCs) by refactoring functionality from internal and ecosystem partner applications. These PBCs can be used by nontechnical end users to streamline care delivery, prioritize resources and deliver positive health experiences and outcomes.

Position and Adoption Speed Justification: Healthcare providers have experienced the limitations of a monolithic, EHR-centric application portfolio. The well-intended but ultimately siloed nature of this architecture has successfully amassed massive data but also stifled innovation and slowed the pace of digital transformation. HDO CIOs' and executives' frustrations are exacerbated by the selective or restrictive attempts at interoperability by vendors, dubious application usability, and a bloated total cost of ownership (TCO).

The sudden disruption of the COVID-19 pandemic has woken up the leadership of every business to the existentially critical importance of business resilience. In healthcare this has exposed significant gaps in EHR capabilities related to adapting and scaling new ways of working like integrated virtual care. To compensate, the vast majority of providers have adopted solutions outside the EHR to respond.

The digital health platform approach will help remove the existing technological barriers and unleash the full power of digital innovation and transformation (see "The EHR Megasuite Oligopoly Will Result in Less Differentiation and Innovation — and Higher Total Cost of Ownership").

The end result is a composable enterprise (CE), defined as an organization that designs its business models, technology, organization and partnership ecosystems in a modular manner, so that it can safely and rapidly change (recompose) at any moment of need. Composable enterprise imposes a model of application design that imagines applications as experiences assembled by or for its users from packaged business capabilities (PBCs). PBCs are composed of purchased applications, internally developed capabilities, and partner capabilities chosen by the provider without vendor interference or data blocking.

The DHP approach is emerging rapidly as number of leading vendors in this space have released powerful cloud native capabilities to create personalized application experiences. This will break the stronghold of monolithic vendors and circumvent EHR vendor controlled application marketplaces.

Examples include:

- Microsoft "Virtual Rounding" capability using Teams

- Salesforce SaaS capabilities such as critical care resource management tools (Thrive Health/ Traction) and COVID-19 care management and engagement (Theon)

- Better's Platform, which provides a vendor-neutral, federated health data repository as well as low-code tools enabling health professionals to quickly build apps to support care processes.

We have positioned this emerging profile early on the Hype Cycle to reflect maturity and market penetration. Despite being classified as "emerging," we expect this Innovation Profile to rise swiftly up and over the peak within the next three years as new visionary platform entrants, regional interoperability regulation (e.g., ONC Ruling) and flexible cloud-first procurement frameworks (e.g., U.K. Digital Marketplace) will require incumbent vendors to adapt. We believe this profile will reach maturity and mainstream adoption within the next decade, and earlier for some organizations that are prepared to take bold moves toward reducing the investment in core EHR products that do not deliver full value or remain closed to this approach.

User Advice: The dynamic experience of the composable enterprise will become the prevailing architecture, integration and delivery model for healthcare digital innovation.

The CIO must:

- Align digital and IT strategy with existing business strategy through the power of people from clinical, business and IT backgrounds in the form clinical informatics fusion teams (see "Fusion Teams: A New Model for Digital Delivery").

- Take appropriate actions on vendor sourcing across the current and future enterprise application portfolio (see "Healthcare Provider CIOs: Use Scenario Planning to Determine the Durability of Your EHR Megasuite Relationship").

- Drive technology and data architecture decisions and organizational models that redefine the relationship between the business and IT.

- Modernize legacy applications toward the PBC model.

The hyperscale solution providers and channel partners along with a swelling open platform movement within the industry will lead to many monolithic solutions becoming marginalized as providers seek more nimble, cost-effective, and scalable digital capabilities that resonate with business and IT leaders.

Business Impact: The digital health platform will enhance and improve many areas of the healthcare provider business. Depending on the digital ambition and scope of each organization or ecosystem, the DHP will typically enable new digital clinical and business capabilities across

consumer engagement, care delivery, real-time healthcare operations, and health analytics including precision medicine and health.

The benefit to the business is the ability to rapidly adapt to changing business requirements/capabilities supporting both optimization and transformation activities. It heralds a new era where clinical and consumer capabilities are driving the technology as opposed to today where the technology (and vendors) are somewhat dictating what the next set of business and consumer capabilities are.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: AWS; Google; InterSystems; Better; Microsoft; Optum; Philips Healthcare; Salesforce

Recommended Reading:

"Future of Applications: Delivering the Composable Enterprise"

"The Applications of the Future Will Be Founded on Democratized, Self-Service Integration"

"Traditional Intranets Are Dead — Modern Intranets Are Alive and Well: Part 2"

"Innovation Insight for Packaged Business Capabilities and Their Role in the Future Composable Enterprise"

"Healthcare CIO Top Actions for 2020"

Real-Time Health System Platform

Analysis By: Gregg Pessin

Definition: The real-time health system (RTHS) platform acquires, accrues, analyzes and translates operational intelligence into enterprise action. Operational intelligence, the collection and contextualization of patient event and situational awareness data, along with real-time analytics, is used for the real-time orchestration and coordination of enterprise resources, workflows, and clinical and business processes.

Position and Adoption Speed Justification: Healthcare delivery organizations (HDOs) often don't leverage the power of real-time data to improve clinical operations performance. Operational intelligence and insights derived from situational awareness positively impact clinical operations performance, but the information must be oriented toward decision making and action.

The extent to which a healthcare delivery organization demonstrates the meaningful use of operational intelligence and real-time analytics to adapt to changing circumstances surrounding the

patient will determine its level of RTHS maturity (see "Maturity Model for the Real-Time Health System"). Three key RTHS capabilities include:

- Situational awareness — Situational awareness within the HDO is the real-time collection, correlation and use of patient-event-related, clinician, facility, and other information that is material to patient care and hospital operations. Situational awareness involves sensing, collecting, analyzing and contextualizing patient event data to improve healthcare provider care delivery, operations and performance. Situational awareness highlights opportunities to improve patient experience, clinical outcomes and reduce costs.

- Operational intelligence — Comprehensive situational awareness begets sophisticated operational intelligence. Operational intelligence can occur at many levels and in many contexts: a smart patient room, a smart ER, automation of coding and revenue cycle engagement with payers. It represents the synthesis and contextualization of current activity and events and the ability to adapt and act intelligently within a specified context, whether it be patient, operations, function or performance-oriented.

- Real-time analytics — Real-time analytics involves predefined analytical models, rather than ad hoc models, and the use of contemporary operational intelligence, rather than just historical data. It satisfies an abiding need of the HDO to increase the speed, accuracy, and throughput of workflows and business processes. Real-time analytics are used to anticipate/predict situations before or soon after they materialize, so that responses can be proactive, prompt and precise.

A healthcare provider at the highest level of RTHS maturity possesses near-ubiquitous enterprise awareness and operational intelligence augmented by real-time analytics that is deliberately applied to contemporary operational events and circumstances surrounding the patient. This information is accrued and analyzed over time, along with key performance data, for continuous improvement. Operational intelligence can manifest through predefined standardized care delivery protocols or digitized care pathways.

The concept of enterprisewide resource orchestration is just beginning to take hold within the healthcare provider industry. Currently, there is no one vendor that can provide a comprehensive set of enterprise-level orchestration capabilities and use cases in the form of a platform. Most vendors provide limited orchestration capabilities within their specific domains, such as care coordination, patient throughput, pharmacy automation, patient engagement, supply chain and medical imaging. This will require industry cooperation to open industry APIs for orchestration, along with strategic vendor alliances to achieve the level of data and workflow integration necessary for advancement. This innovation profile was advanced this year as a result of increased interest by Gartner clients and sales activity of the representative vendors listed below, and it is global in geographic scope.

User Advice: In order to position your organization for success using RHTS concepts, with the goal to implement a RHTS platform, you should:

- Use the observe, orient, decide and act (OODA) loop approach to analyze business situations to determine what types of real-time intelligence to collect and apply.

- Use process simulation modeling to reimagine and reengineer critical workflows and processes as part of your RTHS IT strategy and readiness program.

- If you are at the "reactive" level of the RTHS maturity model, begin deploying healthcare real-time location services in support of workflows and business processes that can benefit from enhanced situational awareness.

- Apply situational awareness and operational intelligence to continuously improve the patient experience and outcomes by continuously reducing response time and increasing response quality.

- Begin to deploy technologies highlighted in this Hype Cycle for translating information into action and real-time orchestration of enterprise resources.

- Work with key vendors to expose enterprise access to their processes and data.

Business Impact: RTHS platforms leverage up-to-date information and real-time analytics to remove delays to the management and execution of the HDO's and their most critical clinical and business workflows and processes. RTHS platforms do this in a way that improves operational efficiency, optimizes costs, improves the patient experience and transforms the delivery of care. It does this by decreasing response time, increasing response quality and balancing resources with demand — all within an enterprise context. By reducing variation and optimizing workflows and processes, greater care efficiencies and patient throughput, as well as lower cost of care, can be achieved.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Exepron; IDS; Intelligent InSites; Lumeon; Q-nomy; Qventus; ThoughtWire

Recommended Reading:

"Industry Vision: The Real-Time Health System Transformation"

"Maturity Model for the Real-Time Health System"

"Strategic Roadmap to the Real-Time Health System"

"The Real-Time Health System Architecture for Health Delivery Organizations"

"The Hospital Will Become a Smart Machine"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Healthcare Provider CIOs: Shift Interoperability Strategy From Moving Data to Orchestrating Workflow"

"Healthcare Provider CIOs: Advance Clinical Operations Performance Through Situational Awareness Technologies"

Digital Twins in Healthcare

Analysis By: Gregg Pessin

Definition: A digital twin is a virtual representation of an entity such as an asset, person or process and is developed to support business objectives. An important example in healthcare is the real-time health system (RTHS). The RTHS has at its core an organizational digital twin of the health system — synthesized from many discrete and composite digital twins. The twin provides the required situational awareness that enables RTHS's event-driven and operationally intelligent adaptive and predictive behaviors.

Position and Adoption Speed Justification: Digital twins in healthcare are digital representations of healthcare assets, people, workflows and their behaviors can help accelerate problem solving, decision making and enable more efficient and effective care delivery and administration operations. By modeling real world entities and concepts (e.g., patient flow, pathways) the HDO can test various scenarios that can lead to improvement by studying the effects of changing various inputs and conditions under which the digital twin operates. The advantage of digital twins is that many healthcare processes are now digitized in some form and notwithstanding issues of data quality, the digital twin allows for change impact to be understood without disruption to services or the risk of impacting patient safety or quality.

CIOs should recognize that there are various types or use cases for digital twins and use business-focused analysis combined with assessment of vendor capabilities to determine where the concept can be meaningfully applied. The RTHS is a prime example of a digital twin that enables the creating of simulations that are both detailed and dynamic across the enterprise as the RTHS encompass many components of hospital operations and care delivery.

We have positioned this early in the Hype Cycle as an emerging technology because there are now a number of emerging uses cases that are proving to be useful in solving some key healthcare issues.

User Advice: The RTHS is about getting the right information to the right people at the right time and place in order to enable highly informed decision making across the healthcare organization. The potential positive impacts of digital twins will accelerate efficient patient care delivery, maximize hospital operations such as revenue cycle management, facilities operations and much more. The foundational driver for this digital transformation is accurate, real-time data collected from every aspect of the healthcare organization. This situational awareness instantiates through the creation of digital twins.

In order to get started with a digital twin program, HDO CIOs should:

- Include a concise digital twin vision within the HDO's digital transformation strategy. Because there is a direct correlation between digital transformation success and digital twins, the linkage must be established as part of the transformation's foundation.

- Educate business and clinical units to inform them about the benefits of digital twins, how they fit in with departmental and organizational goals. Starting this begins the process of identifying

the right data to create highly effective digital twins along with establishing a collaborative environment for the initiative among stakeholders.

▪ Create a pilot program by targeting simple models of patients, a department or other entity tied to a specific desired business or clinical outcome to understand digital twin challenges. Begin by analyzing the underlying source data required to compose the digital twins with the understanding that the usability of the twins is directly correlated to its data quality.

Business Impact: Digital twins are at the heart of situational awareness in healthcare delivery organizations. They are the culmination of information gathered from IoT and other sources to create an informed, accurate digital model of the real-world healthcare organization. Situational awareness is the engine behind various "hospital of the future," "digital hospital" and "smart patient room" initiatives. It is at the core of the RTHS.

Digital twins, when applied through the RTHS, positively impact these organizational areas (each with associated technology examples):

Care delivery

▪ Clinical communication and collaboration

▪ Next-generation nurse call

▪ Alarms and notifications

▪ Crisis/Emergency management

Patient engagement

▪ Experiential wayfinding

▪ Integrated patient room

▪ Interactive patient care

Facilities and operations

▪ Patient throughput and capacity management

▪ Real-time operational dashboards

▪ RTHS supply chain

Management and administration

▪ Real-time costing

▪ Healthcare information exchange

▪ Healthcare interoperability

- Revenue cycle management

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: GE Healthcare; IBM Watson Health; Philips; PTC (ThingWorx); Siemens; ThoughtWire

Recommended Reading:

"Healthcare Provider CIOs: Advance Clinical Operations Performance Through Situational Awareness Technologies"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"What to Expect When You're Expecting Digital Twins"

"Market Guide for Digital Twin Portfolios and Enabling Technologies"

"Survey Analysis: IoT Digital Twin Adoption Proliferates Across Many Sourcing Options"

"Toolkit: Enterprise Readiness for Digital Twin Deployment"

"Use Four Building Blocks for Successful Digital Twin Design"

Process Simulation Modeling in Healthcare

Analysis By: Gregg Pessin

Definition: Process simulation and modeling tools allow users to specify a workflow or process problem, develop models, and run simulations using representative data, operational intelligence and analytics. Simulation results can be used for workflow and process optimization, decision support, and business reengineering efforts.

Position and Adoption Speed Justification: Process simulation modeling involves tools for simulating and modeling the operational requirements of a rapidly changing healthcare delivery environment — for example, the timely and demanding requirements of the real-time health system (RTHS) operational and technology paradigm (see "Industry Vision: The Real-Time Health System Transformation"). Simulation modeling is a dynamic tool that models the behavior of a process over a period of time. It can show how random variation affects intricate, time-based events and resources.

These tools create a digital twin of operational processes that can be used to simulate future operating scenarios for decision making. They can even be used to evaluate physical changes and alterations of patient and staff flow. In the longer term, process simulation and modeling output can be used to reengineer long-standing, problematic clinical workflows and to orchestrate new ones.

This information can then be used to simulate and model critical business processes (e.g., demanding and complex emergency room [ER] and transfer center workflows).

Lean concepts are well understood by healthcare delivery organizations (HDOs), but the use of process simulation modeling to directly address workflow and business process inefficiencies is nascent. The adoption of process simulation and modeling, as a routine part of operations, is new and the adoption is low. That said, the need to improve patient throughput and capacity is a real problem that impacts HDO revenue, staff morale and patient satisfaction. With the increased availability of real-time operational intelligence and ever increasing environment data from IoT, the complex workflows of care delivery and care coordination can be modeled so that they can be refactored and refined to satisfy enterprise key performance indicators. It will also allow the HDO to effectively adapt to rapidly changing business and clinical requirements. This profile is global in scope and positioned to reflect only a slight increase in adoption over the past year.

User Advice: To use process simulation modeling in your organization we recommend you to:

- Use simulation results to model, optimize and reengineer lengthy, complex or problematic clinical workflows and business processes.

- Identify potential sources of operational intelligence data.

- Investigate business process simulation and modeling tools.

- Use optimization results to justify further investment.

- Take advantage of insights and best practices from other industries, such as energy, supply chain and manufacturing.

Business Impact: The supply chain and manufacturing industries have made use of the process simulation and modeling tools for some time now, and there is much to be learned from their experiences. Within the HDO, there is still considerable work to be done to make hospitals more efficient by:

- Responding more quickly and accurately to crisis situations

- Eliminating waste

- Removing latency from workflows

- Accelerating business processes

- Orchestrating new workflows and processes based on real-time operational intelligence

- Maximizing the use of expensive assets and human resources

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: FlexSim Healthcare; Powersim Software; ProcessModel; Rockwell Automation (Arena); SIMUL8

Recommended Reading:

"Industry Vision: The Real-Time Health System Transformation"

"How Process Mining Can Support Operational Resilience in Times of a Crisis"

"Market Guide for Process Mining"

Next-Generation EMPI

Analysis By: Pooja Singh

Definition: Enterprise master patient indexes (EMPIs) maintain cross-referenced identifiers ("golden masters") for consumers (e.g., patients, members) so that a patient/entity known by one application can be cross-referenced to its identifier in another application. Next-generation EMPIs employ "referential matching" along with conventional deterministic and probabilistic matching. Referential matching relies on a nationwide identity proofing database or similar service to extend the core patient attributes used for patient matching and merging activity.

