Hype Cycle for Digital Care Delivery Including Virtual Care, 2021

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Initiatives: Healthcare and Life Science Digital Transformation and Innovation

This Hype Cycle identifies and tracks digital innovations and market solutions for optimizing and transforming clinical capabilities within a healthcare provider. CIOs can use this research to assess the value and impact of new technologies that enable digital care delivery.

Analysis

What You Need to Know

Healthcare providers are changing both strategy and operations in response to business priorities such as cost optimization, higher consumer expectations and new funding models. For many, the transformation of clinical care is at the heart of a new strategic plan that will see a shift from traditional care venues, providers and business models. This shift comes as new market entrants offer a range of digital-first direct-to-consumer health and wellness services. Healthcare provider CIOs can use this Hype Cycle to gauge and select capabilities that will fulfill an ambitious digital care delivery (DCD) vision and roadmap.

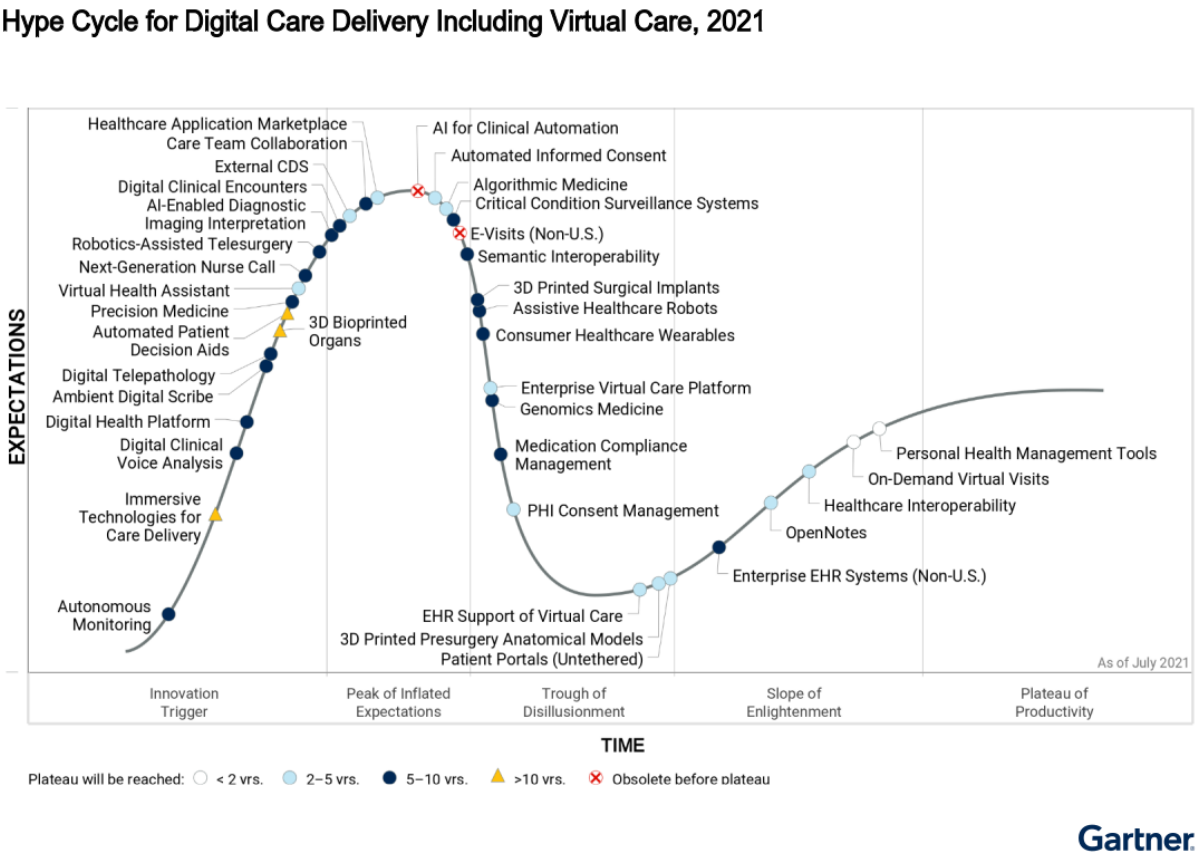
The Hype Cycle

This Hype Cycle covers a broad range of technologies that enable healthcare providers to optimize and transform clinical care delivery. Advanced analytics, artificial intelligence (AI) and virtualization of care are the foundation of many of the innovations — streamlining and transforming clinical workflows while reducing unwarranted variations in data capture and decision making. As a result, clinicians and patients are empowered to engage more effectively together, health outcomes are improved, and clinical productivity is increased.

Movement on the Hype Cycle continues to be influenced by the pandemic, as healthcare providers prioritize digital initiatives and investments to meet immediate business and clinical needs. Technologies supporting the virtualization of care, such as enterprise virtual care platforms, virtual health assistants and EHR support of virtual care, continue to move toward mainstream adoption, albeit at a less intense pace than last year. Remote patient monitoring reached mainstream adoption and matured off the Hype Cycle as did medical device connectivity. At the same time, progression of innovations not aligned to these immediate clinical needs slowed due to reduced interest and adoption capacity.

Autonomous monitoring is new to the Hype Cycle. Autonomous monitoring is the surveillance of patient and care team behavior using video and sensor technology, driving actions and interventions to ensure patient safety, care quality and compliance. The introduction of this innovation reflects a broader trend of increasing applications of automation to support care delivery. Because of this, we have marked AI for clinical automation as obsolete before plateau as these individual use cases evolve.

Figure 1: Hype Cycle for Digital Care Delivery Including Virtual Care, 2021



Source: Gartner (July 2021)

Downloadable graphic: Hype Cycle for Digital Care Delivery Including Virtual Care, 2021

The Priority Matrix

Innovations that leverage AI capabilities for clinical decision support and those that enable virtualization of care are profiles that Gartner believes will deliver high or transformational benefits. The majority of these will take longer than two years to reach mainstream adoption. In order to capitalize on the maturation of these technologies, CIOs should plan for adoption over the next five years as they promise the greatest clinical and operational impact.

Innovations in interoperability and application marketplaces enable a healthcare provider to drive value from existing investments at the same time as improving agility to respond to changing business and clinical needs. Healthcare provider CIOs should pay particular attention to the digital health platform. Although relatively nascent at this stage, the benefit will be transformational through its ability to address challenges associated with EHR-centric technologies, including interoperability, consumer and clinician experience, and automation. Familiarize yourself with the underlying concepts of the composable enterprise, and align procurement of new technologies to include requirements that will support your organization's efforts to build packaged business capabilities.

Table 1: Priority Matrix for Digital Care Delivery Including Virtual Care, 2021

(Enlarged table in Appendix)

Benefit	*Years to Mainstream Adoption*			
↓	*Less Than 2 Years* ↓	*2 - 5 Years* ↓	*5 - 10 Years* ↓	*More Than 10 Years* ↓
Transformational		Algorithmic Medicine	Autonomous Monitoring Care Team Collaboration Digital Clinical Encounters Digital Health Platform Genomics Medicine Next-Generation Nurse Call Precision Medicine	
High	On-Demand Virtual Visits	EHR Support of Virtual Care Healthcare Application Marketplace Healthcare Interoperability Patient Portals (Untethered) Virtual Health Assistant	3D Printed Surgical Implants AI-Enabled Diagnostic Imaging Interpretation Ambient Digital Scribe Critical Condition Surveillance Systems Digital Clinical Voice Analysis Enterprise EHR Systems (Non-U.S.) Semantic Interoperability	3D Bioprinted Organs
Moderate		3D Printed Presurgery Anatomical Models Automated Informed Consent Enterprise Virtual Care Platform External CDS OpenNotes PHI Consent Management	Assistive Healthcare Robots Consumer Healthcare Wearables Digital Telepathology Medication Compliance Management Robotics-Assisted Telesurgery	Automated Patient Decision Aids Immersive Technologies for Care Delivery
Low	Personal Health Management Tools			

Source: Gartner (June 2021)

Off the Hype Cycle

- **Remote Patient Monitoring.** Fueled, in part, by the COVID-19 pandemic, adoption of remote patient monitoring has accelerated over the last 18 months. As such, it has now reached mainstream adoption and matured off the Hype Cycle.
- **Medical Device Connectivity.** The specific software capability represented by this innovation has matured to the point of mainstream adoption and has been removed from the Hype Cycle. We expect to see these capabilities incorporated or evolve into IoT platforms for healthcare providers over time.
- **AI Healthcare Advisors.** The role of AI in healthcare has matured, and new and more relevant technologies have been introduced that encompass the value and use case of AI healthcare advisors. Those innovations include AI-enabled diagnostic imaging interpretation, precision medicine, precision health and genomics medicine.
- **Digital Speech Analysis for Clinical Diagnosis.** To more accurately reflect the capabilities of solutions and breadth of clinical applications, this innovation has been renamed to digital clinical voice analysis.
- **Eldercare-Assistive Robots.** This innovation has been renamed to assistive healthcare robots to include the broader value of assistive robots beyond eldercare.

On the Rise

Autonomous Monitoring

Analysis By: Barry Runyon

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Autonomous monitoring is the surveillance of patient and care team behavior using video and sensor technology. It uses AI and behavioral analytics to understand and act on real-time intelligence derived from human activity and their surroundings. This drives actions and interventions to ensure patient safety, care quality and compliance. Autonomous monitoring is unobtrusive and does not require those being observed to wear special tracking or monitoring devices to detect or ascertain behavior.

Why This Is Important

Autonomous monitoring of patient and care team activity, behaviors and surroundings enables:

- Situational awareness by monitoring current conditions
- Patient safety by alerting staff to potential problems
- Better care outcomes by detecting anomalous behavior or signs of deterioration
- Compliance by enforcing hygiene rules such as hand-washing
- Care coordination by streamlining care transitions and handoffs
- Asset utilization by locating hoarded medical equipment

Business Impact

Autonomous monitoring can positively affect:

- Key performance measures associated with care outcomes and patient/family perceptions

- Liability exposure associated with the security of high-risk patients
- Compliance adherence such as monitoring clinician hand-washing hygiene
- Asset management and utilization by identifying and locating scarce or hoarded equipment
- Labor costs by eliminating bedside sitters and efficiently using nursing resources
- Staff exposure during pandemics through remote monitoring

Drivers

- The need to reduce labor spend (largest contributor to hospital operating costs) by automating care delivery through digital transformation innovations and initiatives
- Increased interest in and acceptance of virtual care delivery options
- Persistent healthcare industry focus on patient safety mandates and risk management requirements
- Significant advancements in AI/ML, IoT, data science, smart device interoperability, behavioral analytics, full motion video and facial recognition technology, which have made autonomous monitoring of patient and clinician activity a realistic option. For these reasons, we have characterized this profile as an emerging technology with transformational potential.