Position and Adoption Speed Justification: Correctly identifying consumers has always been a special challenge in healthcare. Accidentally cross-linking the record of two patients can lead to errors that slow down diagnosis, treatment and billing, and can be potentially life threatening. Such slowdowns increase the cost of healthcare and erode the patient experience. For example, a hospital could fail to provide timely blood thinners to a victim of myocardial infarction because it erroneously thought the patient had been recently treated for hemorrhagic stroke. At the same time, the inability or failure to cross-link records often leads to wasteful, redundant testing.

Failure to cross-link records can complicate legal risk analysis and the documentation necessary to support comorbidities and contraindications for healthcare quality measures. For example, medical record coders may fail to find evidence to support the contention that a "never event," such as a pressure injury, was in fact a pre-existing condition. Failure to properly identify or cross-link patient records can substantially damage the credibility of an institution in the eyes of the patient or a health information exchange (HIE) in the eyes of community providers.

Referential matching relies on a nationwide identity proofing database or similar service. Such services extend the core patient attributes used for patient matching and merging activity to enhance positive patient identification efforts and reduce the number of medical record duplicates found within the electronic health record (EHR).

The current EMPI market is characterized as clinical and stand-alone offerings. Clinical vendors such as Allscripts, Cerner and Epic offer master patient indexes (MPIs) to integrate their own product suites. They occasionally serve as enterprise-level MPIs. Stand-alone EMPIs are almost always deployed to support the entire enterprise and HIEs. The EMPI vendors represented in this profile extend their scope and accuracy with referential matching or a similar service. Referential matching solutions can be used in two ways:

- As a plug-in to existing EMPI solutions cases where a deterministic or probabilistic matching algorithm cannot confidently make a positive or strong match

- As a stand-alone EMPI solution that replaces a conventional EMPI solution

User Advice: Any HDO that does not have a monolithic computing environment (one vendor platform that issues the majority of unique person identifiers) should use the capabilities of an EMPI to ensure that it can accurately aggregate all patient information across all information systems. This capability will be critical as HDOs increasingly participate in information sharing outside of the organization, such as local, regional and state-sponsored HIEs. Select vendor solutions that have demonstrated experience with populations and database sizes comparable to your current and potential future requirements. Key flexibility requirements include the ability to add new searchable patient demographic keys after implementation and to tune search algorithm parameters for different applications.

Business Impact: Gartner client interest in EMPIs is growing worldwide. Interest arises equally from government agencies, government-chartered private organizations and private organizations. Differences in organizational workflow have profound impacts on the cost of implementation and operation, and the quality of the patient matches.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: NextGate; QuadraMed; Verato

Recommended Reading:

"Identity Biometrics and Next-Generation EMPIs Combine to Address Duplicate Medical Records and HIE Challenges"

"National Patient Identifier — Benefits Outweigh Challenges"

Next-Generation Nurse Call

Analysis By: Barry Runyon

Definition: As its name implies, nurse call (aka call light) systems are primarily for patients to communicate with nurses in case of discomfort, pain or emergency. Nurse call is also used for nurses to communicate with one another, and with physicians and care team members. Next-generation nurse call is about using modern mobile point-of-care solutions and bedside multimedia to deliver nurse call capabilities versus conventional nurse call. New nurse call capabilities will surface as a care teams place new demands on conventional nurse call.

Position and Adoption Speed Justification: Nurse call systems can be wired or wireless; can interface with IP phones, pagers, smartphones, communication badges, location services, staffing,

on-call and scheduling systems. Other features include master consoles, pull stations and corridor lights. Nurse call, as it stands today, is not uniquely positioned to meet the needs of evolving care delivery models and patient experience expectations. Real-time healthcare system (RTHS) solutions such as clinical communication and collaboration (CC&C), interactive patient care (IPC), and alarm and notification platforms are converging to assume nurse call responsibilities, as well as augmenting conventional nurse call.

As hospitals evolve to real-time health systems (RTHSs), their workflows will be less and less defined by the specific category of software or platform they implement or limited by an individual vendors' vision or product roadmap. Rather, they will be more defined by rapidly emerging care delivery requirements and consumer expectations.

States in the U.S. require hospitals and long-term care facilities to implement nurse call systems in order to be licensed. In the U.S., nurse call systems are certified against the provisions of UL 1069, the "Standard for Hospital Signaling and Nurse Call Equipment," and hospitals require their nurse call systems to be UL 1069 listed. While the intent of UL 1069 certification is to ensure nurse call system user safety and reliability, it has also served to limit competition and innovation. New mobile communication and collaboration platforms that do not fall under this certification requirement have begun to redefine this space by satisfying nurse call requirements without being labeled nurse call systems. Industry certifications will no longer keep legitimate competition and innovation at bay.

Nurse call capabilities are essential to the success of the RTHS. Conventional nurse call systems are heavily adopted and do not appear on this Hype Cycle per se. This profile was introduced in 2016 and was positioned early in the Hype Cycle as it represented alternative ways of satisfying nurse call requirements. We did not expect this profile to move quickly, given UL 1069 certification requirements and the dominance of conventional nurse call vendors. As it evolved, this profile chronicled the emergence of a new ecosystem of technologies and systems that began to compete with traditional nurse call vendor platforms, and indeed augment them. There is now evidence that traditional nurse call vendors have begun to reinvent themselves as more open, mobile and collaborative systems. We advanced this profile again this year due to the point of care innovations introduced by clinical communication and collaboration (CC&C) and interactive patient care (IPC) vendors that augment, improve upon or replace conventional nurse call capabilities. Recent advances in interoperability technology and open API mandates by ONC auger well for this convergence.

User Advice: Healthcare provider CIOs and nursing leadership should:

- Assess next generation nurse call ability to satisfy patient and care team communication requirements versus delivering conventional nurse call capabilities.

- Delay refreshing your nurse call system until you have a firm grasp on your patient and care team communication requirements and new care delivery models.

- Investigate functional alternatives to nurse call, such as interactive patient care, CC&C, and alarm and notification platforms, or a combination of these RTHS solutions.

- Examine nurse call vendor roadmaps. Look beyond legacy nurse call vendors to determine whether nurse call requirements can be satisfied in other ways.

Business Impact: With the advances in CC&C, interactive patient care, alarm and event notification platforms, location and condition sensing, and medical device connectivity platforms, other less costly and more agile ways will continue to emerge to satisfy nurse call requirements. Nurse call's position within the healthcare provider environment will be increasingly challenged as RTHS technologies evolve to accommodate new care delivery models. Conventional nurse call requirements will be increasingly satisfied by the convergence of RTHS solutions' capabilities.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Amplion; Critical Alert; GetWellNetwork; Hillrom; PerfectServe; Vocera

Recommended Reading:

"All Care Team Collaboration Systems Are Nurse Call Systems"

"Innovation Insight for Care Team Collaboration"

"Market Guide for Clinical Communication and Collaboration"

"Healthcare Provider CIOs: Shift Interoperability Strategy From Moving Data to Orchestrating Workflow"

Real-Time Health System Supply Chain

Analysis By: Barry Runyon

Definition: This profile represents the coming together of the real-time health system (RTHS) and Gartner's patient-driven value network (PDVN) maturity models. The PDVN is a shift from today's siloed product, cost-focused supply chain to an end-to-end orchestration of the supply chain driven by real-time patient information and operational intelligence. This convergence will provide the manufacturer, supplier and clinical operations with the information necessary to drive a more dynamic and responsive supply chain model.

Position and Adoption Speed Justification: Healthcare delivery is marked by a rapidly changing reimbursement landscape and the shift to value-based care models and recently, an increased use of virtual care. As a result, the role of healthcare supply chains must evolve. However, supply chain leaders in integrated delivery networks (IDNs) face challenges in becoming more clinically aligned.

Supply chain organizations have long been seen as primarily a sourcing function. This orientation has limited supply chains' ability to be involved in the product decision-making process where contribution is measured based on innovation and performance, among other patient care measures. There is an opportunity for supply chain managers to strategically partner with clinicians to establish their role in population health management.

Patients are an endless source of interesting data that can yield all manner of insight that can lead to value. End-to-end supply chain orchestration and alignment with patient outcomes will rely on the increased digitalization of healthcare. The real-time health system (RTHS) is a call to action in the healthcare provider space, and healthcare provider supply chain leaders need to identify how its capabilities play a role in supply chain transformation.

At its core, an RTHS brings together the technologies of the different architectural layers and enables the intersection of real-time decision support, applications, sensing infrastructure and enterprise foundational technologies. Three key capabilities emerge: situational awareness, operational intelligence and real-time orchestration. These are precisely the capabilities the PDVN requires to advance its vision and refine its maturity model (see "Assess and Improve an IDN Supply Chain Response Using the Patient-Driven Value Network Maturity Model"). Supply chain leaders who work to align their strategy with the capabilities of an RTHS will accelerate their PDVN journey.

Supply chain has always been a critical, often unheralded, function within a healthcare provider. The focus of RTHS research has been on automating and optimizing clinical, patient management, and care coordination workflows and processes. This technology's positioning on the Hype Cycle will advance steadily as the scope of the RTHS expands and the benefits of RTHS operational intelligence and situational awareness surrounding the patient are applied to the healthcare provider supply chain. This profile has been advanced on this Hype Cycle because of increased interest in the PDVN among client inquiries. This points to the need to more closely manage the healthcare provider supply chain and associated costs, and the inexorable movement of the industry toward value-based care. This need for a closer relationship between clinical operations, population health and the supply chain has been brought to light by COVID-19 pandemic — where critical shortage of personal protective equipment and ventilators were seemingly unanticipated. The PDVN will become more important as HDO leadership increasingly look for opportunities to contain costs.

User Advice:

- CSCOs must collaborate with healthcare provider CIOs to align supply chain's journey with a PDVN and IT's vision for the RTHS. Start with healthcare provider organizational goals to determine how these two transformative journeys can accelerate the attainment of overarching enterprise business goals.

- Identify supply chain goals, data and use cases that are compatible with RTHS concepts and can benefit from the RTHS value proposition. Develop a roadmap that aligns the need for analytics professionals with these new capabilities. Focus on high-impact areas where the value analysis has the greatest impact, such as perioperative and pharmacy.

- Build a case and measure the success of the RTHS-enabled supply chain capabilities across the care continuum. Use Gartner's Clinical Value Analysis Maturity Model (see "Improve Value Analysis Effectiveness to Become a Clinically Aligned Supply Chain") to monitor and measure performance across the patient, financial and operational domains.

Business Impact: A real-time relationship between the healthcare provider supply chain and healthcare provider clinical operations is critical to improving care quality and controlling costs and is beginning to emerge in leading healthcare providers. From a practical perspective, the alignment of the PDVN and RTHS visions will require new IT resources to support supply chain initiatives. End-

to-end supply chain orchestration and alignment with patient outcomes will rely on the increased integration and digitalization of healthcare operational and clinical workflows. The RTHS roadmap outlines specific technologies, integration points and data (such as patient event and transactional data that has clear supply chain implications) that the RTHS supply chain must leverage to advance its capabilities.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Cardinal Health; Infor; Intelligent InSites; McKesson

Recommended Reading:

"Introducing the Patient-Driven Value Network Model for IDN Supply Chain"

"The Patient-Driven Supply Chain of the Future Relies on Alignment With a Real-Time Health System"

"Assess and Improve an IDN Supply Chain Response Using the Patient-Driven Value Network Maturity Model"

"Improve Value Analysis Effectiveness to Become a Clinically Aligned Supply Chain"

Care Team Collaboration

Analysis By: Barry Runyon

Definition: Care team collaboration (CTC) is a healthcare provider IT ecosystem characterized by the convergence of new and existing point-of-care solutions, interoperability middleware, location and condition sensing technologies, and real-time analytics. Enabled by advances in mobility, interoperability and operational intelligence, CTC improves transitions of care, clinical outcomes, care coordination, and, in turn, the patient experience.

Position and Adoption Speed Justification: Care coordination and transitions of care challenges are well-understood in the industry and are the source of workflow friction and consumer and patient frustration. A new care team collaboration (CTC) IT ecosystem has materialized to overcome persistent care coordination challenges, transitions of care and more demanding patient experience expectations. Demanding transitions of care expectations and measures are contributing to the need for an IT ecosystem of situationally aware and interoperable middleware and point-of-care IT solutions that foster care team collaboration within and beyond the inpatient setting, including virtual care.

Point-of-care solutions such as clinical communication and collaboration (CC&C), interactive patient care (IPC), nurse call, and alarms and notifications platforms are converging to form a comprehensive care team collaborative ecosystem. Contact (or call) centers are joining this mix and

will integrate more tightly with these systems to meet new consumer and provider expectations. The next-generation contact center integrates with care team collaboration technologies, consumer/patient engagement systems and CRM.

Location and condition sensing, Internet of Things (IoT) technologies, and other real-time health system solutions will provide the patient context and operational intelligence necessary for this emerging IT collaborative to effectively address persistent care coordination problems. A new vendor landscape has begun to emerge from this IT ecosystem over and the various participants will compete for platform status. In 2018, a notable CC&C vendor, PerfectServe, acquired Telmediq, a competing CC&C platform. The PerfectServe acquisition activity also included CareWire and Lightning Bolt Solutions, to provide patient engagement and on-call scheduling capabilities respectively. In March of 2019, nurse call vendor Hillrom acquired Voalte, another CC&C vendor. In 2019, Critical Alert, a nurse call vendor, completed its acquisition of Sphere3, a mobile rounding and patient experience vendor, with the strategic intent to form an integrated patient communication and experience management platform — essentially a CTC platform.

This profile has been positioned this year to reflect the momentum of M&A activity of the recent past and new opportunities to share data and work at the point of care. We expect CTC platforms to continue to evolve quickly, with time to plateau closer to five than 10 years. These platforms will decrease the healthcare providers' dependence on the very large clinical vendors whose product roadmaps and capacity for innovation do not always aligned with the needs of the healthcare provider or the interests of the consumer and patient. CTC's geographic scope is global, although most CTC activity has occurred in the U.S.

User Advice:

- Adopt care team collaboration as a critical patient care delivery initiative and technology program by promoting it as a broad set of related technologies that must tightly interoperate in order to deliver their full, collective potential.

- Increase enterprisewide situational awareness surrounding the patient and provider by implementing pervasive real-time location and condition-sensing services.

- Improve care coordination and transitions of care by equipping care teams with mobile clinical communication and collaboration tools that interoperate with other core components of the care team collaboration ecosystem.

Business Impact: Care coordination is the purposeful organization of patient care activities among two or more participants (including the patient and the family) to facilitate the delivery of care. Coordinating care involves marshaling care team members and other resources to complete required patient care tasks outlined in a care plan. Care coordination is accomplished by the timely exchange of patient information and other operational intelligence surrounding the patient among care team members.

Healthcare provider CIOs will need to look beyond conventional patient management solutions to the new CTC IT ecosystem to satisfy more demanding consumer and patient experience, expectations, and new industry measures of care coordination and transitions of care. CTC benefits can include improvements in:

- Actionable metrics captured at the point of care

- Care coordination

- Care quality

- Competitive positioning

- Customer satisfaction

- Enterprise key performance indicators

- IoT and smart device integration

- Nurse and care team morale

- Nurse toil levels

- Patient experience

- Patient safety

- Regulatory compliance

- Reimbursement

- Staff utilization

- Transitions of care measures

- Workflow intervention and orchestration

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Amplion; Bernoulli; Critical Alert; GetWellNetwork; Hillrom (NaviCare Nurse Call); PerfectServe; Spok; Vocera

Recommended Reading:

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Innovation Insight for Care Team Collaboration"

"Healthcare Provider CIOs: Overcome COVID-19 Challenges With Real-Time Health System Technology"

IoT Security in Healthcare

Analysis By: Gregg Pessin

Definition: Internet of Things (IoT) security in healthcare addresses software, hardware, network and data protection for HDO's IoTs, including medical devices. IoT security in healthcare enables organizations to securely manage IoT devices, ensure IoT endpoint and data security, and perform asset discovery. IoT security shares many of the same technologies and processes as IT, operational technology (OT) and physical security. IoT security creates trust, as well as provides safe, reliable, private and resilient digital systems for digital care delivery.

Position and Adoption Speed Justification: IoT security in healthcare is solidifying as a market space, showing growth over the last year. The variety and scale of security risks in an IoT-rich healthcare environment is high, with a large and complex threat surface. Most sensor-based things have minimal computing resources, and the opportunities for antivirus, encryption and other forms of protection within things are more restricted. IoT security products specifically designed for healthcare are emerging to help meet these challenges.