Obstacles

- Unclear or unrealistic project or pilot expectations
- Technical limitations of AI/ML
- Patient privacy concerns and cultural issues with real-time video surveillance
- Limitations of image verification and recognition technologies
- Workflow integration challenges
- General staff skepticism and resistance

User Recommendations

- Draft autonomous monitoring business case and value proposition for leadership acceptance, approval and funding. Increase the likelihood of acceptance by aligning the autonomous monitoring value proposition with enterprise key performance indicators and quality measures, such as reducing fall risk and length of stay. Leverage experience and results from existing passive monitoring use cases such as telesitting.
- Create a multidisciplinary steering committee for governance and oversight by socializing the value proposition within the enterprise and among peers to identify potential allies and advocates.
- Identify potential care venues and high-level use cases that could benefit from autonomous monitoring. Begin by establishing a limited pilot with clear constraints, success criteria and time frames. Modify or expand pilot based on results measured against core industry measures.

Sample Vendors

AdhereTech; AvaSure; Biobeat; care.ai; Caregility; MySense

Gartner Recommended Reading

Real-Time Health System Vision

Moving AI to Production — Presentation on Healthcare Providers' Perspectives

Uncovering Artificial Intelligence Business Opportunities in Over 20 Industries and Business Domains

Cool Vendors in Enterprise AI Operationalization and Engineering

Immersive Technologies for Care Delivery

Analysis By: Pooja Singh, Mike Jones

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Immersive technology for care delivery is the application of virtual reality (VR), augmented reality (AR) and mixed reality (MR) technologies that provide patients and clinicians with an ability to experience, practice and prepare for real clinical interactions. It has applications in medical education and training, preparing patients for their treatments and clinical event simulation (like presurgical planning), and for improving patient experience, clinical diagnostics and treatment.

Why This Is Important

Immersive technologies have started to show promise with real-world examples and clinical evidence emerging of small-scale and innovative applications. Their early success in education and training surgical teams, as well as acting as an alternate treatment for distracting patients undergoing chemotherapy has drawn healthcare providers' interest.

Business Impact

AR, VR and MR have the potential to directly benefit the patients via use cases such as pain management, motor rehabilitation therapies and speeding patients' education about conditions or treatment plans. This technology helps clinical teams to streamline their traditional ways of learning via use cases such as medical simulation and presurgical planning. Applications in protecting frontline staff during COVID-19 and facilitating virtual care have also emerged.

Drivers

- During the COVID-19 pandemic, AR/VR adoption has received a positive push at an enterprise level across various industries as use cases for training, education and collaboration have increased (see Predicts 2021: Technological Innovation Becomes a Business Imperative).
- Use cases focusing on use of VR for virtual care have been gaining traction. For example, XRHealth partnered with Pico Interactive to provide VR Telehealth Kits, a combination of Pico headsets with preinstalled VR therapy so XRHealth clinicians can treat and monitor patients remotely. The vendor also raised $7 Million in April 2020 for expanding their VR telehealth platform.
- Examples of various health systems leveraging MR headsets for keeping frontline workers secure have emerged. For example, Imperial College Healthcare NHS Trust is using Microsoft HoloLens with Dynamics 365 Remote Assist, using Microsoft Teams to send a secure, live video feed to a computer screen in a nearby room. This allows healthcare teams to see everything the doctor treating COVID-19 patients can see while remaining at a safe distance. The approach is reducing the amount of time staff are spending in high-risk areas and usage of personal protective equipment (PPE).
- Vendors are tapping this opportunity, and making moves in order to position or introduce new products to support healthcare providers. For example, Microsoft introduced their Mesh platform, which gives users a cross-AR/VR meeting space to interact with other users, and collaborate in real time.
- Globally, venture capital investment in immersive technology and products continues to grow, but both the number of companies funded and the total deal count are declining (see Emerging Technologies: Venture Capital Growth Insights for Immersive Technologies).
- As per the above-listed drivers, this year, we have advanced this profile marginally as adoption rates are now between 1% and 5%. Time to mainstream adoption will be more than 10 years.

Obstacles

- High costs for head-mounted displays (HMDs), design, ease of usability and implementation are key challenges. Large academic medical centers lead in adoption, while other healthcare providers struggle to make a business case and secure funding.
- Designing personalized and attractive content for end users going through medical education or training is essential to increased adoption. Additionally factors such as poor user-centered design can often lead to reduced technology acceptance.
- Patients' attitudes, ages, willingness and weariness of potential side effects (like simulation sickness with VR) are potential barriers (see Challenges and Practical Considerations in Applying Virtual Reality in Medical Education and Treatment).
- The lack of sufficient body of evidence on clinical and cost-effectiveness further makes it difficult to draw investments. Most efforts so far have been small scale.

User Recommendations

- Follow academic literature, updates on regulations and the clinical community's acceptance of these technologies actively by engaging your early adopters with international consensus sources on best practices for the development and testing of VR treatments.
- Create a tightly scoped pilot project that evaluates the results in terms of patient or clinician benefits and experience, as well as ease of integration into clinical workflows.
- Evaluate contract terms, data privacy and security when patient- or clinician-identifiable information is traversing or being stored in a vendor cloud environment.

Sample Vendors

ImmersiveTouch; KindVR; Medtronic (Touch Surgery); Microsoft; MindMaze; Surgical Theater; Virtually Better; VR Education Holdings

Gartner Recommended Reading

Predicts 2021: Technological Innovation Becomes a Business Imperative

Emerging Technologies: Venture Capital Growth Insights for Immersive Technologies

Best Practices for Immersive Learning in Education

Digital Clinical Voice Analysis

Analysis By: Sharon Hakkennes, Sachin Dev

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Digital clinical voice analysis evaluates an individual's linguistic variables and vocal cues such as pitch, tone, pauses, word choices, speech rate and volume. These solutions are using artificial intelligence and machine learning to analyze voice patterns and codify voice biomarkers in order to noninvasively detect clinical abnormalities for clinical diagnosis and monitoring.

Why This Is Important

The characteristics of our voice and speech can be evaluated to screen for and monitor a growing list of clinical conditions. This includes behavioral health issues (including depression, psychosis, dementia and PTSD), Parkinson's disease, cardiovascular disease and lung disease, including COVID-19. Startup companies and researchers are leveraging technologies to find ways to detect abnormalities sooner and less invasively than traditional clinical assessments.

Business Impact

- Applications include predicting the onset, diagnosing and monitoring the progression of disease; measuring severity of symptoms; and monitoring response to treatment.
- Outcomes include supporting earlier detection of disease, more frequent monitoring and reducing reliance on highly specialized clinicians.
- Digital clinical voice analysis is noninvasive, affordable and can be completed in any location. Thus, solutions are highly scalable and ideally suited to support virtual care.

Drivers

This year, we have renamed this innovation profile from digital speech analysis for diagnosis to more accurately reflect the capabilities of solutions and breadth of clinical applications. Currently, clinical implementations of digital voice analysis remain largely restricted to research and small POCs at large academic medical centers. Key drivers impacting hype and adoption include:

- As a result of advances in technologies such as smartphones and home voice assistants, the enabling technology for accurate recording and real-time interpretation of the vocal data is now infinitely more available than ever before. That said, adoption remains limited at less than 1% of the target audience. The slow adoption of this technology is due, in part, to the limited availability of commercial solutions, with no FDA-approved solutions currently on the market.
- In the early stages of the pandemic, the hype around digital clinical voice analysis increased as vendors and researchers worked to identify voice biomarkers for COVID-19. Today, vendors such as Sonde and VocalisHealth have released commercially available solutions for COVID-19 screening. These solutions are enabling the identification of individuals at high risk of infection, supporting the triage process for testing and management.
- Over time, we predict that technologies to enable digital clinical voice analysis will become embedded as a core capability of healthcare chatbots and virtual health assistants. This evolution, combined with the continued extension and scaling of healthcare provider virtual care services, will be the catalyst for rapid scaling in adoption of this technology in the future.

Obstacles

Despite impressive early results and the obvious potential of these solutions, more proof of clinical effectiveness and clarity on regulatory approval are required. Key obstacles to widespread adoption include:

- The lack of large, characterized libraries of voice data from both well and disease-impacted individuals required for training and validating solutions. In particular, for integration into mainstream clinical practice, algorithms require validation on large diverse population datasets.
- Using software in place of physicians may result in lower payments, especially if clinician signoff becomes unnecessary.

- No solution will be 100% accurate; thus the clinical and legal ramifications of both false positive and false negative results must be accounted for. A false negative may result in a patient not seeking required medical care, and a false positive may result in unnecessary clinical testing and patient anxiety.

User Recommendations

Today, digital clinical voice analysis is a nascent technology; as such, healthcare provider CIOs should:

- Identify potential use cases by working with clinical leaders and CDOs, CNIOs and CMIOs to evaluate the current vendor landscape for alignment to clinical strategic priorities.
- Demonstrate both efficacy and practicality for identified use cases through small pilot projects in discrete clinical areas.
- Minimize risk associated with deployment of these solutions through early involvement of risk management to consider ethical, medical, legal and social issues — even in a pilot phase.

Sample Vendors

Canary Speech; Clarigent Health; Cordio Medical; Sonde; Telling.ai; Vocalis Health; Winterlight Labs

Gartner Recommended Reading

Innovation Insight for Natural Language Processing for Healthcare Provider CIOs

Solution Path for Building an Effective Technical AI Strategy

Infographic: Artificial Intelligence Use Case Prism for the Healthcare Provider Industry

Digital Health Platform

Analysis By: Mike Jones, Sharon Hakkennes

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

The digital health platform (DHP) is an architectural approach that enables healthcare providers to rapidly respond to external uncertainty and strategic change. This approach combines modern, cloud-first healthcare-specific applications and tools that encompass EHR data connectivity and powerful analytics with an ability to create application experiences tailored to specific, comprehensive use cases, workflows and user preferences.

Why This Is Important

The DHP directly addresses a major strategic issue for providers, where existing monolithic EHR-centric application architecture cannot meet changing patient, consumer and clinical workforce demands. The DHP architecture and emerging market solutions scale new digital capabilities and reduce digital friction through better end-user experiences. The DHP will reduce EHR total cost of ownership (TCO), liberate data for deeper insight, and deliver key clinical and cost outcomes.