Specific progress has been demonstrated in digital trust, tamper-resistant device hardening techniques in hardware and firmware, secure cloud integration, device discovery, event detection and response systems, and improved consulting and system integration.

User Advice: Chief risk officers, chief information security officers (CISOs) and CIOs should consider the following advice.

In the near term:

- Record all IoT assets, such as minor sensors, facilities controls and medical devices, and create visibility into IoT networks and topologies.

- Assess integration points in their networks for IoT implementations and determine design gaps in capability, skills and infrastructure.

- Assess risk and regulatory exposure from IoT-related initiatives and the HDO's security posture.

- Invest in digital risk management to properly plan for IoT security in digital transformation projects.

- Incorporate regulatory compliance requirements for IoT technologies within existing IT, OT and physical security regulation tracking and management.

In the longer term:

- Work on developing in-house IoT security expertise.

- Assign enterprise ownership for IoT technologies that include those claimed by a business or clinical unit — such as clinical or biomedical engineering.

- Change governance and oversight of IT and OT projects to accommodate specific digital risk concerns that lead to IoT security decisions.

- Restructure skill sets and support resources (that is, organizational accountability and responsibility) to accommodate differences in deployment and operation of digital initiatives requiring secure IoT systems.

Business Impact: High-profile cyberattacks can create compromises that impact both the back office of the HDO and the point of care. As HDOs modernize their infrastructure and refresh aging medical devices with new network connected and programmable, smart replacements, the risk of damage from cyberattacks increases. Cyberattacks have driven some HDOs to begin budgeting for these protective technologies. The FDA has addressed medical device risk by issuing premarket and postmarket guidance on cyber-risk prevention to medical device manufacturers. This highlights the overlapping patient safety impacts of IoT in healthcare and thus the need for security.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Armis; Asimily; CyberMDX; CynergisTek; Forescout Technologies; Medigate; Ordr; Palo Alto Networks (Zingbox)

Recommended Reading:

"Healthcare Provider's Unique IoT Challenges Demand a Platform Strategy"

"Evolving IoT Security Risks Demand New Approaches From Healthcare Delivery Organizations"

"Focus Now on Digital Security Opportunities Within Connected Medical Devices"

Next-Generation Contact Center

Analysis By: Barry Runyon

Definition: The primary purpose of the hospital contact/call center is to connect the community with hospital resources. Conventional contact centers use purpose-built software, combined with technologies such as interactive voice response, paging, PBX capabilities and unified communications, to accomplish this. The next-generation contact center enhances and extends these capabilities by integrating with care team collaboration technologies, consumer/patient engagement systems and customer relationship management (CRM).

Position and Adoption Speed Justification: The healthcare provider space is becoming increasingly competitive as hospitals continually look for innovative and meaningful ways to engage with existing patients and consumers. As their first point of contact for most hospital encounters, the contact/call center is more important than ever. Hospital contact/call centers, when utilized to their potential, can streamline communications, enhance the patient experience and reinforce a

positive brand image. Contact center agents are at the hospital's front line, managing the wide array of communications methods used by the community to interact with their caregivers. Next-generation platforms are critical to operational efficiency. They integrate operator consoles, web-based directories, on-call scheduling, speech recognition technology, unified communications, social media outlets and secure messaging. Next-generation contact centers include care management, referral management and CRM capabilities.

New channels to communicate and collaborate about care are vital to coordinate care within today's complex and disjointed care delivery system. Minimally, care coordination requires robust bidirectional communications among care team members. Ideally, it requires sophisticated care team collaboration capabilities and ubiquitous situational awareness. Point-of-care solutions such as clinical communication and collaboration (CC&C), interactive patient care (IPC), nurse call, and alarms and notifications platforms, aided by advances in interoperability, are converging to form a new, more agile care team collaboration (CTC) ecosystem.

Contact/call centers are joining this new IT ecosystem and will integrate more tightly with other CTC technologies and systems to meet new consumer expectations and care delivery workflow requirements. As the contact center begins to participate more directly in the CTC ecosystem, it will drive additional consumer- and patient-centric innovations. While traditional hospital contact centers have been around for decades, this next-generation iteration has gained traction in the industry. Its current positioning is very early in the Hype Cycle and reflects its healthcare legacy and the capabilities required to accommodate new care delivery workflows and expectations.

Both the contact center and nurse call are currently comfortably ensconced in the HDO — but are coming under increasing pressure to reinvent themselves. To do so, they will have to extend their reach with newer mobile technologies and invest in consumer/patient engagement, behavioral analytics and CRM capabilities. Both are part of a newly emerging CTC IT ecosystem, and both are attempting to become the CTC platform, albeit from different vantage points.

Look for market consolidation and acquisitions that continue to affirm this new direction. This profile was moved ahead of last year's position in recognition of interest demonstrated by Gartner client inquiries and the influence CRM vendors such as Salesforce are exerting upon this space and the adoption of CRM by healthcare providers. The next-generation contact/call center will be the multichannel digital front door to the healthcare provider.

User Advice: Healthcare provider CIOs should revisit the contact/call center's role within the enterprise. Adopt CTC as a critical patient care delivery initiative and technology program by promoting it as a broad set of related technologies that must tightly interoperate to deliver the full, collective potential. Add the contact/call center to this mix of technologies. Improve care coordination and transitions of care by equipping care teams with mobile CC&C tools that interoperate with other core components of the CTC ecosystem.

Business Impact: The scope and effectiveness of the venerable contact center are being reinvented and expanded to improve:

▪ Care coordination

▪ CTC

- Critical codes and emergency response times

- Operational efficiency

- Patient and family experience

- Patient retention

- Referral management

- Staff and resource utilization

- Enterprise key performance indicators

The next-generation contact center will provide highly personalized interactions with the healthcare providers' most important constituents. In the wake of COVID-19, this platform can offer a demonstrable ROI and increased service line revenue through focused education and marketing campaigns.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Change Healthcare; Cliniconex; Healthgrades; PerfectServe; Spok

Recommended Reading:

"Industry Vision: The Real-Time Health System Transformation"

"The Stages of Maturity in the Journey to the Real-Time Health System"

"Innovation Insight for Care Team Collaboration"

"Healthcare Consumer, Member and Patient Engagement Primer for 2019"

API Management in Healthcare

Analysis By: Gregg Pessin

Definition: Application programming interface (API) management are IT tools and platforms for the creation, provisioning, monitoring, and maintenance of application interfaces. Comprehensive API management includes the entire API life cycle — planning, design, implementation testing, publication, operation, consumption, maintenance, versioning, and retirement. The increased adoption of HL7 Fast Healthcare Interoperability Resources (FHIR) has made API management an increasingly important IT capability and an indicator of real-time health system maturity.

Position and Adoption Speed Justification: APIs are the enabling technology that makes e-commerce and digital business work. APIs are on the leading edge of healthcare's digital

transformation and critical to the industry's recently finalized interoperability rules. Mobile apps, modern web architectures, digital strategies, Internet of Things (IoT), and web APIs provided by cloud service providers have made APIs an essential interoperability component of any modern digital transformation strategy and architecture. Successful APIs will have many active consumers and must be secured, monitored, maintained and managed throughout their life cycle — API management's raison d'etre

While APIs and service-oriented principles have been around for some time, they continue to gain acceptance and traction in the vendor-dominated healthcare provider space. Healthcare organizations will require more timely responses to their business and digital transformation requirements than the healthcare software vendor community can accommodate through their release cycles and product roadmaps.

Healthcare organizations have begun to expect proprietary and open APIs from their vendor community that can be safely consumed and orchestrated to support new data requirements, workflows, and business capabilities. They are looking to exchange data and share work and to move beyond conventional messaging interfaces and siloed workflows.

While the current adoption level of API management has only increased slightly from last year, we expect an accelerated uptick in demand as the pace of healthcare provider business and clinical information sharing requirements increases, along with strategic digital transformation initiatives among all jurisdictions. In the U.S., API management is being driven by new patient access and interoperability requirements codified by recently finalized ONC and CMS interoperability rules, which require the use of open APIs for healthcare data access and exchange.

User Advice: HDO CIOs looking to take full advantage of interoperability capabilities should:

- Implement an API management program to streamline the delivery of new business capabilities, extend existing applications and systems such as the EHR, and enable mobile and other multichannel clients.

- Leverage API management technologies to help your build, consume, operate, secure, and manage self-developed APIs and FHIR resources. Use API management platforms to centralize authentication and authorization for your APIs.

- Source your API management capabilities from purpose-built API management and clinical data interchange platforms, and your existing interfacing/integration platform.

- Use APIs when conventional industry interoperability messaging standards fall short of your health information and workflow needs.

Business Impact: Proprietary and open APIs extend the reach, capabilities, and usefulness of expensive and intractable healthcare provider clinical and business systems beyond their individual product roadmaps. APIs provide the timeliness, standardization and agility required for healthcare systems to evolve into real-time health systems and the industry to digitally transform.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Apigee; Axway; CA Technologies; Datica; IBM; Red Hat; Salesforce (MuleSoft); TIBCO Software

Recommended Reading:

"Magic Quadrant for Full Life Cycle API Management"

"How a Service Mesh Fits Into Your API Mediation Strategy"

"Maturity Model for the Real-Time Health System"

"Healthcare Provider CIOs: Shift Interoperability Strategy From Moving Data to Orchestrating Workflow"

"6 Critical Technologies to Advance Healthcare Ecosystem Orchestration Ability"

Smart Care Venues

Analysis By: Gregg Pessin

Definition: Smart care venues improve patient safety, clinical outcomes, operational efficiency, and the patient and family experience by increasing situational awareness through the use of IoT and care team collaborative technologies. Example technologies include real-time location systems, smart beds, IoT in healthcare, environmental controls, clinical communication and collaboration, and interactive patient care. Smart care venues can be as specific as an integrated patient room or can encompass an integrated hospital campus.

Position and Adoption Speed Justification: The integrated patient room is an example of a smart care venue and is a vital component of the real-time health system (see "Maturity Model for the Real-Time Health System"). It is a real-time, holistic, patient-centered environment that advances care delivery using sensor technology and instrumentation, workflow automation and optimization, and enhanced patient engagement. This type of smart care venue technologies includes:

- Alarms and notification platforms

- Biometric identification

- Building and environmental control automation

- Closed-loop medication management

- Digital signage

- Fall prevention and detection

- Interactive patient care platforms

- IoT in healthcare

- Medical device connectivity systems

- Clinical communications and collaboration

- Next-generation nurse call

- Patient video monitoring

- Positive patient identification

- Real-time location in healthcare

- Remote patient monitoring

- Smart beds

Adoption is generally limited to high-visibility innovation centers, pilots and new construction. Progress will be tied closely to new facilities' planning and construction, targeted quality improvement and patient experience initiatives, and is therefore positioned at the Peak of Inflated Expectations. Smart care venues will become a market differentiator as consumers demand a much-improved hospital stay experience for their money. Smart care venues are emerging in developed nations around the world.

User Advice: Every hospital building and renovation project is an opportunity for the HDO CIO to advance an enterprise vision. A digital care delivery vision, guided by planning and design principles, will enable healthcare provider CIOs and facility planners to transform care delivery for the patient, family caregiver and clinician. It will impact patient experience and extend the useful lives of healthcare facilities and care venues.

Challenges surrounding smart care venue initiatives include:

- Creating a patient room vision and gaining stakeholder alignment

- Integrating various building systems, such as heating, ventilation and air conditioning (HVAC); security systems; and location- and condition-sensing technologies in a way that personalizes and enhances the patient experience and provides patient safety

- Safely integrating voice, data and sensor technologies over a single IP network.

- Consistently carrying the vision through the planning and construction process and realizing it in day-to-day operations

- Achieving a deep level of integration with administrative, business and clinical systems inside and outside the room

Gartner's real-time health system (RTHS) research includes a maturity model that describes the stages as the HDO evolves into a digitally enabled next-generation healthcare provider facility. As the overriding RTHS principle, take every opportunity to move from retrospective to real time by amplifying situational awareness surrounding the patient and clinician with IoT technologies.

Smart care venues emerge as the RTHS evolves to a healthcare delivery smart machine. Armed with the appropriate RTHS technologies, it acquires and analyzes up-to-the-minute operational

intelligence derived from patient event and care activity to optimize and orchestrate its most critical clinical, business and administrative workflows.

Business Impact: Smart care venues are not limited to the inpatient room. Patient self-scheduling, patient kiosks, experiential wayfinding, indoor GPS, parking assistance and digital signage should have already made it convenient for patients to schedule an appointment, admit themselves and navigate the facility without experiencing unnecessary waiting times. Moreover, their care team should have been alerted of their arrival and their movements monitored throughout the facility. Their medical record and treatment schedule should be readily available at every point of care. While these things improve the operational efficiency of the facility and more coordinated clinical workflows, the prime directive of smart care venues is to reduce the stress of care and treatment by making the facility quieter and less intimidating through enhanced situational awareness and personalization. When patients are admitted to an HDO equipped with real-time-healthcare system technologies, the care venue should adjust to their individual preferences (e.g., temperature, lighting, music and entertainment).

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amplion; AMETEK (Rauland); Capsule (Bernoulli); Cerner; GE Healthcare Systems; Hillrom; Oneview; Vocera

Recommended Reading:

"The Hospital Will Become a Smart Machine"

"Maturity Model for the Real-Time Health System"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Improve Clinical Operations and Outcomes With Smart Care Venues"

"Healthcare Provider CIOs: Advance Clinical Operations Performance Through Situational Awareness Technologies"

"Progress in Healthcare Analytics Lies in Leveraging Data"

IoT in Healthcare

Analysis By: Gregg Pessin

Definition: The IoT in healthcare is a collection of devices, applications, equipment, appliances and buildings that possess the intelligence and technology to connect, communicate and interoperate with each other using standards within the healthcare provider IT ecosystem of smart things. IoT in healthcare is foundational to the real-time health system.

Position and Adoption Speed Justification: The concept of IoT technologies specifically for use by healthcare has been growing moderately in hype and is positioned just past the peak this year. The hype is beginning to take a new shape as more data collection devices within the healthcare environment evolve into IoT edge devices and begin to interoperate using industry standards. This improvement supports semantic/healthcare interoperability and reduces integration complexity and cost. This evolution is expected to continue, plateauing in the next five to 10 years globally.

These common data collection and analytics platforms will combine with edge processing into IoT platforms, which will include clinical event buses with event listeners/responders. We envision clinical devices and data collection systems will publish data associated with events occurring in the care venue, detected by IoTs, to the service bus. Various response systems will subscribe to the service bus for specific event types and subsequently process them according to their purpose, such as delivering clinical alert notifications to the appropriate caregiver.

Today, the individual categories of IoT devices for healthcare continue to advance, each moving at their own pace — for example real-time location systems are advancing faster than lighting control. Tracked edge device categories include facility devices (security, building management and environmental control), patient monitoring (medical devices, clinical monitors, smart patient rooms and virtual care devices) and real-time location services (asset tracking, patient tracking, employee tracking and visitor tracking). The COVID-19 pandemic is increasing interest in IoT in healthcare but as of yet has not increased actual adoption enough to impact placement on the Hype Cycle.

User Advice: IoT in healthcare impacts a variety of clinical and business processes and, as such, will affect a range of stakeholders. Use the following points to guide your actions:

- Start small, experiment and look to other industries and ecosystem partners for ideas.

- Build business cases with ROI extending across core business processes.

- Engage your customers in the solution development. Use prototypes to help explore opportunities.

- Ensure the architecture teams are ready to incorporate IoT across IT and OT technology stacks. Increase your capabilities to leverage big data cost-effectively.

- Plan to invest in skills and technology to support healthcare specific IoT platform and IoT software integration, data and analytics, as well as managed security solutions.

- Select your technology and service providers based on their technology stack and their ecosystem of partners.

- Ensure there is end-to-end compliance of your IoT solution with health information protection legislation.