Business Impact

- Increased resilience, adaptability and flexibility as organizational imperatives
- Increased value from current IT investments, and the ability to address capability gaps across the application portfolio (e.g., for care team collaboration and virtual care)
- Faster innovation and to help providers execute their digital roadmap by reducing reliance on low-value vendors
- Better business decisions through data and analytics, which improve insight at individual patient and population health levels

Drivers

- Pandemic disruption has required rapid innovation using new digital solutions. These include the need for on-demand virtual care, IoT for home-based patient monitoring, clinical collaboration tools and systems for remote, multiexperience patient engagement.
- Healthcare providers are now more open to innovative approaches from other industries to help recover and renew business and operating models. This has increased their appetite for modern platform architectures and enforcement of standards at national levels when forming digital health policies and procurement regulations.
- Organizations seek to transform the clinician experience to reduce the burden of IT and reduce burnout through automation and to optimize costs.
- The market for healthcare-specific solutions that support the DHP approach is accelerating.
- Adoption of industry standards, such as FHIR, among healthcare IT vendors is increasing as the need for application reuse, unmetered data access and improvements in interoperability is becoming an essential requirement for connected care.
- We have positioned this profile midway up the Innovation Trigger to reflect rapidly advancing maturity and expected market penetration by the leading DHP vendors such as Amazon, Google, Microsoft, Philips and Salesforce. These are companies that have industry experience, significant investment, and an existing mind and market share across regions. We expect the DHP to rise swiftly up and over the peak as drivers combine with the availability of regionally compliant, highly secure and available cloud SaaS and PaaS solutions.

Obstacles

- Regional legislation requires cloud vendors to adapt solution offerings for compliance, but may slow availability of solutions and require complex precontract evaluation·
- The need to increase IT funding streams to support SaaS and PaaS pricing models in an industry that has historically used capital for new investment
- Low API maturity and delays by incumbent vendors to participate in open data ecosystems
- Limited range of packaged business capabilities offered by DHP providers or third-party vendors
- Lack of robust healthcare specific standards and tools to enable the design and operation of a real-time data fabric
- Shortage of architectural skills and capabilities of healthcare IT teams to apply this approach
- Mindset among CIOs and executive sponsorship that retains focus on an EHR-first model for new investment
- Commercial limitations that prevent CIOs from holding incumbent vendors to account

User Recommendations

- Change mindsets and adopt composable thinking by socializing the DHP approach with key stakeholders.
- Evaluate where poor digital experience is a priority and needs to change across existing business capabilities.
- Conduct a review of the current application portfolio to determine where gaps in capability exist, or if there is a negative burden on clinical workflow.
- Form fusion teams with SMEs from the highest-priority business units.
- Ensure common objectives are agreed upon and reflected in team goals.
- Evaluate DHP vendors on the basis of cost, capability and how their solutions fit with your existing licensing models for integration (e.g., in terms of open APIs) and across core I&O.
- Build DHP technical foundations by adopting an application strategy that is modular, composable and resilient.
- Apply the Gartner Composability Business Index to assess composability of current applications.

Sample Vendors

Amazon (AWS); Appian; Better; GE Healthcare; Google; InterSystems; Microsoft; Optum; Philips; Salesforce;

Gartner Recommended Reading

Future of Applications: Delivering the Composable Enterprise

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

Toolkit: Composable Business Index From the 2020 Gartner IT Symposium/Xpo Keynote

Tool: Healthcare Provider CIO Executive Presentation for a Composable Digital Health Initiative

Toolkit: Product Leaders' Guide to Meeting Healthcare Providers' Composable Business Needs

Establish Interoperable Application Ecosystems Early in Your Composable Healthcare Provider Roadmap

Creating the Composable Healthcare Organization for Healthcare and Life Science CIOs

Tool: Healthcare and Life Science CIOs Executive Presentation for Composable Data and Analytics

Ambient Digital Scribe

Analysis By: Sharon Hakkennes

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Ambient digital scribes are intelligent documentation support systems that leverage speech recognition, natural language processing (NLP), artificial intelligence (AI) and machine learning (ML) to automate documentation of the spoken aspects of a clinical encounter. These solutions use ambient listening and speech recognition technology to convert captured audio to text. Relevant information from the clinical encounter is extracted and summarized before being uploaded to the EHR.

Why This Is Important

The introduction of EHRs has increased the burden of documentation and is associated with negative impacts on work-life balance and clinician burnout. Physicians are spending double the amount of time at the computer than with patients. Ambient digital scribes replace clinicians and human scribes with technology by automating clinical documentation in the EHR. Many solutions also include virtual assistant technology, deploying voice user interfaces for EHR navigation.

Business Impact

Ambient digital scribes promise a number of benefits:

- Reducing time spent on clinical documentation and increasing the timeliness, completeness and accuracy of notes

- Addressing issues of clinician burnout associated with documentation and increasing the time available for clinicians to spend with patients, thereby improving engagement
- Supporting the move to value-based care models, which rely heavily on clinical documentation to identify gaps in care and inform shared savings payments

Drivers

There is a steady client interest in ambient digital scribes as HDOs explore potential use cases and value across their organizations. Availability and maturity of solutions are currently driving hype and adoption, including:

- Launch of Cerner's virtual scribe solution (September 2020): The solution was developed in partnership with Amazon Web Services. Through ambient listening of a clinical encounter, the virtual scribe captures the dialogue in text form, translating the concepts and delivering them as suggestions to the clinician for entry into the codified component of the Cerner EHR. The solution is currently in beta testing across a number of clients.
- Acquisition of Seattle-based startup Saykara by Nuance (February 2021): Saykara's voice-enabled assistant Kara is accessed via a mobile app to ambiently listen to conversations between physicians and patients to automate clinical documentation, including the generation of notes, orders and referrals.
- Integration of ambient digital scribe solutions into video-based platforms for virtual care: For example, there is the integration of the Nuance Dragon Ambient eXperience (DAX) solution into Microsoft Teams.

Obstacles

Currently available solutions rely on a quality check process that is performed by a human before the note is presented to the clinician for review and signoff. Commercial solutions are only available in the U.S., and we predict mainstream adoption will be closer to 10 years. This is due to a number of complexities, including:

- Availability and access to significant volumes of high-quality, context-specific, annotated data for training to increase the accuracy of solutions are limited.
- Underlying models must be trained by specialty, specific to language spoken and global variations in healthcare delivery models.

- Current solutions are limited to ambulatory settings, and it will be some years before they will be able to overcome the additional challenges, such as background noise, and complexities of the acute care environment.
- Ambient digital scribes capture the entire clinical encounter, raising privacy, ethical and legal concerns, which must be addressed prior to implementation.

User Recommendations

- Identify potential use cases for ambient digital scribes across your organization by actively engaging with the CMIO/CNIO and clinical leaders. Start with targeted specialty areas to run proofs of concept, using lessons from early trials to scale over time.
- Ensure deployment of ambient digital scribes delivers quantifiable benefits by developing an evaluation framework, including both operational and clinical measures. Align these KPIs with organizational, operational and strategic goals, including quality-of-care measures.
- Address privacy, ethical and legal concerns by enabling robust discussion and debate with legal, clinical and operational leaders. Develop policies and processes that deal with issues of consent, data ownership, retention and secondary use.
- Non-U.S. CIOs should prepare for the availability of ambient digital scribes by actively monitoring the market and evaluating outcomes of published case studies for alignment with local requirements.

Sample Vendors

3M; Cerner; DeepScribe; Nuance; Robin Healthcare; SoundLines

Gartner Recommended Reading

Voice-Enable Your EHR to Improve Clinician Experience and Reduce Burnout

Innovation Insight for Natural Language Processing for Healthcare Provider CIOs

Best-Practice Framework for Realizing Healthcare Provider Value Across the EHR Life Cycle

Digital Telepathology

Analysis By: Mike Jones

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Digital telepathology (DT) enables the remote viewing and manipulation of digitized laboratory specimens for clinical purposes. It contributes to a pathology workflow by creating a digital specimen. DT uses microscopic array technology to produce a 3D representation of the slide for remote viewing and automated image analysis.

Why This Is Important

Telepathology has shown promise by enabling hospitals to take advantage of remote specialist expertise without the need for the physical transfer of specimens and slides. Digital telepathology goes one step further by allowing an entire slide to be digitized and made fully available at a remote site. Digitization also permits AI image interpretation to improve speed, quality and accuracy of pathology reporting.

Business Impact

- Support for clinicians to provide accurate diagnoses.
- Eased processes when obtaining second opinions.
- Increased productivity since digitized specimens can be analyzed by trained AI platforms.
- Reduced pathology costs by outsourcing reading to lower-cost labs.
- Improved access to expert clinical advice for remote sites
- Ability to flex capacity.·
- We have positioned this higher up the Innovation Trigger due to recent efforts to create an international COVID-19 digital pathology repository.

Drivers

- Certain regions, such Canada and the European Union (EU), now permit use of digital telepathology for primary diagnosis. This builds on the U.S. Food and Drug Administration's (FDA's) approval of the first system for one "whole slide imaging" device for primary diagnostic use four years ago.
- Whole slide imaging enables the digitization of entire tissue slides and is a necessary first step for a wide array of digital diagnostic and advanced analytical tools to enter the field of pathology.
- Evidence now indicates steady adoption for secondary diagnosis is below 20% for U.S. labs, with use for primary diagnosis still at around 2% (see Clinical Lab Manager).
- More recently, an online COVID-19 digital pathology repository has been established at the National Institutes of Health in the U.S. to help in the fight against COVID-19.
- Advancement in cloud-based technology for AI-enabled diagnostic imaging interoperation and process automation has increased the expected ROI of these solutions.

Obstacles

- Regulatory constraints that prevent the use for primary diagnosis in some regions.
- Initial costs and prodigious data storage requirements since digital slides can be 500MB even after a 30-to-1 compression. Moreover, because hospitals are typically required to retain the glass slides, digital telepathology does not free up space for other uses in the same way picture archiving and communication systems (PACS) did for radiology departments.
- Lack of clinician familiarity with the technology at the outset can delay adoption to mainstream.
- Cost optimization drives in healthcare providers as a result of COVID-19 will likely limit investment unless clear ROI has been proven elsewhere.
- While most digital pathology manufacturers can support a HIPAA-compliant solution by encrypting PHI-sensitive metadata such as slide label, hospital, patient, case and specimen information, there are still questions of data residency for hosted solutions.

User Recommendations

- Explore the potential of digital telepathology for remote diagnosis, as well as for research and education.
- Evaluate new entrants on the basis of total cost of ownership (TCO) and likely ROI based on a comparison with current staffing complement, machinery and materials costs of providing pathology services using traditional film; and on data residency and information governance compliance (e.g., HIPAA, GDPR) for any hosted solutions.

Sample Vendors

Inspirata (Omnyx); Leica Biosystems; MetaSystems; Meyer Instruments; Philips; Roche

Gartner Recommended Reading

Emerging Technologies and Trends Impact Radar: Security for Healthcare Providers

Future of Work Trends Watch: Healthcare Industry

2021 Business Drivers for Healthcare Provider CIOs

Industry Insights: 2021 Healthcare Providers' Agenda

3D Bioprinted Organs

Analysis By: Pooja Singh, Sharon Hakkennes

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

3D bioprinted organs are living tissue products that function like human organs. Product components include imaging data, design software and 3D printing (3DP) devices. The two main opportunities for these are in life science R&D and human transplants. The latter is the subject of this profile.

Why This Is Important

With the help of 3D bioprinted organs, healthcare providers can eventually help reduce the long waiting lists for patients waiting for an organ transplant. For example, today the average time for a liver transplant ranges between five to six months and up to three years for kidney transplant. The technology offers potential to save lives by providing treatments to patients in need of a transplant when a human donor is not available.

Business Impact

- Alternate approach to solving the existing human organ transplant process because 3D bioprinted organs will shorten the waiting period for patients to receive a transplant.
- Reduced chances of organ rejection by bioprinted organs made from the patient's own tissue, further reducing costs of a lifetime of anti-rejection drugs.
- Many of the emerging use cases are for limited or rare scenarios, but over time the total impact on medicine will be significant as additional use cases become viable.

Drivers

- Researchers at Lund University in Sweden have designed a new bioink which allows small human-sized airways to be 3D-bioprinted with the help of patient cells for the first time. The 3D-printed constructs are biocompatible and support new blood vessel growth into the transplanted material.
- Carnegie Mellon University has developed the Freefrom Reversible Embedding of Suspended Hydrogels (FRESH) 3D bioprinting approach, which solves the issue of gravity and distortion by printing, which is commonly observed when printing complex biological systems.
- Researchers at University at Buffalo have developed a 3D-printing method based on stereolithography that uses hydrogels to produce human organs in less than 20 minutes. They leverage fast hydrogel stereolithography printing (FLOAT), which allows for the creation of a centimeter-sized, multiscale solid hydrogel model within minutes.
- One of the vendors in the space, 3D systems, announced expansion of their Regenerative Medicine Initiative after success of their next-generation additive manufacturing platform solution for lung scaffolds that is capable of full size, vascularized, rapid, micron-level printing.
- Use cases are emerging, such as use of 3D bioprinting for tissue repair at the wound site, or using 3D bioprinting for creating mini brain organoid models for understanding human biology. This includes the modeling of the human blood-brain barrier for brain disorders, such as Alzheimer's disease and deadly cancers, such as glioblastoma.
- Based on the recent developments, we are progressing this profile marginally this year. Time to mainstream adoption will be in more than 10 years.

Obstacles

- To date, the majority of 3D bioprinted organs compose a basic vasculature, and are generally small in size, mini organs. The real potential will be realized when 3D bioprinting can create sustainable large organs, with networks of blood vessels.
- Adoption rates of actual organ products are still highly speculative, the key challenge is lack of viability, real-world availability for use in humans.
- Complexities around how to test how well the organs will integrate in the body (avoiding rejection issues) and how to test and prove the long-term viability and effect of the organs.
- Complex regulatory, ethical and adoption issues.
- Finally, profound potential business and funding impacts will arise when all the other challenges are finally conquered.

User Recommendations

- 3D bioprinted organs are more a major emerging life science technology than “classic” healthcare IT. Given this, the advice to most healthcare provider CIOs, CMIOs and medical leaders is to monitor advances in 3D bioprinting and other technologies to identify potential use cases as the technology evolves.
- CIOs supporting life science companies and academic medical centers that lead in these investigations must support R&D efforts to develop 3D bioprinting techniques.
- Early instantiations of 3D bioprinting organ transplants are likely to be delivered by remote manufacturing services.
- CIOs must be prepared to support exchanges of design parameters (patient and imaging data transmitted in a different context), unique tracking in the supply chain and documenting transplanted custom organ data of a different nature in the EHR associated with this scenario.

Sample Vendors

3D Bioprinting Solutions; Allevi; Organovo; Prellis Biologics; Regenovo Biotechnology; Wake Forest Institute for Regenerative Medicine; Wyss Institute

Gartner Recommended Reading

Predicts 2019: 3D Printing Accelerates, While 4D Printing Is Getting Started

Automated Patient Decision Aids

Analysis By: Veronica Walk

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Definition:

Automated patient decision aids (APDAs) are software-based, complex interactive systems that use computational logic and AI to help patients make better-informed health decisions aligned with their personal values and preferences. ADPAs provide the patient with access to evidence-based insight, probabilities and scenario analyses personalized to their unique needs. These aids may include triage, diagnostic and treatment options, end-of-life choices, and first-pass genetic counseling.

Why This Is Important

The precursor to APDAs are patient decision aids (PDAs) that inform patients about alternative treatments along with their benefits, risks and costs. However, PDAs lack automation and require considerable guidance from clinicians to support individual decision making. The advanced capabilities of APDAs empower patients to understand their personalized options and guide patients more independently through the decision-making process.

Business Impact

Healthcare payers and providers can use ADPAs to improve patient:

- Engagement through increased knowledge about their condition, choices and accuracy of their risk perceptions.
- Interactions with clinicians by narrowing complex decisions to the critical issues and facilitating shared decision making.
- Satisfaction and loyalty by taking into consideration patients' values and preferences in the context of their healthcare decisions.

Drivers

- Shared decision-making (SDM) in healthcare has been shown to improve patient satisfaction and outcomes and remains a key objective of patient-centered care initiatives.
- The COVID-19 pandemic has increased patient and provider openness to the concept of ADPAs for primary care and triage. For example, many organizations implemented self-triage solutions as part of their patient portal or website to help patients determine whether they needed to be tested for COVID-19, self-quarantine or seek medical treatment.
- Although decision aids have broad benefits for engaging and empowering patients, we continue to see slow progress along the Hype Cycle for APDAs.

Obstacles

- Traditional PDAs are not widely adopted to facilitate SDM, and ADPAs remain more of a research interest rather than commercial interest.
- The use of robust AI-driven APDA integrated within a clinical pathway is still experimental and triggers concerns over the ethical use of artificial intelligence (AI) in clinical decision support (CDS) and SDM.
- Barriers to adoption include relatively immature products, healthcare providers' competing priorities, payment issues and legal concerns.
- Lack of integration with other clinical workflows and solutions, such as the enterprise electronic health record (EHR), consumer engagement, and care management systems also impeded adoption.
- Patient barriers include a lack of trust in automated systems, lack of personalization and perceptions about quality.

User Recommendations

If you are CIO of a digitally progressive organization with mature patient engagement strategies:

- Pilot ADPAs by engaging with clinical colleagues to identify the right use cases and explore adoption challenges.

- Encourage adoption in your organization by coaching clinicians on how to use APDAs and how to communicate with patients during discussions of their informed preferences.

- Minimize digital friction by incorporating ADPAs into your overall patient engagement strategies and platforms, such as your digital front door or patient portal.

- Increase clinician engagement and support for these solutions by integrating within clinical workflows, such as the EHR.

Sample Vendors

EBSCO; Health Dialog; Healthwise; Optum; Wolters Kluwer

Gartner Recommended Reading

Create Connected Care Pathways That Bridge Consumer and Healthcare Provider Activities

Healthcare Provider CIOs: Bridge the Virtual Care Divide Between Provider- and Consumer-Directed Care

Precision Medicine

Analysis By: Sachin Dev, Mike Jones

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Precision medicine improves health outcomes by precisely diagnosing and treating a disease condition or its prevention. It leverages individual factors of the disease, such as physiology and genomic indicators, and patient factors, such as social determinants of health and lifestyle. Precision medicine technology orients this data in context for clinical diagnosis and treatment protocols — thus integrating EHR, PHM, genomics, labs, images, treatment protocols and other digital data sources.

Why This Is Important

Precision medicine has the potential to transform medicine and significantly improve health outcomes.

As the underlying technologies mature, precision medicine will become prevalent — even pervasive — in clinical practice and complex disease treatment (for example, creating a targeted treatment plan in cancer patients). To remain competitive, HDOs must adopt these technologies to bring precision insights to clinical diagnosis and treatment, and bridge clinical decisions into care delivery.

Business Impact

Precision medicine has the potential to transform clinical medical decision making and to enable mass personalization of consumer healthcare engagement. It will likely drive the majority of healthcare delivery and targeted clinical decision support by 2026. HDOs are reporting its yield in terms of significantly reducing incidences of medical diagnosis error, better patient outcomes, reduction in treatment variability and ultimately leading to reduction in total cost of care.

Drivers

- Technology and research advancements as well as product innovations are sustaining the growth of precision medicine adoption.
- Many new treatments designed to target a specific change are used globally, and more use cases are being tested right now in precision medicine clinical trials.
- Advancements in genomics plus the inclusion of genomic data with clinical data helped curate an expanded knowledge base. This helped gain the clinical community's confidence, ultimately leading to more commercialization of precision medicine technology in the last two years.
- The field is gaining new insights into disease origins, which drugs work in which patients, which therapies are effective given an individual patient's profile and how various diseases respond to efforts to combat them.
- Precision medicine technologies provide a manageable context to align the scientific, genomic and phenotypic data, and other data about the disease and patient to enable precision medicine at scale. This enables the systemic use of information in care delivery processes, integrated with EHR and other tools within the care delivery workflow, and enables the primary benefits of precision medicine.
- Gartner is observing transitions from custom approaches to more scalable platform-based approaches, integration of data and analytics, and diagnosis and treatment decisions driving the demand from HDOs.

For these reasons, we cautiously advance precision medicine closer to the peak on the Hype Cycle, and also adjust our forecast of time to mainstream adoption from more than 10 years to five to 10 years.

Obstacles

- Precision medicine at scale is unevenly accelerating. Oncology is an early adopter, while other areas of medicine are closely following the development of additional approved diagnostic and therapeutic use cases in their respective field.
- Regulatory requirements and government agency approvals slow approval and adoption in heavily regulated markets. However, there are a number of use cases of precision medicine globally, especially in self-regulated or unregulated nations.
- While we observed some great advancement this year, ongoing challenges continue with the speed of new scientific discoveries beyond oncology. These challenges include technology adoption, cost and reimbursement of genomic sequencing, EHR integration, and managing the volume of data required to truly deliver precision medicine.

User Recommendations

- Assess the preparedness of your organizational clinical data collection and analysis strategy. Precision medicine relies on effective, efficient and actionable patient data collection and the analysis and assessment of that data to arrive at a precise diagnosis and treatment.
- Adopt a forward-looking healthcare analytics architecture. CIOs must lead the move toward the enterprise architecture, workflow and decision support design, and new partnerships that enable precision medicine analysis.
- Prepare IT architecture to accept a diverse array of patient information sourced from genomics, mobile apps and devices, wearables, patient-reported data, social determinants of health, and other sources. Similarly, CIOs should engage a data broker or medical hub partner for patient data collection and assess vendors that provide precision platforms built on open technology and aid cognitive support at the point of care.