Business Impact: IoT in healthcare is foundational to digital business and, as such, will transform care delivery as it evolves and matures. Its projects will positively impact the healthcare providers' ability to deliver care more efficiently and cost-effectively. Connected things will drive revenue and improve operational efficiency and asset utilization. Other benefits include:

- Improved operations: Better productivity and increased efficiency, logistics and coordination

- Optimized assets: Asset utilization, health monitoring, reliability, predictive maintenance and asset performance management

- Enhanced services: Remote monitoring — telehealth/virtual care/proactive maintenance

- Increased engagement: Improved experiences of patients, care providers and others

- Improved well-being: Wellness, longevity and care delivery for a better quality of life

- Enhanced security: Protection of physical assets as well as safety of patients to reduce risk

- Better use of resources: Energy efficiency and long-term waste reduction

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: ALTEN Calsoft Labs; Connexall; IBM; Kaa; Philips; Siemens; ThoughtWire; Vivify Health

Recommended Reading:

"Strategic Roadmap to the Real-Time Health System"

"Healthcare Provider's Unique IoT Challenges Demand a Platform Strategy"

"Survey Analysis: Healthcare Provider IoT Adoption Is Becoming Mainstream"

"Evolving IoT Security Risks Demand New Approaches From Healthcare Delivery Organizations"

Sliding Into the Trough

Experiential Wayfinding

Analysis By: Gregg Pessin

Definition: In its most basic form, wayfinding applications indicate where a person is currently located, provides a way to identify a destination, and offers directions on how to get there. Experiential wayfinding augments the value, scope, and convenience of conventional wayfinding with real-time location and situational awareness data and contextual insight to guide consumers and patients through their entire healthcare journey.

Position and Adoption Speed Justification: Getting to and from, and navigating the hospital or medical center campus, should be as easy and convenient as finding your way around a shopping mall. In an "experience" economy, implementing a wayfinding solution is fundamental to creating memorable and positive consumer and patient experiences. These experiences influence patient satisfaction and perceptions of the healthcare provider and create a more efficient and productive

work environment for caregivers. In retail, experiential wayfinding has become a critical part of digital engagement and operational strategy (e.g., using wayfinding data to create and optimize spaces). For healthcare providers, experiential wayfinding is critical to attracting, engaging and retaining patients by making their health journey easier. Experiential wayfinding can be used to understand and optimize patient flow, queue management and care delivery processes. Experiential wayfinding can also support referral management processes through improvements to patient navigation and retention. Eventually, we expect experiential wayfinding will become as pervasive within healthcare as it is in the retail industry by engaging patients in a way that enhances their healthcare journey, experience and health outcome.

Much of today's wayfinding is based on information desks, static digital signage, customer ambassadors, and passive self-service kiosks. Wayfinding technologies primarily focus on making mapping and guidance technologies available to the public and patients on their smartphones. Experiential wayfinding is much more.

Experiential wayfinding creates a personal, engaging and interactive digital experience using real-time contextual technologies and systems such as:

- API management platforms — for device and system interoperability

- Bluetooth low-energy technology — for locating and engaging the patient or other individual

- Indoor location services and space mapping — for navigating the facility and simplifying the space

- Integrated digital signage — for navigating the facility, for example, using patient scheduling data

- Integrated self-service kiosks — for providing patient-specific assistance within the provider facility

- IoT platforms — for collecting and correlating wayfinding telemetry

- Real-time location systems — for tracking the patient's progress throughout the provider facility

- Mapping services— for guiding patients from their homes to the provider

- Mobile messaging — for engaging the patient based on specific context

- Parking management systems — for helping patients locate parking nearest to the care venue

- Waypoint tagging — for marking and storing a specific location or set of locations to assist with finding them again (e.g., tagging the location of your parked car to make it easier to find later from any location in the campus)

Based on inquiry calls, experiential wayfinding adoption is increasing, often driven by healthcare facility renovation or new construction. Top tier HDOs globally use experiential wayfinding primarily as a means to create a consumer-centric patient experience. For healthcare provider visionaries, experiential wayfinding is seen as an integral component of a consumer and patient engagement strategy, and as an onramp to the RTHS (see "Strategic Roadmap to the Real-Time Health System").

User Advice: Wayfinding of any generational level should no longer be considered "nice to have." Leading HDOs will use experiential wayfinding as an essential tool for delivering a superior end-to-end patient experience and operational optimization. HDOs should examine ways to use experiential wayfinding technologies to sense, collect, correlate, analyze and act upon event information to guide patients from their homes to the provider facility and throughout the entire continuum of care. Use wayfinding to make it easy, convenient and less stressful for patients and consumers to access care and common provider destinations, particularly in complex and far-flung campus facilities. This technology should be one way providers bring consumers to their digital front door. Healthcare provider CIOs should monitor and measure the impact wayfinding technologies have on delivering a positive and memorable consumer and patient experience.

Business Impact: Wayfinding has evolved to encompass an ecosystem of technologies that combine in a way that assists a patient to conveniently locate and navigate the healthcare provider facility and space. Experiential wayfinding helps patients navigate an episode of care or navigate their health journey. Wayfinding of all forms is becoming a requirement as the complexity of care delivery continues in increase.

At a minimum, HDOs should focus on using wayfinding for:

- Reducing patient stress and anxiety

- Reducing patient wait times

- Reducing staff time spent providing directions to patients

- Streamlining access to common destinations (cafeteria, gift shop and pharmacy)

- Optimizing patient and clinical workflows

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: 22MILES; Connexient; Etelu; Gozio Health; Jibestream; LogicJunction; Polestar; Spreo; Wifarer

Recommended Reading:

"Healthcare Provider CIOs: Advance Clinical Operations Performance Through Situational Awareness Technologies"

"Strategic Roadmap to the Real-Time Health System"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Market Guide for Indoor Location Application Platforms"

Patient Self-Scheduling

Analysis By: Mark Gilbert

Definition: Patient self-scheduling applications allow patients to conveniently identify and locate an appropriate provider, specify a preferred appointment date and time, book an appointment in real time, receive immediate confirmation, and conveniently cancel or reschedule a confirmed appointment in real time. This profile includes patient self-scheduling systems integrated with an EHR and stand-alone solutions.

Position and Adoption Speed Justification: Patient self-scheduling systems leverage intelligent rules and predictive, real-time analytics of open physician schedules to enable patient self-scheduling based on questions and information gathered to offer appropriate appointments. Programmed rules provide greater control to ensure the right physician and optimal locations are identified and appropriate duration for the appointment is scheduled. Rules include physician business rules (e.g., opening times for first appointments), anticipated appointment durations due to type or acuity of symptoms, and prioritization to fill canceled appointment slots and reduce cancellations.

Patient self-scheduling is quickly becoming a consumer expectation and an integral part of digital catchment and consumer engagement strategies. Accordingly, provider CIOs should consider immediate action. Patient benefits include a new level of convenience and flexibility, reduced work absenteeism, and more-immediate access to provider services for routine and less complex visits. Provider benefits include higher facility and staff utilization, fewer no-shows, improved patient experience and retention, enhanced operational efficiency, and growth within the unaffiliated insured market segment. Physician benefits include greater control over their scheduling preferences and greater control over their time.

Over time, patient self-scheduling systems will evolve to include:

- Eligibility checking with payers

- Assessing financing liability and offering financial options

- Insurance, HSA and credit card payments

- Medical shopping based on quality, cost and geographic location

- Real-time, out-of-pocket or co-pay estimates

- Simplified billing and bundled pricing

Patient self-scheduling makes another big jump in the Hype Cycle this year. This reflects the fact that nearly all EHR vendors have introduced a basic patient self-scheduling capability within their portal software. We also see strong interest in patient self-scheduling from our global clients who are using stand-alone patient self-scheduling solutions. The increasing use of online scheduling for telehealth sessions will also help fuel adoption and accelerate the time to maturity.

The barriers to adoption tend to be cultural. Physicians have the perception that patient self-scheduling will reduce their control over their calendar. They have concerns that the algorithms used

to schedule patients will not be capable of matching the skill of staff who have a highly nuanced understanding of the physician's preferences. Collectively, these factors have helped propel this innovation profile past the Peak of Inflated Expectations to begin a slide into the Trough of Disillusionment. The highest risks for disillusionment rest in selecting a lightweight solution that isn't capable of meeting the complex needs of physicians and the complex coordinated care needs of high utilization patients.

User Advice: Currently, many consider patient self-scheduling to be a market differentiator. In the near term, it will be a commonplace consumer expectation. Healthcare provider CIOs should act now to prepare for the introduction of patient self-scheduling over the next two years:

- Refine your understanding of patient self-scheduling requirements and challenges. Mitigate project risk by piloting in a low-patient-volume care venue. Use pilot outcomes to determine how, when and where to expand the program.

- Monitor and measure patient self-scheduling's impact on customer satisfaction and other important KPIs, and use the results to decide whether to expand the program or not.

- Increase the likelihood of your success by assessing the IT, cultural and organizational readiness for patient self-scheduling.

- Garner support for patient self-scheduling using Gartner's healthcare moment (see "Healthcare Moment: Attract and Retain Patients With Patient Self-Scheduling") as the basis for a compelling business case.

Business Impact: Patients who self-schedule have a higher compliance with attending their appointments, and they arrive better prepared. Any last-minute cancellations are usually filled from a waiting list of patients immediately notified when a cancellation happens.

From a patient perspective, patient self-scheduling is becoming a fundamental service expected from a healthcare provider based on its common use by consumers within the restaurant, hotel and airline industries. Providers that do not offer patient self-scheduling risk losing their patients to other providers that do.

Real-time patient self-scheduling requires a sophisticated level of system integration and interoperability that is now in place using FHIR interoperability standards. True patient self-scheduling is synchronous, convenient and seamlessly real-time integrated with provider-patient management, workforce management and care delivery systems. Patient self-scheduling also creates concerns from clinicians about potential loss of control over their schedule and calendar. New rules must be established under which patients can rebook or cancel appointments to ensure efficient provider staff and resource utilization.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: DocASAP; Healthgrades; Kyruus; Mend; MyHealthDirect; Odoro; Radix Health; Relatient; Solutionreach; Zocdoc

Recommended Reading:

"Healthcare CIOs Will Enable Three Generations of Consumer Engagement"

"Survey Analysis: Consumer Insights Illustrate the Strengths and Weaknesses in Digital Engagement Within Healthcare"

"Healthcare Provider CIOs: Shift Interoperability Strategy From Moving Data to Orchestrating Workflow"

"Healthcare Moment: Attract and Retain Patients With Patient Self-Scheduling"

Real-Time Health System Command Center

Analysis By: Laura Craft; Gregg Pessin

Definition: A real-time health system (RTHS) command center is an enterprise-level composition of clinical, operational and administrative dashboards powered by real-time patient event data, advanced analytics, and predictive models. As the center of the RTHS platform model, the command center uses real-time operational intelligence to anticipate, optimize and orchestrate healthcare provider enterprise and network resources, workflows, and capacity in response to changing internal and external conditions.

Position and Adoption Speed Justification: The rise of RTHS command centers is an important and leading indicator that the era of the RTHS is well underway. It represents HDO executives' need for reliable, real-time operational intelligence to support more precise, predictive and proactive decision making.

While progressive health systems have been using departmental and domain-specific operational dashboards for years, this profile characterizes the increased need for and use of enterprisewide command centers for systemwide use cases, like pandemic response. The RTHS command center represents a holistic view of the healthcare provider to optimize decision making and resources utilization across the clinically integrated enterprise. It is derived from organizational, operational and clinical performance and situationally aware data fed by sources situated at critical points within the provider ecosystem.

Considerable command center development is underway — both self-developed by healthcare providers and enabled by vendor product offerings. Dashboard data used in RTHS command centers is commonly derived from sources and systems such as:

- Asset management

- Daily census

- Patient flow

- Staff scheduling

- Transfer center

- Bed management

- Clinical condition surveillance

- Emergency department

- Patient throughput and capacity management

- Virtual care

Increased adoption and emerging success stories place the command center beyond the Peak of Inflated Expectations, but we nudge it forward only slightly this year as we cautiously watch for more examples of full enterprise adoption. It's descent into the Trough of Disillusionment will be characterized by HDOs failure to turn initial successes into robust, sustainable results.

Much of the current movement toward command centers starts on the clinical side of operations. However, fully deployed command centers will represent real-time operations across the entire healthcare delivery organization and include administrative operations, revenue cycle management and facilities operations, among others. The impact of COVID-19 is likely to increase interest and broader enterprise application of command centers for disaster preparedness and responses.

User Advice: To reap the benefits of advancing dashboard capabilities, hospital provider leadership should:

- Assemble operational and clinical SMEs to form a command center steering committee. CIOs, and chief nursing informatics officers (CNIOs) in particular, should help raise awareness and evaluate opportunities across the provider's facilities.

- Scope and plan for multiple command center use cases. Use COVID-19 as an opportunity to illustrate how a peer organization's command center is or yours could be beneficial to your organization's response.

- Select a IT/informatics innovation team to become more familiar with detailed hospital operations, especially critical paths and potential flashpoints.

- Select pilot opportunities to deploy process engineering capabilities, such as Lean Six Sigma, across medical/nursing and supporting resource teams, to enable and orchestrate the successful use of a real-time command center.

- Leverage evolving capabilities and experience from areas that contribute to an advanced command center concept, such as network operations centers, cybersecurity monitoring centers, and application performance or end-user experience monitoring. Use technical and operational expertise to provide valuable insights in creating an RTHS command center.

Business Impact: Integrated real-time operations and medical/clinical dashboards — grouped into a RTHS command center and applied to high-impact use cases is the ultimate manifestation of the

RTHS paradigm. The pervasive use of predictive dashboards, adjusting operations and responding to clinical demand and risk in real time is transformational for hospital management, patient satisfaction and outcomes. The quest for better hospital demand, capacity and patient throughput management, as well as the drive for operational processes efficiency and cost control, is palpable in many countries. This is especially true where hospital capacity is strained and where funding models like accountable care organizations and bundled payments boost the pressure to eliminate unjustified variance in processes, quality and cost. The COVID-19 crisis has highlighted how important it is for HDOs to sense and understand the current operational and clinical environment in real time in order to effectively respond to changing conditions. RTHS Command Centers are the eyes and ears of the organization enabling organizational agility.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Care Logistics; Cerner; Dimensional Insight; Epic; Exepron; GE Healthcare; IBM; Intelligent InSites; SAP; TeleTracking

Recommended Reading:

"Industry Vision: The Real-Time Health System Transformation"

"The Stages of Maturity in the Journey to the Real-Time Health System"

"How to Move Analytics to Real Time"

"Healthcare Provider CIOs: Shift Interoperability Strategy From Moving Data to Orchestrating Workflow"

"Put Patient Throughput and Capacity Management at the Center of Your Performance Improvement Plan"

Real-Time Healthcare Costing

Analysis By: Sachin Dev

Definition: Real-time healthcare costing (RTHC) provides concurrent and predictive visibility into patient-level direct variable costs for clinical or operational decisions. It collects administrative and clinical data, employs algorithms, calculates costs and provides alerts or reports for real-time cost visibility and adaptive decision making around patient care and resources like labor and supplies. Solutions may use machine learning and AI-based analytics and predictive modeling.

Position and Adoption Speed Justification: Clinicians and business leaders must optimize affordable, quality care outcomes and revenue objectives operating within primarily volume, and increasingly value-based, payment models. RTHC provides point of care data to clinicians and administrative staff, making it an important tool that clinicians and business leaders must optimize

for affordable, quality care outcomes and revenue objectives operating within primarily volume, and increasingly value-based, payment models. RTHC provides point of care data to clinicians and administrative staff, making it an important tool to inform timely management and clinical decision making to support cost management objectives. RTHC itself is not a cost accounting system, but a component of an integrated cost decision support (ICDS) solution with real-time insight at point of care.

We see early and growing hospital adoption and ongoing market interest. Early adopters are implementing and piloting solutions that allow them to access data such as:

- Daily, wholesale medication costs

- Cost accounting data (or medicare allowable charges) on lab and radiology tests

- Real-time labor and supply costs, along with productivity utilization and quality information

In 2020, we move RTHC further along on the Hype Cycle as early adopters begin to attribute tangible benefits from RTHC. Although with very few cost accounting and decision support, vendors offer real-time costing capabilities and adoption barriers such as clear demonstrated ROI and provider usability. RTHC is moved from Peak of Inflated Expectations to Trough of Disillusionment. RTHC will continue to inch forward in 2020, driven by the HDOs response for compelling need to control costs due to the COVID-19 pandemic and HDOs' initiatives such as value-based care, price transparency and cost optimization.

User Advice: CIOs should expect their CFO and chief medical officers (CMOs) to express growing interest in real-time costing. We recommend CIOs become proactive in assessing the progress of these tools. It's a good opportunity to engage the CFO to demonstrate the role of IT in helping control operating costs and in enabling value-based care. CIOs should also illuminate the importance of the real-time health system paradigm of visualization, situational awareness and contextualized decision making in order to make management decisions that improve outcomes.

RTHC tools are only valuable to the degree that both business and clinical personnel use them to improve management decisions. To get there:

- Healthcare CIOs must become savvy in all aspects of costing and in advancing costing capabilities, including real-time technologies. They must also model the requirements of real-time cost information into their enterprise architectures.