Sample Vendors

2bPrecise; BC Platforms (GeneVision); IBM (Watson); Orion Health; Philips; Syapse; Tempus

Gartner Recommended Reading

Healthcare and Life Science CIO's Genomics Series: Part 1 — Understanding the Business Value of Omics Data

Virtual Health Assistant

Analysis By: Kate McCarthy, Sachin Dev

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Virtual health assistants (VHAs) are specialized virtual assistants, which are conversational interfaces that use semantic and machine learning to assist people or automate tasks. VHAs apply this technology to enable healthcare and life science consumers to digitally engage with their health and wellness. VHAs incorporate a broad range of use cases for digital encounters including chronic condition management, medication compliance, triage, and health and wellness routines.

Why This Is Important

COVID-19 accelerated use of digital touchpoints, and virtual assistants specifically, across industries. VHAs, which are specific to the complexities of health and wellness, have better context models and deeper integration with business applications and back-end systems compared to basic chatbots. They can be deployed to help manage consumer engagement for chronic and acute condition management, wayfinding, clinical trials, medication therapy management, and health and wellness coaching.

Business Impact

- VHAs are designed to help healthcare consumers improve health and wellness compliance and outcomes.
- VHAs often initiate an interaction to remind the consumer to perform an activity — such as taking a glucose or blood pressure reading, recording weight, or taking a medication.
- VHAs are a necessary touchpoint for healthcare and life science organizations seeking to improve digital consumer engagement strategies.

Drivers

- VHAs have become a primary mechanism to triage and contact trace COVID-19. The data and information collected is remotely monitored, often in command or virtual care monitoring centers, and can trigger alerts, recommend actions and a remote encounter with the appropriate clinician if needed.
- VHAs are marketed to payers, providers, life science companies and employers for use cases ranging from COVID-19 risk mitigation, virtual behavioral health, chronic disease management, wayfinding and clinical trials.
- VHAs are a strong means to improve patient adherence to care plans and outcomes, lower cost, reduce adverse or unplanned events, and increase consumer satisfaction by: (1) increasing productivity and time to care for clinicians and improved recruitment and retention in clinical trials because of automation; (2) rendering real-time insight into consumers' vitals, activities, behaviors and attitudinal preferences for more immediate, personalized interventions; (3) improving engagement and access to healthcare advice and guidance for condition or treatment management; and (4) providing a more positive people-literate tactile consumer experience for many administrative and transactional tasks that are essential for medication and care plan compliance.
- As VHAs mature, they are increasingly able to initiate a conversation and pick up moods using sentiment analysis, which will be critical for consumer engagement.

Obstacles

- Healthcare and life science organizations continue to lag other industries in digital maturity in consumer-facing capabilities. To overcome adoption barriers, leading organizations incorporate VHAs into their larger multiexperience consumer engagement strategies to yield greatest value to the business and consumer.
- Data orchestration remains challenging across disparate systems. Leading organizations prioritize their data fabric to ensure employees, users and consumers have access to the right information at the right time to execute informed next best actions. VHAs should be one touchpoint of many available to engage consumers, employees and users.
- Due to the increased interest and adoption, we continue to advance this profile to the midpoint between the Innovation Trigger and Peak of Inflated Expectations, and continue the benefit rating as high. We expect this to be a rapidly maturing technology capability and now project VHAs to reach the Plateau of Productivity on the later side of two to five years.

User Recommendations

- Create personas and journey maps for key consumers and users to identify moments of friction that represent high-value use cases for VHAs.
- Actively engage clinicians in user testing and experience design to ensure usability and engagement.
- Counter any resistance by having a robust plan (training, awareness), and ensure your workforce that the technology is to augment their job, not take it away,
- Monitor the direction of the electronic health record vendors and their intersection with the personal health record.
- Identify the regional privacy regulation for countries when piloting on live patients. For example, how and where do the apps collect, store and reuse data as many of these will be cloud and mobile device enabled.

Sample Vendors

Avaamo; Babylon; Medocity; Openstream; Orbita; Sensely; Verint Next IT

Gartner Recommended Reading

Case Study: Automation With Intelligent Virtual Assistant (Humana)

Healthcare Provider CIOs: Bridge the Virtual Care Divide Between Provider- and Consumer-Directed Care

Innovation Insight for Consumer Experiences in Healthcare and Life Sciences

Emerging Technologies: Emergence Cycle for NLP Intelligent Interfaces and Virtual Assistants

Next-Generation Nurse Call

Analysis By: Barry Runyon

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Patients use nurse call systems to communicate with the care team in case of discomfort, pain or emergency. Nurses use them to communicate with one another and other care team members. Conventional nurse call includes master consoles, pillow speakers, pull stations and corridor lights, and integrates with alarms and notification platforms. Next-generation nurse call systems extend nurse call's reach through mobility and interoperate with systems within the care team collaboration ecosystem.

Why This Is Important

A nurse call system is, first and foremost, a patient safety measure. The conventional nurse call value proposition is based on optimizing care team response times. Next-generation nurse call systems are focused on improving care quality and patient experience. In the U.S., nurse call systems are tested against the provisions of UL 1069, the "Standard for Hospital Signaling and Nurse Call Equipment." Most states require nurse call systems to be UL 1069-listed.

Business Impact

The healthcare provider industry has an abiding need for nurse call capabilities:

- With advances in interoperability, mobility, IoT and cloud computing, more agile ways are emerging to satisfy nurse call requirements.

- The significant overlap between nurse call and other point-of-care solutions has created new market disruptions, opportunities, and workflow and technology convergence that CIOs and nursing leadership should begin to exploit.

Drivers

- Increased focus on outcomes and patient experience quality measures.
- Merger and acquisition activity in the hospital market is driving nurse call consolidation and standardization.
- UL 1069 is a global standard for this technology and most U.S. states require hospitals, rehabilitation and long-term care facilities to implement compliant nurse call systems for licensing purposes.
- Mobile communication and collaboration platforms that do not fall under UL 1069 certification requirements have begun to extend and redefine the nurse call space.
- Recent advances in interoperability and open API adoption have made it possible to deliver nurse call capabilities outside of conventional nurse call platforms.
- Persistent care collaboration and coordination issues will demand more agile and cost-effective nurse call alternatives.
- The need to address clinician burnout with systems that intelligently route communications to the right care team members.
- The “nurse call” moniker is a legacy artifact and no longer represents the role of nurse call within the healthcare provider.

Obstacles

- UL 1069 certification will continue to be a barrier to innovation and will be revisited to reflect the need for more than protection from electronic component failure.
- Loyalty to the incumbent vendor and organizational resistance to change.
- The nurse call budget is often held by the hospital facilities and clinical engineering groups — not nursing operations staff who most benefit from nurse call innovation.
- Small innovative nurse call solution vendors are not seriously considered by university medical centers, integrated delivery networks and larger hospital systems.
- Changing and upgrading nurse call systems and vendors is an expensive and disruptive process.

User Recommendations

- Look beyond conventional nurse call platforms to determine whether other point-of-care systems can provide nurse call capabilities. In the near term, this will be done in concert with traditional nurse call systems.
- Investigate functional alternatives to nurse call systems. Consider combining clinical communication and collaboration capabilities, interactive patient care, and alarms and notifications platforms through middleware and other real-time health system technologies.
- Delay refreshing your nurse call system until you have a firm grasp of patient and care team communication and collaboration requirements in light of new care delivery models. Purchase only as much nurse call as you need to satisfy licensing and quality mandates.

Sample Vendors

Ascom; Critical Alert; Hillrom; Rauland

Gartner Recommended Reading

Is Nurse Call Still Necessary?

Innovation Insight for Care Team Collaboration

Clinical Communication and Collaboration System Core Capabilities

Establish Interoperable Application Ecosystems Early in Your Composable Healthcare Provider Roadmap

Robotics-Assisted Telesurgery

Analysis By: Sharon Hakkennes, Mike Jones

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Robotics-assisted telesurgery is defined as a surgical procedure carried out by a human surgeon from a distance utilizing surgical robotic technology, high-bandwidth telecommunications and shared visual interactive presence. Robotics and software steady the surgeon's hand movements and translate them into the movements of a remote robot.

Why This Is Important

Robotics-assisted telesurgery seeks to virtually create the presence of a remote surgeon at the patient's operating table, using a robot, with an on-site surgical team available to take over manually in case a problem occurs. Telesurgery can enable access to specialist surgical care in circumstances where it would otherwise be unattainable such as in remote areas, developing countries, military settings and surgical emergencies.

Business Impact

Despite the many barriers and limitations, robotics-assisted telesurgery holds substantial long-term promise, including:

- The ability to provide high-quality surgery to underserved medical locations including remote areas, military and developing nations.
- Improved quality of care and patient outcomes.
- Increased efficiency through the elimination of long-distance travel for surgery.
- Real-time collaboration across surgeons in different locations.

Drivers

Hype regarding robotics-assisted surgery is currently being driven by reports of successful pilots and advances in enabling technology. This includes:

- The Apex Heart Institute in India successfully performed remote robotics-assisted percutaneous coronary intervention on five patients with coronary artery disease with the surgeon located 20 miles away from the patient.
- The potential for the implementation of 5G technology with its low latency, high reliability and high bandwidth to address issues relating to latency. For example, doctors in China have successfully performed remote robot-assisted spinal surgery on 12 patients over a 5G network. 5G networks have also been used in Italy to perform laser microsurgery from 15 kilometers away on a synthetic larynx and in the U.S. to perform remote coronary procedures from over approximately 3,000 miles away.
- Consistent improvements in the robotics technology, including developments in the field of haptics, which are increasing tactile feedback to the surgeon.

Obstacles

Robotics-assisted telesurgery remains a nascent application, predicted to reach mainstream adoption within 10 years, possibly sooner in some clinical scenarios, such as cardiac stenting; prostrate, kidney and bladder removal; and tumor excision. Many barriers to adoption remain including:

- The lack of fully developed training programs and standard operating protocols.
- Complex negotiation around funding and medicolegal liability across jurisdictional boundaries.
- Lack of medical advocacy and stakeholder support due to insufficient evidence regarding safety and clinical outcomes.
- Cost. Surgical robots remain expensive, including the initial purchase, consumables and repairs, and maintenance. As a result, proving return on investment is challenging.
- Technical limitations, including latency, the time delay in transferring auditory, visual and even tactile feedback between the two distant locations, often attributed to network reliability, routing, congestion and overload.

User Recommendations

To prepare for future applications of robotics-assisted telesurgery, healthcare provider CIOs, chief medical informatics officers and clinical leaders should:

- Keep an eye on the expanding vendor landscape for minimally invasive robotics-assisted surgery and interventional cardiology, watching for indications that the technology is advancing.
- Explore opportunities to pilot in the context of a research study or in use cases where surgical resources are limited, interventions require extreme urgency, travel is extremely difficult, and the technology can be deployed and supported, such as in military theaters.
- Assess the medicolegal implications and risks that telesurgery poses, including standards for training programs and clinical protocols.
- Evaluate the communications infrastructure that will be necessary to enable telesurgery, including high-speed 5G communication networks with less latency and jitter; reliable power; and smaller, lighter and more efficient telesurgery robots.

Sample Vendors

Asensus; Intuitive; Johnson & Johnson; Medrobotics; Medtronic; Siemens Healthineers; Stryker; Titan Medical

Gartner Recommended Reading

Healthcare and Life Science Business Driver: Medical Technology Innovation

Innovation Opportunities Will Be Enabled as 5G Evolves Through 2025

At the Peak

AI-Enabled Diagnostic Imaging Interpretation

Analysis By: Pooja Singh, Sachin Dev

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

AI-enabled diagnostic imaging interpretation uses deep learning techniques, machine learning (ML) and categorization technology on large sets of medical images in order to create workflows and algorithms that allow for faster and more accurate image interpretation. AI-enabled interpretation can be applied to many radiological procedures, such as X-ray studies, magnetic resonance imaging (MRI) exams and computed tomography (CT) scans.

Why This Is Important

Radiology images are a significant component of a patient's health information. As the number of images that require analysis and reporting per patient is growing, global concerns around shortages of radiologists, radiologist burnout and chances of misdiagnosis are rising. AI-enabled solutions can augment radiologists, prescreening large numbers of images, helping clinicians prioritize their workloads and redirecting their attention to the images that are most urgent.

Business Impact

- AI-enabled diagnostic image interpretation helps reduce the read time by highlighting and drawing readers' attention to the abnormality in the image. This assistance helps reduce radiologist burnout.
- Reduces the likelihood of a missed diagnosis, as the AI algorithms flag abnormalities that may be missed by the reader's eye at times.
- For high-risk patients, it helps automatically prioritize the scans in the radiologist's worklist, which allows faster diagnosis, treatment delivery and intervention.

Drivers

- Regulatory bodies worldwide now approve solutions that can augment clinicians' decision making when reading diagnostic images. Recent success with lung imaging analysis during the COVID-19 pandemic along with multiple vendor approvals granted by FDA to use AI-enabled imaging analysis is further accelerating adoption.
- The number of use cases and applicable modalities are increasing. While CT and MRI have been the primary modalities, use cases are emerging in other areas such as mammography (including 3D tomosynthesis), fundus imaging (of the eye), ultrasound and echocardiography.
- Recently, in the U.S., the Centers for Medicare and Medical Services (CMS) has granted New Technology Add-On Payment (NTAP) to various vendor solutions offering AI/ML solutions for diagnostic image interpretation. As a result, healthcare providers who are using AI/ML solutions from approved vendors for diagnostic image interpretation can receive CMS payments (see CMS' New Technology Add-On Payment Ruling). This move by CMS encourages healthcare providers to adopt the technology.
- Major picture archiving and communications system (PACS) vendors have started introducing AI-algorithm marketplaces which offer a range of AI-algorithms designed for specific clinical use cases (such as cardiology, bone health and oncology). This approach leads to a simplified integration process with native PACS systems, and often helps reduce the total cost of ownership to the healthcare provider.
- Based on the increased interest and recent developments, we are positioning this profile at the Peak of Inflated Expectations, with time to mainstream adoption between five and ten years.

Obstacles

- AI-enabled diagnostic imaging interpretation has matured from nascent to emergent in the past 18 months, However, regulations, lack of clarity on likely ROI and cultural acceptance (by radiologists, clinicians) can stifle the chances of mainstream adoption.
- Based on Gartner client interactions, there is a degree of skepticism among some healthcare providers — primarily apprehension regarding the disruption to existing reporting workflows which many radiologists view as already being efficient.

- Healthcare providers often have concerns around whether the test data that will be used to train algorithms is representative of a wide population and applicable to their specific patient population.
- A lack of product standardization and benchmarking complicates the solution procurement process (see FDA Challenges for Approving AI). Many vendors are still in the early stages of product development.

User Recommendations

- Update their position on using AI for diagnostic image interpretation by developing an assessment framework to evaluate the benefits, risks and understand regional regulatory requirements prior to making a business case.
- Work with clinical leaders in the imaging specialties and risk management to carefully evaluate and determine the speed and priority of adoption. Healthcare providers already experiencing shortages of imaging specialists or long lag times between study completion and final interpretation should consider piloting sooner rather than later.
- Address cultural acceptance issues by both patients and clinicians and concerns about the efficacy of these solutions and transparency of the algorithms.
- Prioritize solutions offering integration with your existing medical imaging workflow with minimal disruption, their ability performance at scale, and their compliance and regulatory approval status.

Sample Vendors

Aidoc; Arterys; DiA Imaging Analysis; GE Healthcare; MaxQ AI; Philips; Qure.ai; RapidAI; Siemens Healthineers; Zebra Medical Vision

Gartner Recommended Reading

Innovation Insight for AI-Enabled Diagnostic Imaging Interpretation for Healthcare Provider CIOs

Healthcare Provider CIOs: Get Ahead of AI Innovation With Strong AI Governance

Moving AI to Production — Presentation on Healthcare Providers' Perspectives

Emerging Technologies and Trends Impact Radar: Artificial Intelligence in U.S. Healthcare Delivery

Survey Analysis: Healthcare Providers — Measure Your Readiness for the Expanding Role of AI

Digital Clinical Encounters

Analysis By: Sharon Hakkennes

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Digital clinical encounters are semiautomated patient interactions that include the use of a combination of clinical protocols, algorithms and artificial intelligence (AI) to facilitate history taking, triage, diagnosis, prescribing and documentation. The encounter leverages the latest evidence-based clinical knowledge to reduce clinicians' direct involvement prior to their review of the captured and analyzed content for clinical oversight and action.

Why This Is Important

Epidemiological factors (such as an aging population and increasing burden of chronic disease), coupled with clinician shortages and burnout, have made access to primary and specialist care a major challenge currently facing the healthcare industry. Digital clinical encounters help address these issues by improving clinician efficiency through the automation of certain steps in the care delivery process.

Business Impact

Digital clinical encounter solutions are transformational systems that use automation to:

- Dramatically reduce the time taken by clinicians to gather and review patient information, confirm a diagnosis, select treatment options and document the encounter.
- Direct patients to the right level of care, avoiding unnecessary emergency room visits.
- Increase both patient and clinician satisfaction.
- Improve access for more complex encounters and those that require in-person visits.

Drivers

Interest in these solutions is growing globally due to:

- Improvements in AI capabilities and increasing availability of solutions.
- Increasing clinician and patient acceptance and adoption of virtual care. In particular, with the onset of the pandemic, many healthcare providers rapidly deployed specific COVID-19 online triage tools in a bid to direct patients to the right levels of care, diverting appropriate cases away from overwhelmed acute care resources.
- Positive outcomes in regional and national deployments; for example, the use of Sensely, Babylon, and Doctorlink apps across the U.K.
- The pent-up demand for healthcare services as a result of many patients delaying access to care for non-COVID-19 related illness. This will create increasing interest in digital clinical encounters over the coming 12 months as healthcare providers look for solutions to resolve demand and access issues.

Obstacles

- Current systems are designed predominantly for low-acuity primary care visits and patient triage, restricting adoption to these care settings.
- There are a number of barriers impacting clinician acceptance of adoption of digital clinical encounter solutions; these include concerns about safety and efficacy, and the perceived negative impact on the clinician patient relationship.
- Legal and compliance risks as well as a lack of dedicated funding stream for digital clinical encounters have also hampered adoption.

User Recommendations

CIOs should partner with chief medical informatics officers (CMIOs) to:

- Increase clinician awareness and acceptance by running targeted educational campaigns focusing on how digital clinical encounters can support increased access to care across high-demand clinical areas.
- Scale implementation through the use of pilots and proof of concepts (POCs), starting with low-complexity, high-volume encounter types.

- Measure the pilot success through a comprehensive benefits management plan that includes measures of patient and clinician satisfaction in addition to clinical outcome measures.
- Minimize potential medico legal ramifications by working with risk management, legal and clinical leadership to establish an enterprise governance framework for digital clinical encounters.

Sample Vendors

AdviNOW Medical; Babylon; Bright.md; Doctorlink; Intellivisit; Sensely Zipnosis

Gartner Recommended Reading

Market Guide for Virtual Care Solutions

Predicts 2021: Healthcare Providers Must Accelerate Digital Transformation to Address Disruption

Healthcare Provider CIOs: Get Ahead of AI Innovation With Strong AI Governance

Survey Analysis: Healthcare Providers — Measure Your Readiness for the Expanding Role of AI

Toolkit: Board-Ready Slides for Your Digital "Healthcare Without Walls" Initiative

External CDS

Analysis By: Veronica Walk, Sharon Hakkennes

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Definition:

External clinical decision support (CDS) solutions integrate into the clinical workflow and provide patient- and provider-contextualized guidance. CDS supports timely, evidence-based clinical decision making and reduces unnecessary variations in care. These solutions augment native electronic health record (EHR) CDS and include clinical alerts, reminders and care pathways aligned to evidence-based guidelines.

Why This Is Important

EHR-native CDS requires significant maintenance, lacks knowledge content management and, in many cases, has disrupted clinical workflow with low-value alerts. The new generation of external CDS augments core EHR capabilities and delivers relevant clinical knowledge proactively in the context of the patient and clinical workflow. Relying on a specialized vendor to manage the evidence basis, algorithms and technologies underpinning CDS reduces burden on both clinical and IT teams.

Business Impact

CDS enables standardized, evidence-based care that improves clinical judgment and patient outcomes and reduces the cost of care delivery. With a dedicated focus on CDS tools and evidence, these solutions enhance healthcare providers' ability to impact high-priority clinical conditions, practices and outcomes, such as:

- Advanced imaging utilization
- COVID-19
- Chronic condition management
- Hospital readmissions
- Opioid prescribing practices
- Sepsis mortality
- Surgical outcomes

Drivers

- Prior to the pandemic, it was estimated that the body of clinical knowledge doubled nearly every two years. The pandemic triggered an unprecedented surge in clinical knowledge and volatility in evidence and practice. This reinforced the value of external CDS to deliver up-to-date, evidence-based, patient-contextual guidelines and recommendations within the clinical workflow.
- External CDS vendors also have improved workflow integration and ease of implementation, creating a stronger value proposition. For example, Wolters Kluwer and Nuance partnered to create a voice-enabled search of UpToDate clinical content using Dragon Medical One.
- Many external CDS vendors sought to support healthcare providers in their pandemic response by making their content and tools available free of charge. This resulted in rapid development and adoption of solutions that may otherwise have been too expensive or lower on the priority list of digital clinical tools.
- In the U.S., changing reimbursement models are also fueling uptake of CDS solutions. For example, the Centers for Medicare & Medicaid Services (CMS) established a program to enforce appropriate use of advanced outpatient imaging. It requires ordering providers to consult a qualified Clinical Decision Support Mechanism (qCDSM) prior to ordering an exam and furnishing providers to submit proof of this consultation on the claim.
- Based on increasing adoption in the U.S., we advance this profile from post-trigger 45% in 2020 to prepeak 20% for 2021. Adoption in other regions and countries is lower, impacted by the limited supply of external CDS solutions, maturity of EHR adoption, clinical workflow integration options and the proprietary nature of the content. We also observe wide variation in the degree of autonomy many health providers have to standardize care and reduce unwarranted variation. More use cases with demonstrable clinical and business benefits will be required to accelerate adoption across all geographies.