- CMIOs and CNIOs should team with business peers to champion real-time cost (and quality) information as these solutions mature. Many business leaders need further education on financial, budget and total cost-of-care systems and how to use these systems to improve quality in a real-time management context.

Business Impact: RTHC should augment best practice medical decisions with insight that lowers the cost of care, meeting value-based care payment model, CFO and consumer objectives. Clinicians must demonstrate the ability to drive improved outcomes and lower costs at the point of care. Vendor solutions entering the market are starting to demonstrate the actual value of direct costing on healthcare processes and variance. As functionality and adoption advances, outcomes

should include moderately improved budget conformance and lower total operating cost for complex hospital environments. RTHC has moderate potential impact including savings from visibility into decision management systems including workforce scheduling/management, patient throughput and capacity management, and location and condition-sensing technology platforms. Through 2021, benefits will be primarily achieved in the U.S. as technologies rely greatly on cost accounting maturity and availability of real-time data to fuel increasingly integrated RTHS management performance.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Allscripts (EPSi); IllumiCare; Infor

Recommended Reading:

"HDO CIOs Must Adopt Integrated Cost Decision Support to Meet CFOs' Changing Needs"

"Healthcare Provider CIOs' COVID-19 Cost Optimization Action Plan"

"Healthcare CIOs: Build Next-Level RCM Performance With a Proactive Denials Management and Avoidance Strategy"

Crisis/Emergency Management Platforms

Analysis By: Barry Runyon

Definition: Crisis/Emergency management platforms (C/EMP) orchestrate and manage tasks, resources, communications, collaboration and information during a crisis. The goal of C/EMP is to contain and minimize the impact of a crisis or incident on individuals, localities, businesses and public agencies, in this case the healthcare delivery organization (HDO). A crisis or emergency includes information security breaches, weather events, natural disasters, deliberate man-made events, accidents and infrastructure failures.

Position and Adoption Speed Justification: C/EMP functionality includes traceable multimodal crisis communications, both within and beyond the hospital setting, virtual command and control center; vulnerability assessment; training planning; resource tracking; workforce scheduling; social media analysis; data visualization; multichannel/app viewing; and government agency compliance reporting.

If a crisis or incident is not handled properly, damage can be done to an organization's reputation; operations and revenue, and public safety compromised. C/EMP are used to:

- Assists organizations in enforcing a standardized best-practice model for crisis and emergency response across the enterprise.

- Coordinates response, recovery and restoration actions through task and workforce management and reduces staff training time and ensures better integration with internal and external communities.

- Increases the efficiency of crisis/incident command and control through continual progress assessment and postincident review and regulatory reporting.

- Leverages relationships and alliances with internal and external stakeholders, especially between critical infrastructure service providers and government agencies during regional and nationwide disasters.

- Accounts for expenses incurred during a crisis to better ensure repayment from business interruption insurance and government programs.

The goal of C/EMP in healthcare settings is to rapidly mobilize appropriate staff and resources to respond to unplanned critical events and ensure continuity of operations and patient care for the duration. HDOs are an essential part of the community response to a crisis, providing care to the influx of sick, displaced and injured, resulting from a crisis or incident. HDOs, like any other business, must also contain and minimize the impact of a crisis that may impair their ability to deliver care continually.

We fully expect C/EMP vendors to continue to pivot their capabilities toward internal healthcare provider incidents (e.g., coordinating emergency department responses, EMS communications, manage patient flow and capacity issues) — that result from external incidents (e.g., severe weather, hazardous material spill, disease outbreak, emergency department diversion). We believe that C/EMP will go beyond the coordination activities associated with classic emergency scenarios to address the operational challenges within the hospital that impact the effective delivery of care. Already, some vendors in this space, such as LiveProcess and Everbridge, offer clinical communications and collaboration (CC&C) capabilities (e.g., secure messaging, workflow orchestration) and interoperability with vendors in this space.

To date C/EMP uptake by healthcare providers has been slow due to a limited understanding of the C/EMP value proposition and a narrow definition of the space set forth by the vendors themselves. This profile's position on the Hype Cycle reflects the healthcare provider's current level of interest and adoption, and the uptick in interest that has occurred due to the COVID-19 pandemic. C/EMP is purpose built for such a crisis. C/EM platforms have proven useful to healthcare providers in responding to the COVID-19 pandemic by facilitating real-time communication and collaboration between operations, care teams and community resources. While most C/EMP adoption is concentrated in North America, the requirement is global in nature.

User Advice: Healthcare provider CIOs investigating or considering adopting a C/EMP should:

- Match the C/EMP selection to your most critical use cases — regulatory-prescribed processes (e.g., ONC and CMS rules) that must be performed to ensure the safety of the citizen, customer, patient and workforce.

- Select a platform that adheres to public-sector crisis/incident protocols relevant to the geographic regions in which the solution is deployed (e.g., National Incident Management System [NIMS]/Incident Command System [ICS]).

- Adopt a C/EMP solution that is interoperable with regional public service protocols to ensure timely and efficient responses that minimize damage and shorten recovery time.

- Favor C/EMP solutions that will work with you to expedite the purchase and deployment of their platform during a time of crisis.

Business Impact: C/EMP help organizations enforce a standardized best-practice model for crisis/emergency response across the enterprise. C/EMP reduce staff training time and ensures better integration with internal and external communities involved in recovering from a disaster. In the case of the healthcare provider, C/EMP contribute to a more expansive view of CC&C — providing ready access to the information and personnel inside and outside the enterprise. C/EMP will increasingly participate in the emerging care team collaboration (CTC) ecosystem.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Everbridge; IBM Knowledge Center; Juvare; LiveProcess; Veoci

Recommended Reading:

"Market Guide for Crisis/Emergency Management Platforms"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Healthcare Industry Hot Topic: Use Crisis/Emergency Management to Manage COVID-19 Challenges"

Patient Privacy Monitoring

Analysis By: Gregg Pessin

Definition: Patient privacy monitoring (PPM) is software and services for the detection, analysis and management of fraud or misuse across information system users and accounts. PPM is used to monitor and analyze user activity and behavior at the user and application level, as opposed to the system, database or network level. It monitors what transpires inside and across accounts using any channel available to a user. PPM is the healthcare industry's implementation of a user and entity behavior analytics (UEBA) solution.

Position and Adoption Speed Justification: PPM is most commonly used in vertical industries that manage money and benefits, such as banking, brokerages, insurance, retail, and government. Through the innovative use of artificial intelligence (AI) and behavioral analytics at scale, PPM streamlines the forensic, reporting and compliance responses necessary to aggressively address

this problem. Gartner continues to see monitoring for unauthorized data access and movement, suspect privileged user activities, and malicious or unauthorized employee activities as viable UEBA use cases.

Healthcare provider and payer organizations are beginning to use PPM more regularly to detect internal fraud and unauthorized data access. PPM combines application log monitoring with behavioral analysis, statistical modeling and machine learning. It is also considered a subset of a security incident and event management and includes privacy breach detection and prevention.

Healthcare is an industry where insiders along with miscellaneous errors (see Verizon's "2020 Data Breach Investigations Report") cause more data breach damage than external bad actors. Insiders, employees and other intended users of digital care delivery systems, most notably the electronic health record, pose a unique cybersecurity risk to the healthcare provider and the patient.

PPM is still nascent within the healthcare provider space, slightly moving forward in the Hype Cycle this year. However, it will see increased adoption over the next several years as healthcare providers concentrate on strategies, policies and technical controls to mitigate risk in response to increased data breach activity and more-rigorous compliance scrutiny and enforcement.

In light of the COVID-19 pandemic, the evolution of the healthcare provider to a real-time healthcare system (RTHS) is accelerating (see "Maturity Model for the Real-Time Health System"). A functional RTHS must support a host of applications, systems, platforms and devices. To be effective, the RTHS requires a significant amount of patient information to be readily available. This requirement exacerbates the fraud and misuse problem, underscoring the need for PPM. This profile represents a U.S. perspective at this point — although some of the representative vendors are pursuing deals outside of the U.S.

User Advice: Healthcare providers must monitor and detect unauthorized access and disclosure of protected health information (PHI) more proactively to prevent and reduce healthcare fraud and misuse. The U.S. Department of Health and Human Services (HHS) has increased pressure on healthcare providers through more aggressive Health Insurance Portability and Accountability Act (HIPAA) and Health Information Technology for Economic and Clinical Health Act compliance and audit activity. The HHS is also imposing more-significant fines and penalties on transgressors. The same is true for the EU General Data Protection Regulation.

HIPAA explicitly calls out application log review as a best practice for ensuring privacy and security. However, most healthcare providers do not have mature application log management in place. If they do, they struggle to extract meaningful and actionable information from this data. To combat the rising tide of fraud and misuse, healthcare provider CIOs and compliance officers should track and monitor access to patient data by routinely examining the application log entries that are generated by their critical business and clinical systems. This function is provided by PPM.

Business Impact: PPM has the potential to improve a healthcare provider's overall IT governance, risk and compliance posture. Specifically, it can reduce the risk of fraud and misuse related to unauthorized disclosures and access to PHI, as well as the significant fines, penalties and damage to brand and reputation that might result. With the recent passing of the interoperability rules in the

U.S., the number of people with access to PHI and the amount of PHI being transmitted is predicted to increase substantially. PPM provides a methodology to commensurately scale monitoring.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: FairWarning; Iatric Systems; Maize Analytics; Protenus; Securolytics; Veriphyr

Recommended Reading:

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Healthcare CIOs: Prepare for Granular Patient Consent"

"Market Guide for User and Entity Behavior Analytics"

"Maturity Model for the Real-Time Health System"

Patient Throughput and Capacity Management

Analysis By: Barry Runyon

Definition: Patient throughput and capacity management (PTCM) systems offer a less-siloed, evidence, and analytics-based approach to orchestrating and managing patient movement and care transition issues. PTCM systems include bed management, patient flow, transfer centers, staff scheduling, and referral management. PTCM systems anticipate demand, alert to bottlenecks, monitor conformance with clinical pathways and performance objectives, and balance hospital resources with demand as circumstances change.

Position and Adoption Speed Justification: The value of optimizing patient flow and managing capacity is well-understood by most healthcare provider organizations. Managing patient throughput and the utilization of facilities, staff, and materials are persistent hospital operational and strategic priorities and underlie most cost optimization initiatives. While many healthcare delivery organizations (HDOs) have invested in stand-alone bed management and patient flow solutions to address these challenges, PTCM represents a more integrated, next-generation approach. The PTCM IT ecosystem also includes next-generation contact centers, transfer centers, on-call, and staff scheduling systems, and referral management.

Adoption barriers include the realization of current vendor R&D plans (more-predictive algorithms, better integration, synthesis, and contextualization of situational awareness data for real-time decision making) and more proof of value studies. More sophisticated interoperability with IoT devices will be necessary to acquire location and condition sensing data for real-time analytics.

Other adoption barriers include the increasing number of HDO priorities, HDO executives' reluctance to entertain new risk, the chief nursing officers' (CNOs') willingness to lead, and need for stronger collaboration between nursing and physician leaders of emergency departments and ICUs.

Integrated PTCM platforms also require reskilling, reassignment, and centralization of PTCM responsibilities (e.g., bed assignments). There is also an abiding need to optimize the use of electronic health record (EHR) generated data to refine patient throughput algorithms.

Significant investments continue from several representative vendors, with nursing and staff scheduling, patient classification and acuity, and predictive staffing models added through acquisitions or vendor alliances. More precise sensor technologies for real-time location information on patient and care team locations, time, and interaction patterns are also valuable enhancements. We advanced this profile this year based on our assessments of vendor product enhancements, increased provider interest demonstrated by inquiry requests, and new market entrants. We continue to anticipate that PTCM will be comfortably situated on the Plateau of Productivity during the latter part of its five-to-ten year journey.

User Advice: We recommend the following:

- Look for the chief nursing informatics officer (CNIO) to be a key leader in the planning and implementation of patient throughput technologies.

- Establish an enterprisewide PTCM strategy and roadmap by engaging key stakeholders, such as admissions, transition management, referral management, workforce management, discharge planning, and the emergency department. The most significant stakeholder is nursing operations.

- Increase the likelihood of PTCM success by increasing your understanding and use of vendor proprietary and open APIs that provide more-granular access and control than messaging interfaces. Enterprisewide PTCM will require sophisticated interoperability to share both work and data among systems and technologies participating in PTCM workflows.

- Begin to materialize your PTCM vision by selecting a patient flow system with the strategic intention and technical architecture necessary to fulfill the broader PTCM vision as outlined in this profile.

Business Impact: Cost pressures on HDOs continue to mount, and PTCM technology has real potential to advance clinical operations performance and improve key performance measures (e.g., bed occupancy rate, length of stay [LOS], asset utilization, time to service, operating margin) and the patient experience. The impact of COVID-19 on healthcare provider revenue and operating budget has exacerbated this situation. PTCM systems aim to deliver higher patient throughput and enhanced resource utilization and revenue at lower resource costs by eliminating waste and delay. PTCM is key to a healthcare provider evolving into a real-time healthcare system (RTHS).

In the evolving value-based payment and accountable care environment, many leaders have become focused on chronic disease management strategies and avoiding hospital admissions and readmissions. However, there is still critical work to do in making hospitals more efficient and maximizing asset and human resource use by optimizing patient throughput and quality. Bundled payment models, such as those from the U.S. Centers for Medicare & Medicaid Services (CMS), make this clear.

While this profile focuses on hospital patient throughput, vendors are beginning to expand the use of these solutions and management concepts across the care continuum, which is added value for revenue, resource utilization, patient satisfaction, and value-based care contract accountabilities. This is beginning to manifest in the use of RTHS command centers, where dashboard data from many operational disciplines are presented side-by-side to help correlate and synthesize situational awareness from many domains and independent sources.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Allscripts; Aptean; BedWatch; Care Logistics; Central Logic; Cerner; Epic; GE Healthcare; TeleTracking

Recommended Reading:

"Healthcare Provider Command Centers Advance Real-Time Digital Care to Improve Efficiencies"

"Put Patient Throughput and Capacity Management at the Center of Your Performance Improvement Plan"

"Healthcare Provider CIOs: Advance Clinical Operations Performance Through Situational Awareness Technologies"

Climbing the Slope

Clinical Communication and Collaboration

Analysis By: Barry Runyon

Definition: Clinical communication and collaboration (CC&C) systems offer secure mobile messaging and collaborative capabilities directed at clinicians and care team members. Their purpose is to improve situational awareness and information sharing around the patient at the point of care and during transitions of care.

Position and Adoption Speed Justification: CC&C systems can reduce care team toil and improve care team efficiency and effectiveness and related care quality and performance measures. CC&C systems represent the convergence of conventional inpatient communications channels, such as voice and paging, with those of a smartphone platform, such as secure messaging and chat. New avenues to collaborate on care are vital at the point of care and during transitions of care. It requires sophisticated, bidirectional, context-aware situational awareness that CC&C provides. CC&C systems are used to coordinate the activities of care team members to optimize:

- Care quality
- Clinical workflows

- Patient experience

- Patient safety

- Patient throughput

- Transitions of care

Vendors participating in the CC&C market have been resourceful in describing the products and services they offer. Capabilities such as secure messaging, chat, email, voice, and paging emulation are common to most CC&C platforms. CC&C systems are interoperable with electronic health record systems, nurse call systems, alarms/alerts/notification platforms, interactive patient care systems, and on-call and staff scheduling systems. CC&C systems increasingly take advantage of patient data held in patient throughput and capacity management systems, bed management systems, wayfinding systems, and telemetry provided by location and condition-sensing technologies. Some CC&C platforms offer nurse and executive rounding capabilities; capture quality data and charges; and participate in supply management, crisis management, and incident response workflows. Other standard CC&C capabilities include:

- Alarm management

- Analytics

- Bar code scanning

- Contact lists

- Critical results

- Dashboard

- Desktop support

- Electronic signature

- Family and caregiver support

- Paging support

- Patient event notifications

- Presence status

- Provider directory

- Quality metrics

- Reporting

- Rounding

- Secure messaging

- Smartphone, tablet, wearables and hands-free device support

- Voice recognition

- Workflow integration

CC&C systems continue to gain traction within healthcare providers due to the increased use of mobile devices and an industry focus on improved outcomes, care coordination, and the patient experience. The CC&C space has further matured over the past year, coincident with financial incentives for improved care quality, an enhanced patient experience, and recent merger and acquisition activity among CC&C vendors. Because of CC&C's inherent ability to improve situational awareness and information sharing around the patient at the point of care and during transitions of care, CC&C systems have proven particularly useful during the COVID-19 pandemic. For these reasons, CC&C has advanced on this Hype Cycle.