Obstacles

- Early external CDS solutions had limited utility as they existed outside of the clinical workflow as referential content. Solutions today have greatly improved, although challenges with semantic interoperability and availability of adequate workflow engines to manage CDS for order sets and care plans remain.
- Poorly implemented solutions impede adoption due to factors such as low clinician trust in the CDS, alert fatigue and inappropriate alerts.
- While evidence-based content is a key capability of these solutions, this means maintaining an expensive proprietary knowledge base, the cost of which is passed on to buyers. This also reduces competition as startups may not be able to afford the research investment to develop the clinical content.

User Recommendations

Healthcare provider CIOs, CMIOs and CNIOs should:

- Augment the capabilities of your core EHR and other clinical systems by selecting and implementing specialized CDS solutions that provide relevant, evidence-based guidance in tight integration with clinical workflows. Reduce the burden on your IT team by adopting external CDS with capabilities such as content management, citizen IT tools and API integration.
- Address the issue of nuisance CDS and alert fatigue by collaborating with your clinical colleagues to establish governance to oversee judicious use of CDS. Establish quantitative, as well as qualitative, metrics to determine if external CDS is effective, including adherence to CDS and its impact on patient outcomes.
- Extend the value of CDS across the care continuum by investing in solutions that support additional venues of care such as ambulatory, behavioral health, care coordination, home health, hospice, post acute and virtual care.

Sample Vendors

AgileMD; EBSCO; Elimu Informatics; Elsevier; Hearst Health; Wolters Kluwer

Gartner Recommended Reading

Reframe and Reignite Clinical Decision Support in Response to COVID-19

Healthcare Provider CIO Top Actions for 2021: Clinical Decision Support

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

Care Team Collaboration

Analysis By: Barry Runyon

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Care team collaboration (CTC) is an interoperable application ecosystem representing the convergence of existing and emerging point-of-care solutions such as nurse call, interactive patient care, alarms and notifications technology, clinical communication and collaboration systems, and next-generation contact centers. This interoperable application ecosystem enhances the care team's effectiveness and is enabled by advances in mobility, interoperability and real-time operational intelligence.

Why This Is Important

The CTC IT ecosystem has materialized in an effort to overcome persistent care transition and care coordination challenges, and more demanding patient experience expectations. CTC is a critical point-of-care interoperable application ecosystem (IAE) that improves situational awareness surrounding the patient, addresses challenges of sharing and exchanging patient information in real-time, streamlines disconnected workflows and business processes, and makes operational intelligence actionable.

Business Impact

CTC facilitates the purposeful organization of patient care activities to facilitate the delivery of care by:

- Marshalling enterprise resources to complete patient care tasks outlined in a care plan and the timely exchange of patient information and operational intelligence surrounding the patient.
- Improving care outcomes and quality measures to attract patients, enhancing industry reputation, and increasing revenue.

- Reducing care team toil and enhancing staff productivity, morale and retention.

Drivers

- Participation in value-based care models and contracts
- Patient safety, care quality and care coordination measures
- Competitive position within patient population
- Patient satisfaction scores (e.g., Hospital Consumer Assessment of Healthcare Providers and Systems [HCAHPS])
- Enterprise key performance measures
- IoT and smart device integration advancements
- Maturity of IoT and Real-Time Health System (RTHS) technologies for real-time operational intelligence
- Interoperability capabilities of CTC vendor participants
- Increased interest in the composable enterprise and architecture

Obstacles

- Legacy integration challenges
- Lagging adoption of APIs and HL7 FHIR
- Nursing operations resistance to potential workflow changes
- EHR enterprise agreements that limit best-of-breed solution purchases
- Lack of current CTC reference sites
- Confusing and misleading CTC vendor messaging and claims

User Recommendations

- Establish CTC as a critical patient care delivery initiative and technology program by promoting it as a broad set of related technologies that must interoperate in order to deliver their collective value proposition.
- 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 core components of the CTC interoperable application ecosystem.

Sample Vendors

Connexall; Critical Alert; GetWellNetwork; Hillrom; PerfectServe; Vocera

Gartner Recommended Reading

Innovation Insight for Care Team Collaboration

Establish Interoperable Application Ecosystems Early in Your Composable Healthcare Provider Roadmap

The Hospital Will Become a Smart Machine

Healthcare Application Marketplace

Analysis By: Mike Jones, Sharon Hakkennes

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

An application marketplace is an online digital platform that facilitates the composition, hosting, distribution and consumption of packaged digital products and services to healthcare providers. Application marketplaces can operate at an organization level — to support internal sharing of prebuilt applications and algorithms — or be deployed across an ecosystem (e.g., by EHR or PACS vendors to their customers), operating as a distribution channel for third-party developers.

Why This Is Important

Healthcare application marketplaces deliver low implementation effort solutions to healthcare providers that can address both significant gaps in EHR or PACS vendor functionality and offer new products that would not typically be found in an EHR. Products, in the form of apps and algorithms, are targeted to specific business needs. Marketplaces help CIOs quickly scale new capabilities to a range of end users without the need to develop that capability in the underlying clinical system of record.

Business Impact

- Application marketplaces support patients and care teams with a range of modern digitally enabled business and clinical activities, such as patient engagement apps (e.g., a patient portal on a smartphone), digital therapeutics (e.g., hypertension or diabetes management) and clinical algorithms (e.g., a COVID-19 symptom checker).
- Application marketplaces require dedicated information governance, privacy and security protocols as marketplace solutions will need to access and integrate with core systems.

Drivers

- The explosion of consumer-facing medical grade devices (e.g., fitness trackers that incorporate an ECG) into the market in recent years has increased the demand for apps to manage those devices and securely capture associated data.
- There is an increased need for easy access to functionality that addresses the gaps that exist in core clinical systems such as consumer and patient engagement, access to patient held records, and virtual care.
- EHR and PACS vendors are offering proprietary application marketplaces for their core products as part of their business model for generating revenue through API licensing and revenue shares of any app sold on their marketplace (e.g., Epic's App Orchard).
- Open source developer communities are also developing their application marketplaces. For example, the Substitutable Medical Applications and Reusable Technologies (SMART) App Gallery from Smart Health IT is an open-standards-based platform. It is built from systems that, together, allow for access authorization and application execution of independent code that can access HDO-based FHIR resources, typically EHR-controlled medical records. The apps are compatible with any EHR vendor's environment from a single codebase.
- As a result, the number and availability of marketplace apps and algorithms will increase, driving up care quality and reducing costs.
- Increasingly, health systems are looking to shift elements of their care model outside the facility and into patient homes or provider care remotely. Application marketplaces are a way for health systems to publish their solutions or easily signpost and subscribe patients to recommended apps.
- As this is one area of digital healthcare that will accelerate with the shift toward virtual care and that thrives in the digital health platform era, we project the time to maturity for the healthcare application marketplace to become mainstream within two to five years.

Obstacles

- Application vendor onboarding requires dedicated experts in API security and information governance, which not all healthcare providers have. API security requires dedicated tools to ensure risks are mitigated and monitored to prevent data or security breaches.
- Managing the application marketplace is usually the domain of the core system of record vendors (e.g., an EHR vendor or a PACS vendor). As healthcare providers seek to bring an app into the marketplace, they may need to meet the commercial requirements of the marketplace, which often creates additional licensing costs.
- Patient privacy requirements can be onerous and require third-party application vendors to meet certain standards, which can increase development costs and time to value.
- For some EHR vendors, application marketplaces pose a threat to their business model of providing all functionality in the core product. This can lead to information blocking practices when trying to establish workable APIs or commercial terms.

User Recommendations

CIOs working with CNIOs and CMIOs seeking to expand patient facing and clinical functionality beyond the core EHR should:

- Raise enterprise awareness of the potential to use a healthcare application marketplace and explain the advantages that the application marketplace offers vs. in-house development.
- Develop an app strategy that sets out how you will evaluate and benefit from the deployment of apps by assessing capability gaps across your organization (e.g., mobile capture of patient vital signs and calculation of early warning scores).
- Determine how your EHR or PACS vendor currently supports the integration of third-party apps or seeks to monetize new application integration.
- Extend your application and information governance policies to ensure apps and algorithms acquired through application marketplaces meet clinical, infrastructure, support, privacy and security requirements and standards.

Sample Vendors

Allscripts; Apervita; athenahealth; Cerner; Epic; Microsoft; Orion Health; Salesforce; SMART Health IT; VigiLanz

Gartner Recommended Reading

Unleash the Innovative Potential of EHR App Extensions to Advance Healthcare Delivery

Governance and Change Management for a Pace-Layered Application Strategy

Emerging Technologies: Adoption Growth Insights for API Security

Top 10 Things CIOs Need to Know About APIs and the API Economy

AI for Clinical Automation

Analysis By: Sharon Hakkennes, Mike Jones

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

AI for clinical automation is an umbrella term for solutions that leverage technology to assist clinicians with routine, standardized and often-repeated tasks to streamline workflow, increase productivity and improve the quality of care. Clinical automation is accomplished using EHR and third-party-sourced data that is incorporated within clinical workflows across the care continuum.

Why This Is Important

Care delivery is replete with routine and often-repeated tasks or circumstances that are ideally suited for automation. EHR vendors have begun to address automation use cases such as conversational AI, clinical documentation and other tasks using AI-enabled multichannel virtual assistants and APIs to permit third-party products to drive automation. Other solutions automate and delegate routine repetitive tasks such as prescription refill requests, diagnostic triage and results management.

Business Impact

- Enables accurate real-time case prioritization, triage and throughput management by converging diverse datasets to scan for clinical findings and patient-specific factors.
- Standardizes care and ensures clinicians can easily access vital information at the point of care, reducing time to diagnosis and treatment and improving quality of care.
- Increases clinician productivity and accessibility of healthcare services, improving efficiency and addressing challenges associated with clinician shortages.