User Advice:

- Improve care coordination and care transitions by equipping care teams with CC&C solutions that interoperate with critical components of the care team collaboration ecosystem — such as nurse call, interactive patient care, clinician scheduling systems, and alarms and notification platforms.

- Focus care team toil-reduction initiatives on the tasks that erode nurses' morale and well-being and contribute to clinician burnout. These are the tasks that tend to be tedious and repetitive and can be mitigated or eliminated through automation and interoperability.

- Favor CC&C solutions that include patient engagement capabilities that improve care quality (e.g., HCAHPS) ratings, such as pre- and post-treatment follow-up, real-time family and caregiver communications, and virtual bedside rounding.

- Don't confuse secure text messaging with CC&C. Secure text messaging is an essential capability of a CC&C system, but secure text products are not axiomatically CC&C systems. Secure messaging is a feature of a CC&C platform.

- When purchasing a CC&C platform, understand the vendor product roadmap and associated time frames to determine how well they align with your business priorities. CC&C, like most IT projects, presents risks related to vendor selection, implementation, integration, support, and service-level expectations.

Business Impact: CC&C systems can positively impact patient safety, care team productivity and efficiency, care coordination, and the healthcare provider's ability to manage patient throughput and capacity. CC&C systems can assist the healthcare provider in addressing regulatory mandates and improving key quality and enterprise performance measures. A new care team collaboration (CTC) IT ecosystem is emerging, enabled by advances in mobility, interoperability, situational awareness, and real-time analytics. It includes CC&C, interactive patient care, alarms, and notification systems, and next-generation nurse call and contact/call centers. The CTC IT ecosystem is materializing to overcome persistent care coordination and transitions of care challenges and new patient experience expectations, and CC&C is at its core. The preponderance of CC&C activity is occurring in North America at present.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Halo Health; Hillrom; Mobile Heartbeat; OnPage; PatientSafe Solutions; PerfectServe; TigerConnect; Uniphy Health; Voalte; Vocera

Recommended Reading:

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Innovation Insight for Care Team Collaboration"

"Market Guide for Clinical Communication and Collaboration"

"Healthcare Provider CIOs: Overcome COVID-19 Challenges With Real-Time Health System Technology"

Positive Patient Identification

Analysis By: Pooja Singh

Definition: Positive patient identification (PPID) is the encoding of individually identifying information on a wristband, bracelet or tag, and affixing it to the patient for use by medication administration and laboratory applications or any workflow requiring unique identification for patients. The encoded patient identification information commonly takes the form of a linear, or 2D, bar code or RFID tag.

Position and Adoption Speed Justification: PPID is essential to a patient's safety and improved outcomes. The overarching value proposition of PPID is the systematic reduction of medical errors, along with the mitigation of potential healthcare and liability issues associated with misidentifying a patient under treatment. It directly addresses the issue of positively identifying patients before they receive care for treatments such as receiving medications, having blood samples drawn and tested, and being given blood products. While PPID is fundamental to patient safety and care quality, other benefits include:

- **Operational efficiency** — PPID systems can help streamline hospital workflows by reducing tedious and redundant data entry and improving data accuracy and integrity. It can also reduce the number of duplicate records found with the electronic health record (EHR) and associated healthcare information management (HIM) rework.

- **Patient experience** — PPID can contribute to improved patient outcomes and workflow improvements that benefit the patient and can reduce the frustration that patients feel when they are provided with the same information multiple times.

- **Regulatory compliance** — PPID systems can address The Joint Commission's standards and other industry guidelines surrounding patient safety and care quality.

- **Federal incentives —** PPID can help healthcare delivery organizations (HDOs) qualify for American Recovery and Reinvestment Act of 2009 "meaningful use" incentives.

- **Identity theft —** PPID can mitigate medical fraud and abuse, and theft of service.

The PPID innovation profile has passed through the Trough of Disillusionment, entering the Slope of Enlightenment this year. This space is slowly evolving to meet the needs of the real-time health system (see "Strategic Roadmap to the Real-Time Health System"). It is an operational and management paradigm that relies heavily upon enterprise awareness and positively identifying patients, clinicians and resources to create a positive patient experience.

Although PPID is a legacy concept, it will get increased attention as health information exchange becomes pervasive and the complexities and shortcomings of our current approaches are laid bare. The geographic scope of PPID is global.

User Advice: Healthcare provider CIOs, CTOs and chief medical informatics officers (CMIOs), when introducing or revisiting an enterprise PPID strategy, should focus on its overarching value proposition, relevant enterprise use cases and data and application integration requirements. To date:

- PPID solutions are made up of several different components, depending on the approach chosen. Decisions will need to be made regarding wristband systems, data encoding and payload, scanning/reading devices and printers.

- A single, enterprisewide approach to PPID may not be appropriate for all patient venues, encounters and workflows. Healthcare providers that have implemented PPID are more likely to be using bar codes and bracelet systems, and to a lesser extent, RFID.

- Healthcare provider enterprises should pursue a vendor-neutral environment in which a variety of PPID systems can interoperate.

- Separate location- and condition-sensing requirements from PPID requirements. Although the technologies overlap, the difference in use cases dictates different solutions.

- Favor bar codes now over RFID to satisfy most of your PPID use cases, but expect to replace bar codes with RFID, or use combined bar code/RFID wristbands once the technology becomes more cost-effective.

Currently, bar code and bracelet systems and RFID approaches are considered "good enough" to address most PPID and identity verification use cases. Healthcare providers are reluctant to adopt unfamiliar and potential costly technologies that they perceive to be only marginally better than what they already have in place.

Advances in biometric identity technologies have reduced false positives and technology price points. It is now time for healthcare provider CIOs to evaluate and pilot identity biometrics (iris, palm vein scanning) for healthcare provider use cases (registration, medication, transfusion and laboratory) that present the most potential risk to the patient and enterprise.

Business Impact: Once a patient has been positively identified, all subsequent encounters and related work become safer and more efficient. HDOs that have implemented PPID systems report

improvements in patient safety, patient satisfaction, staff efficiency and even staff morale. There is evidence that hospitals that use bar code identity systems avoid a significant number of adverse drug events caused by errors in the distribution and administration of medications. The U.S. Food and Drug Administration (FDA) has estimated that about half of all adverse drug events were caused by errors in those stages of treatment. The FDA also has estimated that the per-bed cost of implementing a bar code point of care (BPOC) system for medication administration can be offset by the per-bed cost of a single adverse drug event occurrence.

Positive patient identification can reduce duplicate medical record rates at patient registration and reduce back-end manual review burden by deploying an enterprise master person index (EMPI) solution that is integrated with identity biometrics solutions (see "Identity Biometrics and Next-Generation EMPIs Combine to Address Duplicate Medical Records and HIE Challenges.")

The COVID-19 pandemic will likely increase interest in PPID, at least in the short term, particularly for the identification and monitoring of COVID-19-positive patients within the HDO and for more advanced contact tracing within a population.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: General Data; Honeywell (Intermec); Imprivata; MSoft; RightPatient; Zebra Technologies

Recommended Reading:

"Five Key Principles for Hospital Facility Planning in the Digital Age"

"Identity Biometrics and Next-Generation EMPIs Combine to Address Duplicate Medical Records and HIE Challenges"

Health Information Exchange

Analysis By: Barry Runyon

Definition: Gartner defines a health information exchange (HIE) platform as the software, technology, services, and trust agreements necessary to create and operate an HIE. HIEs facilitate the safe and compliant exchange of patient-centric healthcare information among healthcare stakeholders such as providers, payers, diagnostic laboratories, public health agencies, and other HIEs. HIE participants, by prearrangement, exchange data for care coordination and patient safety purposes.

Position and Adoption Speed Justification: Many U.S. regional and state HIE organizations were initially funded through grants under the 2009 Health Information Technology for Economic and Clinical Health Act (HITECH Act). HIE platforms are the technology underpinnings for the

information-sharing services they offer. The fundamental value proposition of an HIE is about securely exchanging patient information with legitimate healthcare stakeholders — such as payers, providers, plans, laboratories, trust networks, patients and other HIEs. Their purpose is to reduce medical errors, better coordinate care, and improve care outcomes. Going forward, as HIEs pursue new revenue opportunities, HIEs will be offering data management, data quality, analytics, and direct-to-patient/consumer services.

Buyers in the HIE market look to exchange patient data such as test results, clinical documentation, discharge summaries, prescription history, medical images and continuity of care documents with other HIE participants and subscribers. They also seek to provide clinical portal capabilities to HIE participants without electronic health record systems or the ability to integrate HIE data into their EHR systems. Minimum functional requirements for an HIE platform are outlined in Gartner's "Market Guide for Health Information Exchange Platforms."

In the next three to five years, the U.S. HIE market will be in part characterized by the evolving guidance, specifications, principles, and industry experience coming out of the Trusted Exchange Framework and Common Agreement's (TEFCA) finalized rule. HIEs are poised to become increasingly important as the U.S. Office of the National Coordinator for Health Information Technology (ONC) focuses on promoting and enforcing interoperability, as mandated by the 21st Century Cures Act. Through TEFCA, HIE platforms will provide organizational and technical support for inter-HIE patient data exchange.

Most international progress to date has occurred in jurisdictions where there is less variability in culture or resistance to adoption. Some successful global HIE exemplars include Israel (Clalit Initiative), Scotland (Emergency Care Summary), Sweden (National Patient Summary), Denmark (MedCom — Danish Health Data Network), Australia (Personally Controlled Electronic Health Records) and Canada (Canada Health Infoway), and the epSOS program in Europe.

This year we have advanced this profile based on increased adoption of HIE in general, aggressive support and advocacy in the U.S. by the United States Department of Health & Human Services, and increased transaction volumes in the successful HIEs.

User Advice: U.S. healthcare providers that see the need to exchange data with community physicians or public health agencies should assess the prospects of participating in a local or regional HIE. Where there is no viable prospect, healthcare providers should consider going it alone or participating in interoperability networks such as Carequality, CommonWell Health Alliance or Surescripts. Non-U.S. healthcare providers will need to investigate government-sponsored programs. They should base their involvement on clear, pragmatic and achievable information-sharing goals, the HIE's use of industry-standard interoperability standards and protocols, and the ability to exchange patient data among heterogeneous systems. The rise of HL7 FHIR APIs (or so-called "open APIs") will offer HIE alternatives as new clinical data interchange platforms purpose-built for this purpose begin to emerge.

Business Impact: The fundamental value proposition of an HIE is about securely exchanging patient information with legitimate healthcare stakeholders — such as payers, providers, plans, laboratories, trust networks, patients and other HIEs — to reduce medical errors, better coordinate care and improve outcomes. Going forward, HIEs will be offering data management, analytics and

direct-to-consumer-/patient-related services. HIEs enable increased patient information sharing, which can lead to improved patient safety, care quality, cost savings, and fraud and misuse mitigation. HIEs create opportunities to create coalesced communities of clinicians in a region to support other care quality efforts.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Allscripts; Cerner; Forcare; Health Catalyst (Medicity Network); Infor; InterSystems; McKesson (RelayHealth Pharmacy Solutions); Optum; Orion Health

Recommended Reading:

"Best Practices for Healthcare Provider CIOs to Select the Right Patient Data Interoperability Platform"

"Healthcare Provider CIOs: Prepare for the Consumer-Mediated Health Information Exchange"

"Market Guide for Health Information Exchange Platforms"

"ONC NPRM Envisions Open and Equitable Health Information Exchange"

Healthcare Interoperability

Analysis By: Barry Runyon

Definition: Interoperability among health information systems and devices refers to the ability to share, exchange, and effectively use electronic health information in a timely and meaningful manner. For this profile, interoperability refers to the adoption of and advances in notable healthcare interoperability rules, standards, and industry initiatives.

Position and Adoption Speed Justification: Rather than plotting the adoption and progress of the myriad of individual healthcare industry interoperability rules, standards, protocols, frameworks, initiatives, technologies, and platforms, we have chosen to express their collective and overall impact and maturity.

Interoperability includes the concepts of interfacing, application integration, and health information exchange. It is a healthcare industry challenge and mandate that impacts providers, payers, and other industry stakeholders and constituents (e.g., consumers, patients, members) and the near singular focus of the most recent Office of the National Coordinator for Health Information Technology (ONC) and Centers for Medicare & Medicaid Services, CMS rulemaking process.

Interfacing is message brokering — copying, transforming, enriching, and routing health data from one endpoint to another. Interfacing has almost exclusively been a healthcare provider activity until recently. Integration is about making a vendor's suite of products work together as a system and in

concert with other systems and platforms within their IT ecosystem. Interoperability is about achieving similar results between various, often competing, vendor products and platforms and healthcare industry players — regardless of the product architecture, technologies, and tools they employ. Interoperability involves technologies such as message brokering, web services, electronic data interchange (EDI), APIs, cloud computing, file transfer, email, and fax and database connectors. It consists of a plethora of wire protocols, data exchange standards, application platforms, common data elements, and vocabularies (semantic interoperability).

Interoperability involves standards development organizations and interoperability networks and industry alliances such as CommonWell Health Alliance, Carequality, Surescripts, and IHE offerings by technology service providers and clinical vendors. It also includes semantic interoperability or the exchange of clinical information with enough meaning and granularity to support clinical decision support, care management, clinical research, quality assessment, and business intelligence.

In February of 2019, the U.S. Department of Health & Human Services (HHS) issued a "Notice of Proposed Rule Making to Improve Interoperability of Health Information." More specifically, the NPRM was issued by the ONC, and it supports the overall mission and goals of the 21st Century Cures Act — i.e., the seamless and secure access, exchange, and use of electronic health information (EHI), including more convenient access for caregivers and patients. The rule promotes and incentivizes the adoption of open application programming interfaces (APIs) and trust frameworks and an expanded set of core clinical data elements for more effective health information exchange. The ONC NPRM most notably addressed the practice of "information blocking."

Around the same time, CMS issued a complementary rule that required government health plans as well as health plans offered through Affordable Care Act (covered plans) to provide patients with free control of, and increased access to, their HIPAA EHI. The CMS rule aims to improve access to and the quality of information that citizens need to make informed healthcare decisions, including data about healthcare prices and outcomes while minimizing reporting burdens on affected plans, healthcare providers, or payers.

After an extended public comment period, both rules were finalized in March of 2020 to reflect public and industry feedback and current administration priorities. This event has served to advance interoperability in general within the industry in 2020 and has justified the advancement of this profile on this Hype Cycle.

User Advice: We recommend the following:

- Evaluate your enterprise interface/integration platform plans to support more robust interoperability requirements and industry timelines.

- Participate in a regional health information exchange network that takes advantage of existing interoperability standards, trust frameworks, and industry alliances.

- Promote the use of HL7 Fast Healthcare Interoperability Resources (FHIR) and SMART on FHIR capabilities of your electronic health record (EHR) vendor (API technology supplier) necessary to support consumer and third-party EHI access.

- Report incidents of suspected information blocking by referring to the guidelines set forth within the ONC rule. Seven legitimate information-blocking exceptions should be taken into consideration.

- Strengthen patient engagement by preparing for consumer-mediated health information exchange (HIE). Investigate notable industry alliances and advocacy groups such as the CARIN alliance and government initiatives such as MyHealthEData.

Business Impact: Healthcare IT systems, whether self-developed or purchased, must be able to work together to deliver on healthcare IT's value proposition. Interoperability makes it possible for disparate, heterogeneous systems to exchange health information to support care delivery, care coordination, and business requirements across system and organizational boundaries. Interoperability makes it possible for access and exchange of longitudinal patient records. Safe and effective interoperability is essential for the industry to evolve and transform. There have been more interoperability advances in the last five years than in the previous twenty.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Carequality; CARIN alliance; CommonWell Health Alliance; Da Vinci Project; Health Level Seven International; IHE; Surescripts

Recommended Reading:

"7 Critical Domains of a Successful Healthcare Provider Interoperability Strategy"

"Best Practices for Healthcare Provider CIOs to Select the Right Patient Data Interoperability Platform"

"Healthcare Payer CIOs, Leverage Vendor Partners to Succeed at Clinical Data Integration"

"Healthcare Provider CIOs: Prepare for the Consumer-Mediated Health Information Exchange"

"Market Guide for Clinical Communication and Collaboration"

"ONC NPRM Envisions Open and Equitable Health Information Exchange"

Vendor-Neutral Archive

Analysis By: Barry Runyon

Definition: A vendor-neutral archive (VNA) is an enterprise image platform and repository of patient-centric medical images and studies, and related clinical content. Vendor neutrality is achieved through standards-based interoperability with departmental picture archiving and communication

system (PACS), and by accommodating proprietary vendor and healthcare provider local requirements for medical image access, retrieval, manipulation, storage, and viewing.

Position and Adoption Speed Justification: The VNA value proposition centers on promoting medical imaging standards, increasing healthcare provider control and ownership over its medical image data, reducing data migration cost and complexity, and decreasing the healthcare provider's dependence on individual PACS vendors. The VNA enables centralized storage and access to the patient images for historical comparison, for second opinions and consultations, and the integration with electronic health record (EHR) systems, third-party mobile apps, and health information exchange (HIE) platforms.

Basic VNA capabilities include the ability to interface with major PACS and clinical systems via the Digital Imaging and Communications in Medicine (DICOM) and Health Level Seven standards, and the ability to store images in a nonproprietary DICOM format. VNAs are partly a response to prodigious medical imaging storage growth and the cost and complexity of PACS-to-PACS migrations.

A genuine interest in VNAs among HDOs began around a decade ago. Since then, healthcare providers have put the VNA at the core of their enterprise imaging strategies. With a significant portion of the electronic medical record represented as unstructured data, along with the increased use of analytics, more effort has been made to mine value from imaging metadata to support population health and value-based care.

Healthcare providers have begun to invest in VNA (evidenced by Gartner client interaction and RFP review requests) as their PACS come up for replacement, and as these medical images are shared outside of their departmental silos. VNAs are being increasingly configured for direct access to imaging modalities and have begun to offer enterprise-level worklists and advanced visualization capabilities. This evolution often referred to as the deconstructed PACS.

As more healthcare providers put the VNA at the center of their enterprise imaging strategies, the VNA will continue to make incremental, year-over-year progress on the Hype Cycle as it moves toward mainstream adoption. The geographic scope of VNA is global, with 2019 seeing continued VNA adoption outside of North America.

User Advice:

- Select a VNA that is agnostic to your existing PACS and storage infrastructure.

- Select a VNA that will image-enable your EHR, provide for universal viewing and mobile app support, and offer collaborative capabilities such as workflow integration and enterprise worklist processing, and AI-enhanced analytics and decision support.

- Deploy a VNA to decrease dependence on departmental PACS and increase the control and ownership over medical imaging data and other patient-care-related unstructured content.

- Make VNA the underpinning of your enterprise imaging strategy and information sharing architecture by crafting a strategy that takes into account all of the medical imaging "ologies" and "oscopies" surrounding patient care and satisfies real-time healthcare system (RTHS) transformational requirements.

- Identify tangible sources of efficiencies, savings, and revenue that can result from deploying a VNA — to bolster the business case and offset the total cost of ownership.

Business Impact: A VNA can stem the proliferation of proprietary, departmental archives and viewing solutions across the healthcare provider enterprise, and on occasion, across healthcare enterprises participating in HIE or regional care records solutions. By centralizing enterprise image storage to a single, sometimes remote, scalable repository, it can also improve the healthcare provider's disaster recovery posture.

By routinely offloading aging studies, it can improve the performance and availability of individual departmental PACS. It can facilitate PACS decommissioning and PACS-to-PACS migration efforts by eliminating vendor-specific DICOM header information and storing the medical images in a vendor-neutral manner. A VNA frees up healthcare providers to purchase best-of-breed imaging solutions. It can facilitate image exchange between healthcare facilities or HIEs. Diagnostic quality images can be shared with DICOM-compliant PACS with the proper level of patient detail.

The VNA will evolve to provide unstructured clinical content services for a wide variety of systems, apps, and clients. Unstructured non-DICOM clinical content often originates in departments such as emergency and family medicine, ophthalmology, obstetrics, and pathology. It includes MPEG, WAV, JPEG, MP3, PDF, and other multimedia data types acquired from medical imaging, diagnostic, and monitoring devices.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Agfa HealthCare; Canon Group (Vital); Carestream; Dicom Systems; FUJIFILM Medical Systems (TeraMedica); GE Healthcare; Hyland (OnBase); Mach7 Technologies

Recommended Reading:

"Market Guide for Vendor-Neutral Archives"

"Healthcare Provider CIOs Need to Leverage the Vendor-Neutral Archive for All Unstructured Clinical Content"

"Imaging Content Management Issues at Healthcare Providers Demand a New Strategy"

Patient Self-Service Kiosks

Analysis By: Mark Gilbert

Definition: Patient self-service kiosks are typically free-standing terminals that enable patients to perform tasks such as patient registration, check-in, wayfinding and account payments. Along with improved customer convenience and data quality, these kiosks offer opportunities to engage the patient, reduce patient wait times, and improve patient throughput and safety.

Position and Adoption Speed Justification: Patient self-service kiosks were introduced in healthcare in the early 1990s, and they have undergone several transformations as their use case has evolved over time. They were originally envisioned as a self-service tool before the prevalence of smartphones and home internet usage. They then became a means of offloading tasks from caregivers onto patients during cost-cutting initiatives. Recently, kiosks began being positioned as a patient engagement tool. With COVID-19, kiosks are being repurposed to be part of a no-touch approach to patient intake and discharge. The continuously evolving use case has created doubt among health delivery organizations (HDOs) about the business case for deploying kiosks. However, there are clear benefits from the use of kiosks.

Kiosks provide a self-service alternative to consumers who prefer the speed and convenience of interacting with a kiosk to check-in, find a location within a healthcare campus, look up patient information, fill out forms and make a payment. Kiosks also provide a form factor and features that are not available in their smartphones; examples include printers, scanners, thermal readers and contactless payment. Finally, kiosks provide HDOs with patient administration labor savings and real-time information that can be used to optimize the operational and clinical flow of a facility.

Greater consumer functionality increases the value of kiosks, but also increases integration challenges. To be effective, the kiosk must integrate with the HDO's business and clinical system portfolio, such as patient management, scheduling, billing and the electronic health record (EHR) system. The kiosk should therefore support industry integration standards and protocols (such as Health Level Seven International [HL7], web services and APIs), and provide the necessary off-the-shelf connectors or adapters for these systems. In certain venues, kiosks should support strong authentication measures (such as card readers, biometrics and e-signatures), privacy controls (such as in accordance with laws like HIPAA, and GDPR) and Payment Card Industry compliance.

Although the self-service kiosk can contribute to an improved customer/patient experience, competition from higher-profile mobile initiatives has resulted in continued slow adoption by healthcare providers. Kiosks allow providers to combine multiple patient-facing applications (for example, wayfinding, patient intake, billing and customer satisfaction survey) into one user interface. As such, kiosks make up one part of providers CIOs' total engagement and service technology needs. It is highly likely that self-service kiosks will reach the Plateau of Productivity as a niche presentation and interaction product.

User Advice: HDO CIOs and IT and patient experience leadership:

- Consider the use of self-service kiosks within initiatives to enhance the patient experience, improve operational efficiency and improve data quality. Use self-service kiosks as a supplement to staffing, rather than as a replacement for staff. Make self-service kiosk use voluntary. Begin with check-in, wayfinding and payments. Emphasize services that leverage kiosk integration with existing services that are difficult to perform on patient-owned mobile devices. Place kiosks in high-traffic areas where there are many repeat customers. Kiosk placement is of singular importance to ensure adoption.

- Consider the use of stand-alone units in inpatient settings for functions such as wayfinding and directory services. Similarly, consider wall-mounted and countertop units in ambulatory settings for check-in, consent forms and surveys. Look for kiosks that offer touch-free capabilities like

scanning a quick response (QR) code for registration or the use of Apple Pay for payment. For the next year, we suggest postponing consideration of shared handheld and tablet kiosks due to COVID-19 sanitation protocols.

- Make sure HDO-supplied mobile apps intended to run from patient-owned mobile devices seamlessly integrate with the functions of self-service kiosks. Minimize situations where a patient is learning a completely new UI in front of other patients. Consider kiosks a purpose-built solution that complements mobile apps (for example, a larger screen, integrated printer and scanner to read QR codes). Think in terms of the functionality provided by airline kiosks at the airport, how they complement an airline's mobile apps and improve the operational efficiency of the check-in process, while enforcing security policies.

- Also, consider kiosks for the basic use case of offering thermal scanning and presenting COVID-19-screening questions to patients prior to entering a facility.

Business Impact: Ensure kiosk usage by focusing on the patient's benefits as the primary objective for deploying patient self-service kiosks. A focus on patient benefits like reducing check-in times and wayfinding will improve customer satisfaction and the patient experience. Once a kiosk successfully engages a patient, it can be used for operational benefits like automating and streamlining registration, check-in, information gathering, queue status, and customer payment workflows. These self-service activities can improve the HDO's operational effectiveness, reduce head count in some cases and improve collections. Better data quality can contribute to better clinical outcomes, patient safety, compliance and revenue cycle management. Self-service kiosks can be used to capture updated patient information for near-real-time integration with other HDO clinical and business systems.

Along with patient portals, interactive patient care systems and mobile apps directed at the patient, self-service kiosks are part of an emerging patient-facing IT ecosystem that is steadily transforming the HDO into a real-time health system (see "The Real-Time Health System Architecture for Health Delivery Organizations").

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Advanced Kiosks; CERTIFY; DynaTouch; Intouch with Health; KIOSK Information Systems; Meridian; Olea Kiosks; PatientWorks; SeePoint; Vecna

Recommended Reading:

"How to Develop a Winning Customer Self-Service Strategy"

"The Gartner Customer Service Technology Vendor Guide, 2019"

"Deliver Customer Service During COVID-19: Improve Digital and Self-Service Capabilities"

"Digital, Self-Service and Assisted Customer Service Channels Primer for 2020"

"Top 10 Strategic Technology Trends for 2020: Multiexperience"

Interactive Patient Care

Analysis By: Pooja Singh

Definition: Interactive patient care (IPC) solutions use interactive TV, wireless peripherals, bedside multimedia and mobile devices to engage patients within acute and ambulatory care settings. IPC solutions provide access to caregiver and personal communications, hospital services, entertainment and educational content for improving patient safety, patient experience and care team collaboration. IPC solutions are extending their reach to engage patients pre- and postadmission and within alternative care settings.

Position and Adoption Speed Justification: IPC solutions improve patients' outcomes, quality measures and patient satisfaction scores during hospitalization or time spent in an ambulatory care facility by educating, improving communications and entertaining patients. IPC solutions complement clinical workflow by performing education and communications tasks that are currently part of a clinical workflow. Examples include:

- Calming and distracting patients though entertainment or educational features

- Collecting patient sentiment data, meal selections or patient satisfaction surveys

- Educating patients on pre- and postprocedure activities and therapy options

- Engaging patients with the care team through communications, notifications and status information

These benefits have been consistently observed within IPC deployments. As such, IPC solutions can now be considered part of a maturing market with adoption approaching mainstream within new facilities or the renovation of existing facilities. Their success and product maturity have resulted in interest by vendors and Healthcare providers to extend the reach of their systems, both preadmission and postadmission, to the home and other care venues. IPC solutions are also adding digital health and virtual care services, such as real-time video consults with clinicians and caregivers.

User Advice: Healthcare provider CIOs should:

- Regard IPC solutions as part of an inpatient patient engagement strategy and, increasingly, as part of an enterprise patient engagement strategy.

- Consider the addition of an IPC solution whenever building or renovating a facility.

- Contain costs and improve time to value by selecting IPC solutions that leverage existing information and communications technology infrastructure and have demonstrated experience integrating with your particular application portfolio.

- Evaluate IPC solutions on their ability to improve key performance measures relating to patient experience, care quality and patient retention.

- Consider vendors with integrated analytics and data sharing with revenue cycle managements systems to better understand staff utilization, tasks, costs and capacity planning.

Care should be taken to assess IPC solutions based on their ability to better integrate with clinical communications systems to improve the coordination and exchange of information between the care team and the patient (see "Innovation Insight for Care Team Collaboration" for a discussion of how IPC is becoming a critical component of an emerging care team collaboration ecosystem). Healthcare providers should also consider IPC solutions' ability to engage patients outside of acute and ambulatory care settings. Leading IPC vendors have repositioned their IPC solutions to become an integral part of an enterprise patient engagement platform.

Business Impact: IPC solutions are well established as inpatient entertainment and education platforms. Next-generation IPC solutions facilitate preregistration and postdischarge care communication, and are becoming critical components of care team collaboration and patient engagement, both within and outside of acute or ambulatory care facilities. IPC solutions can provide benefits for both the hospital and the patient by improving patient satisfaction, outcomes and care measures, and operational efficiency. The same IPC benefits are evolving to enable comparable benefits within other care venues, such as the home, through the use of a platform architecture. Healthcare systems should now consider IPC as a critical component of a patient engagement strategy. See "Market Guide for Interactive Patient Care" for a deeper analysis of the market and for descriptions of IPC vendors.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Aceso; GetWellNetwork; Lincor Solutions; Oneview; SONIFI Health; TeleHealth Services; TVR Communications

Recommended Reading:

"Market Guide for Clinical Communication and Collaboration"

"Innovation Insight for Care Team Collaboration"

"The Evolution of Healthcare Consumer Engagement Hub Architecture"

Entering the Plateau

Alarms and Notifications

Analysis By: Gregg Pessin

Definition: Alarms and notifications (A&N) platforms are IT middleware that captures alarms, alerts, physiological and telemetry data from medical and patient monitoring devices, and operational and clinical systems and distributes it to subscribing systems for patient safety and care quality purposes. Examples include critical lab results, waveforms, patient monitor and medical device codes and telemetry, and ADT event data.

Position and Adoption Speed Justification: A&N platforms acquire, filter, publish, and push this information to mobile and wearable devices, clinical communication and collaboration (CC&C) platforms, nurse call, and other care team collaboration (CTC) systems. A&N addresses critical healthcare provider use cases, such as:

- Medical device integration — low latency, high-fidelity data capture from medical devices, such as pulse oximeters, ventilators, anesthesia machines and patient monitors.

- Alarm management — goes beyond basic alarm filtering and distribution to reduce the number of alarms nurses must handle (aka alarm fatigue) based on patient context and best practices.

- Patient/clinical surveillance — the real-time centralized surveillance of acute care patients via a clinical dashboard.

- Real-time analytics — a platform to apply clinical algorithms to acquired patient data to improve safety and outcomes.

A&N platforms possess data analysis and reporting capabilities, integrate with major EHR vendor platforms and handle smart bed alerts, and make use of patient location data. They are essential to operational efficiency and critical to patient safety and care quality. A&N platforms are important components of the real-time health system (see "Maturity Model for the Real-Time Health System").

The data-collection services that A&N provides are similar to the services offered by IoT platforms in that it accepts data from a variety of sources, normalizing the data streams into a process-ready form. This meets the definition of an IoT platform service and places A&N as a subset of IoT core platform services.

As competition grows for this capability, set the various functional components of A&N will define their own market space and align under IoT, IoT platforms, clinical event service buses, and event listeners/responders. Clinical devices and data collection systems will publish data associated with events occurring in the care venue to the service bus. Various response systems will subscribe to the service bus for specific event types and subsequently process them according to their purpose, such as delivering clinical alert notifications to the appropriate caregiver.

Given this profile's current level of healthcare-provider penetration and the compelling nature of the use cases it addresses, it is on its way to mainstream adoption within the next two years. More healthcare delivery organizations (HDOs) will be acquiring these platforms as their nurse call systems come up for replacement and as the care team collaboration IT ecosystem continues to coalesce (see "Innovation Insight for Care Team Collaboration").

User Advice: Ensure that your prospective A&N vendor has a comprehensive library of validated medical device drivers, can develop new drivers as needed and integrates easily with your EHR. Ideally, your vendor should participate in industry interoperability events such as the IHE

Connectathon and HIMSS Interoperability Showcase and the Medical Device "Plug-and-Play" (MD PnP) Interoperability Program.

With the predicted IoT convergence that includes this capability, be prepared to include A&N into IoT strategic planning. The role A&N platforms play in clinical workflow is significant, any strategic planning must include input from the care delivery staff most impacted by these services.

Business Impact: A&N platforms can significantly reduce the number of critical codes and alarms the nursing staff must respond to through best-practice filtering and alarm management — improving operational efficiency, care outcomes and measures and staff morale. Look for tighter integration with CTC systems and technologies, especially CC&C, as these platforms evolve.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amplion; Connexall; Royal Philips; Spok; Vocera

Recommended Reading:

"HDO CIOs, Get Ready to Transform Your Alarms and Notification Systems Into IoT Platforms"

"Healthcare Provider's Unique IoT Challenges Demand a Platform Strategy"

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"Industry Vision: The Real-Time Health System Transformation"

"Market Guide for Clinical Communication and Collaboration"

Content Services Platform

Analysis By: Barry Runyon

Definition: The content service platform (CSP) is an integrated platform that provides content-focused services, repositories, APIs, solutions, and business processing tools to support digital business and transformation. Typical CSP use cases include document management, back-office processes, business process applications, records management, and team productivity. A CSP has its own repository. CSP services and data may also integrate with external, non-native repositories and applications through prebuilt connectors and APIs.

Position and Adoption Speed Justification: Previous versions of this profile referred to CSP as enterprise content management (ECM). ECM is used to create, store, distribute, discover, archive, and manage unstructured content, such as scanned documents, reports, office documents, and non-Digital Imaging and Communications in Medicine (DICOM) images. ECM is used by HDOs as a

centrally managed repository of unstructured information, bridging the gap between the administrative, business, and clinical systems (most notably, the electronic health record [EHR]).

The transformation from ECM to content services denotes a critical conceptual shift away from the "management" of content and too much focus on the repository as the solution. Redefining the market as content services recognizes that it is no longer strictly about the storage of content for the enterprise. It is now about the consideration of how individuals and teams use content — internally and externally — to create, collaborate, share, transform and leverage that content in business processes and to gain insight. This transformation will be a multiyear one and reflects a change in requirements from buyers.

HDOs often have multiple departmental document management systems that support their various administrative, business, and clinical workflows. Although document management is well-established within HDOs, an enterprisewide view or approach is being driven by the need to organize unstructured data around the patient. CSPs can help HDOs take control of their content, and in so doing, boost productivity and promote collaboration. Some CSP vendors have technology components, such as digital asset management (DAM), for handling rich media and electronic forms. As e-discovery requirements in HDOs continue to grow, the value of having a system of record or release of information also increases. By controlling access to content, managing the versions of content and, simultaneously, reducing the reliance on less-managed environments (such as file servers), enterprises can improve their overall data quality. CSPs are evolving to include content such as non-DICOM medical images and file sync and share capabilities. The optimization of the EHR will drive some CSP adoption.

The domains of content services and medical imaging are now converging within the VNA platform. Gartner's long-term view is that this convergence will continue, and the need for neutral storage of healthcare data will endure and grow. The VNA is now central to the healthcare provider's enterprise-imaging strategy and is evolving to include all unstructured clinical content (see "Imaging Content Management Issues at Healthcare Providers Demand a New Strategy"). Hyland Software's acquisition of Lexmark's Acuo VNA is a case in point.

Gartner believes that the value and use of unstructured data within the HDO will continue to gain momentum. It is very likely the convergence of CSP and enterprise imaging strategies will accelerate (see "Imaging Content Management Issues at Healthcare Providers Demand a New Strategy"). It has taken years for healthcare providers to move beyond document management to ECM, and this transition remains incomplete. Transitioning from ECM to CSP requires HDOs to expand and optimize the use of their existing ECM platforms. Recent advances in interoperability make this easier. CSP will remain in place on this Hype Cycle while this rethinking and refactoring take place. The geographic scope of CSP is global.

User Advice: HDOs should take inventory of their various document and content management systems. Those that have unstructured content stored on file servers and in niche departmental document management applications have an opportunity to manage this content at an enterprise level. HDOs should view CSP as an essential component of an enterprisewide information infrastructure that will support all their business and clinical applications, workflows, and digital transformation initiatives. HDOs should develop exit strategies for departmental and niche document and content management systems. All unstructured data will be increasingly organized

around the patient. As CSP adoption continues to increase within the HDO, this unstructured content will become an increasingly rich source of operational intelligence and fodder for analytics.

Business Impact: Departmental document management systems will continue to yield to CSP. Many HDOs look to CSP to make their workflows and business processes more efficient and to reduce costs. HDOs can use CSP to automate vertical business processes, such as claims, billing, and discharge processing, as well as satisfy data requirements surrounding regulatory compliance, e-discovery, intranet, extranet, and website or portal publishing. CSPs complement EHR systems by linking transactional patient information with unstructured patient information captured and managed outside the EHR. In the absence of a vendor-neutral archive (VNA), the CSP platform is also being used to house non-DICOM medical images.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Hyland; IBM; Microsoft; OpenText; Quest Diagnostics

Recommended Reading:

"Reinventing ECM: Introducing Content Services Platforms and Applications"

"Healthcare Provider CIOs Need to Leverage the Vendor-Neutral Archive for All Unstructured Clinical Content"

"Imaging Content Management Issues at Healthcare Providers Demand a New Strategy"

Real-Time Location in Healthcare

Analysis By: Gregg Pessin

Definition: Real-time location systems in healthcare (RTLS) are used to track the location of identified assets or people within the confines of the healthcare provider facility or campus. Location information is acquired or sent in real time from wireless tags that are worn by people inside facility or attached to an asset. The wireless communication is typically over radio frequencies (RF), but can also be accomplished with infrared or ultrasound.

Position and Adoption Speed Justification: Real-time location in healthcare is used to track high-value medical assets such as intravenous infusion pumps, wheelchairs, pulse oximeters, specialized surgery tables and equipment, and computers on wheels. It is also used to track clinicians, care team members, patients in addition to trackable specimens such as tissue samples and blood. RTLS has increasingly become a routine component of everyday cost, patient throughput and quality initiatives. Healthcare providers globally are adopting the technology with most developed markets having at least one notable vendor to consider. Overall, vendors continue to vie for market

share and leadership and push for widespread adoption, while expanding their footprints of supporting applications and sensor technologies.

Vendors have responded to healthcare provider requirements by expanding their access point and tag architectures to allow for multiple or hybrid transmission types such as combining Bluetooth and infrared with Wi-Fi. This allows a single vendor to provide solutions for a broader set of healthcare provider use cases than in the past.

With the inclusion of people tracking, technologies such as Bluetooth low energy, and industry acceptance of RTLS, this Innovation Profile is holding steady at its pre-plateau position.

As this technology approaches mainstream adoption, it will most likely be absorbed into the Internet of Things in healthcare (IoT) set of standard capabilities. RTLS is well ahead of IoT on the Hype Cycle and, when combined, will move IoT forward on the cycle.

Most of the offerings in this market space are single-stack solutions, where vendors offer complete solutions from the tags through to the reporting systems. As the IoT platform matures, it is clear that the true value these systems provide is not derived from the raw data itself but from what systems do with the data. As competition increases, the various functional components of RTLS will define their own market space and align under IoT, IoT platforms, clinical event service buses and event listeners/responders. Clinical devices and data collection systems will publish data associated with events occurring in the care venue to a service bus. Various response systems will subscribe to the service bus for specific event types and subsequently process them according to their purpose, such as delivering geospatial location data to the appropriate systems and people.

User Advice: RTLS is foundational to the real-time health system operational paradigm:

- Larger hospitals and multihospital systems should be leveraging this technology now.

- Select from vendors that have extended their value from location detection to equipment inventory optimization, maintenance management and regulatory compliance.

- Total cost of ownership (TCO) evaluation for RTLS should include the appropriate allocation of shared and incremental (if needed) infrastructure (such as Wi-Fi and LAN). This infrastructure is needed to ensure the accuracy of the identified locations meet the desired business outcome. The TCO also includes tags, batteries, sensors, receivers, software/support, staff training and support, and managerial oversight to ensure the full potential impact of RTLS is realized.

Business Impact: RTLS improves timely clinician access to mobile equipment, improving its utilization, maintenance and management. It can also be used to aid in the management of IT assets and other fixed assets. It has significant benefits of increasing productivity and reducing costs for nursing staff and clinical engineering departments with the ability to identify the location in real time of a nurse or piece of equipment. Properly implemented RTLS can reduce the organization's total cost (including new purchase and rental costs) for equipment such as infusion pumps and wheelchairs (two of the most commonly tracked assets), and other biomedical and IT equipment.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: AiRISTA Flow; CenTrak; Impinj; Midmark; Siemens (Enlighted); Sonitor; STANLEY Healthcare

Recommended Reading:

"Strategic Roadmap to the Real-Time Health System"

"Industry Vision: The Real-Time Health System Transformation"

"The Promises and Pitfalls of People Tracking Within Healthcare Providers"

"Five Key Principles for Hospital Facility Planning in the Digital Age"

Medical Device Connectivity

Analysis By: Gregg Pessin

Definition: Medical device connectivity (MDC) systems connect medical devices and patient monitors to the electronic health record (EHR) system. They translate and transfer data between proprietary instrument formats to the input requirements of specific EHR systems. They provide data buffering during EHR downtime, can flag abnormal data, and provide a user interface (UI) for clinicians to review the data from the medical device or instrument.

Position and Adoption Speed Justification: MDC is a well-established technology that supports both low- and high-acuity devices such as infusion pumps and bedside monitors, as well as vital signs and oxygen saturation devices. MDC vendors provide, with their systems, extensive certification of specific instrument software releases. UIs are available for many classes of devices, including patient monitoring, infusion, respiratory care, anesthesia administration, and critical care monitoring. Device libraries continue to grow year over year.

Some vendors have already achieved substantial penetration of the global market through direct channels and remarketing by EHR vendors. Most major EHR vendors now have experience working with these products in various workflows. Device manufacturers are increasingly supportive because they realize that EHR integration affects the time to market for new instruments. In the U.S., many MDCs are regulated by the U.S. Food and Drug Administration (FDA) as medical device data systems (MDDSs). If the data that the MDDS transfers are used for continuous monitoring of a patient or immediate clinical decision making, then it is more strictly regulated. Under this regulation, manufacturers do not require premarket approval. Still, they must meet requirements for good manufacturing practices (GMP), including formally tracking problems and resolutions, collecting adverse events, and providing the FDA with an annual report of adverse events. These regulations apply to healthcare organizations that have built their own MDC software. Regulation requirements outside the U.S. vary by country. MDC vendors have also started to provide data from devices for analytics purposes.

We have positioned this technology at the end of the Hype Cycle (reflecting the U.S. position) because the usage of these products has been stable, as evidenced by continued low level of inquiries in 2019. However, non-U.S. HDOs are currently implementing integrated EHRs, so they are early in the implementation and use of this technology. Therefore, the adoption rate has been adjusted to 20% to 50% of target audience, and so it remains on the Hype Cycle.

As the IoT platform market matures, it is clear that the real value these systems provide is not derived from the raw data itself but from what systems do with the data. As competition grows for this capability set, the various functional components of MDC will define their own market space and align under IoT, IoT Platforms, clinical service buses, and event listeners/responders. Clinical devices and data collection systems will publish data associated with events occurring in the care venue to the service bus. Various response systems will subscribe to the service bus for specific event types and, subsequently, process them according to their purpose — such as delivering clinical alert notifications to the appropriate caregiver.

User Advice: HDO CIOs should:

- Obtain business sponsorship from nursing, critical care medicine, and biomedical engineering for an MDC project.

- Develop a pilot program and work with clinicians to determine business value and success by measuring the time until device data is available in the EHR system and the amount of nursing time required.

- Take note of nurse call integration requirements and alarm management issues.

- Review other integration capabilities between the MDC and existing (or planned) systems and medical devices.

Business Impact: Medical device connectivity:

- Allows clinicians to spend more time on direct patient care, providing demonstrable savings in nursing full-time-equivalent requirements.

- Improves the accuracy of charted vital signs and other respiratory and blood parameters.

- Enables near-real-time access to medical device data.

- Enables EHR-improved decision making and automated alerts.

- Provides a faster time to market for new instruments and more consistent instrument interactions with EHR systems.

- Introduces medical device integration into nursing workflows, which improves nursing efficiency, chart accuracy, and more timely use of decision support capabilities.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Bridge-Tech Medical; Capsule; CareTrends; Cerner; GE Healthcare; Masimo

Recommended Reading:
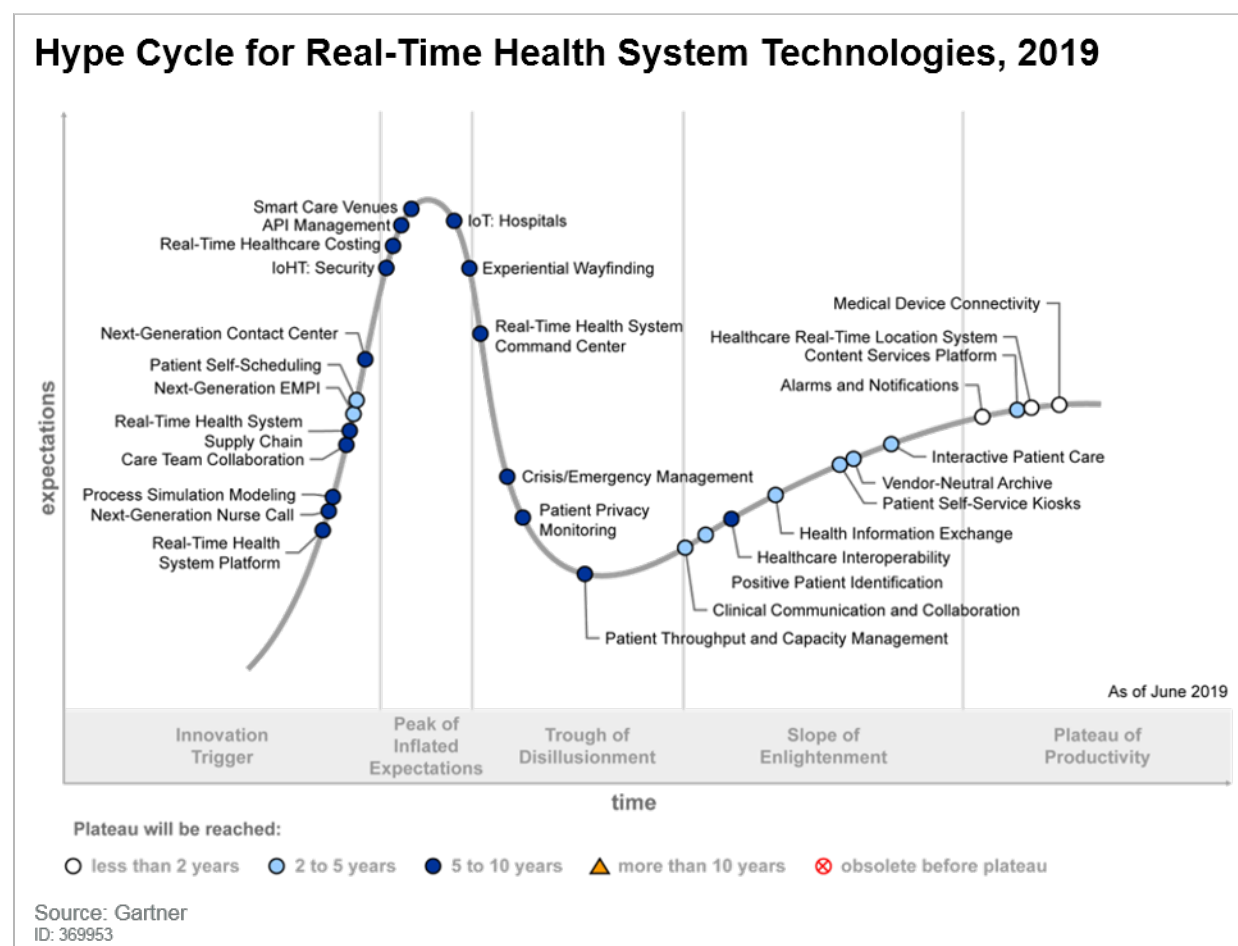
"Strategic Roadmap to the Real-Time Health System"

"HDO CIOs, Get Ready to Transform Your Alarms and Notification Systems Into IoT Platforms"

"Evolving IoT Security Risks Demand New Approaches From Healthcare Delivery Organizations"

"Healthcare Provider's Unique IoT Challenges Demand a Platform Strategy"

Appendixes

Figure 3. Hype Cycle for Real-Time Health System Technologies, 2019

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Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

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

Source: Gartner (July 2020)

Table 2. Benefit Ratings

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

Source: Gartner (July 2020)

Table 3. Maturity Levels

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

Source: Gartner (July 2020)

Gartner Recommended Reading

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

Understanding Gartner's Hype Cycles

The Hospital Will Become a Smart Machine

Business Drivers of Technology Decisions for Healthcare Providers, 2020

Future of Applications: Delivering the Composable Enterprise

Healthcare Innovation Trends: Reinventing Hospital Operations and Administration

The EHR Megasuite Oligopoly Will Result in Less Differentiation and Innovation — and Higher Total Cost of Ownership

The Real-Time Health System Vision Transformation

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