Drivers

- Clinical acceptance and acknowledgment of the value of clinical automation are growing. In a recent survey by Stanford University, medical physicians, residents and students estimated that as much as one-third of their work will be automated by technology in the future.
- Digital transformation initiatives deployed in response to COVID-19 and the current cost pressures on HDOs are fueling interest and hype around AI in clinical automation. For example, faced with overwhelming demand during the peaks of the COVID-19 pandemic, digital triage solutions were deployed to automate clinical screening and direct patients to the right level of care.
- In addition, clinical automation is supporting HDOs' vaccination efforts including identification and outreach to high-risk populations, triage, education, and appointment scheduling and reminders.
- We have designated this profile obsolete before plateau. This change reflects the maturing role of AI in healthcare, as new and more-specific technologies have been introduced that encompass the value and use case reflected in this profile. Those new technologies include AI for diagnostic interpretation, digital clinical encounters, ambient digital scribes and critical condition surveillance.

Obstacles

- Outside of the U.S., adoption is negatively impacted by a lack of maturity of EHR deployment and availability of other third-party sourced data.
- The use of AI for clinical automation continues to raise both legal and ethical concerns. Questions regarding liability where errors are made and implications on HDO funding hamper implementation efforts. In response, some regions (e.g., U.S. and Europe) are issuing regulations to address these issues.
- Clinical automation frequently involves both cultural and significant clinical workflow change. In the absence of sufficient resourcing and funding for change management efforts as a core component of implementations, these initiatives fail to deliver on promised benefits.

User Recommendations

- Identify priority areas for clinical automation by developing a formalized decision framework specific to the needs of your organization. Use your framework to assess potential use cases and articulate the expected business impact to determine whether and what type of automation is appropriate for a proposed use case.
- Ensure successful implementation of clinical automation initiatives by working with clinical leaders to develop an automation initiative roadmap that incorporates strong clinical governance and focuses on change management. Execute proofs of concept and pilots to automate processes that can deliver quick returns, gain organizational experience and evaluate vendor and solution performance.
- Demonstrate the value of clinical automation by ensuring all initiatives include a framework for the evaluation of the effectiveness. In addition to tangible measures of quality and efficiency, these frameworks should include measures of clinician experience and satisfaction.

Sample Vendors

Bright.md; Diagnostic Robotics; GYANT; healthfinch; Notable; Nuance

Gartner Recommended Reading

Strategic Automation Decision Framework: From RPA to AI on the Journey to Hyperautomation in Healthcare

Scale Automation in Healthcare Using a Center of Excellence

CIOs Need to Expand Their Perspective on Clinical Data and Analytics Change Efforts or Plan to Fail

Healthcare Provider CIOs: Get Ahead of AI Innovation With Strong AI Governance

Automated Informed Consent

Analysis By: Veronica Walk, Barry Runyon

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Automated informed consent solutions are used to ensure that patients (or their proxies) are educated, and understand the benefits, risks and alternatives to diagnostic tests or therapeutic procedures prior to deciding whether or not to proceed. These solutions deliver the necessary information in patient-friendly formats, often via mobile apps, tailored videos and forms, measure patient comprehension, and capture their informed consent alongside or within the health record.

Why This Is Important

For ethical and legal reasons, clinicians are obligated to review the benefits, risks and alternatives to diagnostic tests or medical procedures with their patients. Current practices are predominantly manual, inconsistently administered by individual clinicians and often fail to achieve meaningful informed consent. Automated informed consent solutions standardize and streamline the process for clinicians, while improving patient comprehension and engagement in their own care.

Business Impact

Healthcare delivery organizations (HDOs) can use automated informed consent solutions to:

- Standardize the informed consent process to increase patient safety and clinical efficiency.
- Reduce test, treatment and procedure delays or cancellations due to missing or inadequate consent forms, thereby increasing revenue.

- Engage patients in their own care, leading to improved outcomes and patient satisfaction, which in turn, may reduce malpractice claims.

Drivers

- There are still few fully automated informed consent solutions for healthcare providers with most vendors in this space focused on clinical trials and research.
- Given its importance to compliance, safety and the patient's experience, automated informed consent will likely replace more manual approaches in HDOs over the next five years.
- The pandemic forced the adoption and increased acceptance of digital, low or no-touch interactions in healthcare. As such, patients and clinicians are likely to be more open to a digital-first approach to informed consent.
- Many HDOs were forced to halt elective surgeries and procedures during the peak of pandemic activity and now face a backlog of cases. The preprocedural workflow is fraught with slow, paper-based processes and is prime for automation to increase throughput and capacity. For some HDOs, automated informed consent solutions were implemented as a strategy to reduce delays, cancellations and increase the capacity for elective procedures.

Obstacles

These solutions must go beyond a digital record of legally required consent. They must address existing issues with traditional, manual processes, such as:

- Patient's language and cultural considerations.
- Timing, which can add to stress and impede patient comprehension and decision-making.
- Patient's lack of awareness that they can refuse the procedure or delay the decision, and the ramifications of such a decision.
- Constrained clinical resources to adequately guide and advise patients.
- Clinician's inability to detect a patient's lack of comprehension.
- Clinician's concerns about the ramifications of providing too much information.

User Recommendations

- Understand current practices by establishing an index of tests, treatments and procedures that require informed consent, surveying frontline clinicians, and mapping workflows. Review cases with missteps in the informed consent process, such as a wrong-site procedure, to identify failure modes.
- Establish pilot use cases for automated informed consent by prioritizing highly standardized tests, treatments or procedures, and partnering with clinician champions who will be supportive and participative in trialing these solutions. Consider your use case in terms of the patient cohort as well and potential barriers to their adoption.
- Choose these solutions with a broader patient engagement strategy in mind by enabling their integration with patient portals, engagement platforms and clinical workflows.

Sample Vendors

E Process Med; Interlace Health; Taylor Health Care Group; Telesofia Medical; Wellcast.Health; Wolters Kluwer

Gartner Recommended Reading

The Digital First Engagement Framework for Healthcare Delivery Organizations

The Evolution of Healthcare Consumer Engagement Hub ArchitectureInnovation Insight for Consumer Experiences in Healthcare and Life Sciences

Algorithmic Medicine

Analysis By: Veronica Walk, Sachin Dev

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Algorithmic medicine enables advanced clinical decision support using insights and rules built from clinical guidelines, evidence-based best practices and other clinical data repositories to accurately draw “expert level” diagnosis and treatment decisions. These solutions rely on artificial intelligence, machine learning, natural language processing and rule-based algorithms to augment clinical judgment by suggesting diagnoses and specific treatment protocols.

Why This Is Important

Algorithmic medicine has the potential to radically change care delivery. These solutions can supplant certain clinical activities up to and including diagnosis and treatment, enabling increased diagnostic accuracy and earlier interventions and freeing clinicians to focus on clinical situations that require human interaction. There is already ample evidence of machine learning predictive models outperforming clinicians.

Business Impact

Algorithmic medicine can augment clinical decision making and speed time to diagnosis and treatment, improving outcomes and reducing the cost of unnecessary testing. It is increasingly accepted and used to address high-priority clinical conditions and outcomes, such as hospital readmissions, sepsis and most recently, COVID-19. Growing evidence exists for use cases such as cancer detection, diagnostic image interpretation and speech analysis for disease detection.

Drivers

The pandemic has accelerated the acceptance and development of advanced algorithmic medicine solutions that previously have been stymied by cultural, ethical and medicolegal challenges.

- Healthcare providers struggled to keep pace with rapidly evolving COVID-19 diagnosis, treatment and infection-control guidelines. Due to surging patient volumes, many organizations were forced to augment their hospital workforce with nontraditional or external providers unfamiliar with the acute care setting. These circumstances exacerbated the need for and accelerated the development and adoption of algorithmic medicine.
- Likewise, many organizations faced shortages of hospital and ICU beds, medications, personal protective equipment, testing, ventilators and other resources, provoking a demand for algorithms to allocate limited resources and standardize clinical decision making.

- As with other healthcare technologies, algorithmic medicine benefited from the relaxation of regulatory barriers, enabling rapid deployment and real-world proof of concept. However, as regions return to some semblance of normal, these regulations are likely to tighten but not without lessons learned from the solutions developed and implemented in response to the pandemic.
- In light of increased interest and usability of algorithmic medicine during the COVID-19 pandemic, and with a growing number of FDA-approved algorithms in medicine, we move this profile further to the Peak of Inflated Expectations. We expect algorithmic medicine to reach mainstream adoption in less than five years.

Obstacles

Despite progress due to pandemic conditions, numerous barriers remain that need to be addressed:

- Regulatory issues, payment concerns, medicolegal issues (for example, who will be held responsible when an algorithm is "wrong" or when it will be considered malpractice to not use an algorithm).
- Algorithmic bias due to incomplete or inherently biased datasets or models. These biases became evident in some deployments of algorithmic medicine during the pandemic and are highly concerning for their potential to exacerbate existing socioeconomic health disparities.
- The most advanced algorithms are often the least explainable — often referred to as "black box algorithms" — leading to doubt and distrust among patients and providers.

User Recommendations

CIOs and informatics leaders such as the chief medical informatics officer or chief nursing informatics officer should:

- Maximize investments in algorithmic medicine by partnering with clinical and business leaders to identify high-priority use cases and drive adoption. Leverage shared risk agreements with vendors to ensure the solution delivers on the value proposition.

- Establish strong governance to vet and oversee algorithmic medicine by engaging with leaders throughout the organization, including clinical leadership, compliance, data sciences, legal and risk management. Carefully monitor for algorithmic bias and unintended consequences. Work with risk management and legal to understand and eventually mitigate any ramifications of either using, or failing to use, algorithmic medicine.
- Earn clinicians' and patients' trust by starting with more explainable algorithms. Commit to transparency in reporting outcomes and addressing any signs of bias or unintended consequences.

Sample Vendors

AgileMD; Cerner; Dascena; Epic; Jvion; VigiLanz

Gartner Recommended Reading

Reframe and Reignite Clinical Decision Support in Response to COVID-19

Reset and Accelerate Your Digital Care Delivery Agenda With Clinical Informatics Partners

Healthcare Provider CIOs: Get Ahead of AI Innovation With Strong AI Governance

Critical Condition Surveillance Systems

Analysis By: Veronica Walk, Pooja Singh

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Critical condition surveillance systems monitor clinical data from the electronic health record (EHR) and point-of-care medical devices in near real time. Using evidence-based algorithms, these systems detect signs of clinical decompensation that could be life-threatening or warrant urgent transfer to a higher level of care and then trigger alerts to appropriate members of the care team.

Why This Is Important

Historically, healthcare providers in the acute care setting have relied on early warning scores to monitor for signs of clinical deterioration using manual or partially automated calculations. Critical condition surveillance systems have drastically improved on these methods by using real-time clinical data to continuously monitor and predict deterioration across a broader patient population. Pandemic conditions have only increased the value proposition and adoption of these solutions.

Business Impact

Healthcare delivery organizations (HDOs) providing higher acuity care can use these solutions to:

- Enable earlier intervention on deteriorating patients, which can improve their chance of survival and reduce the need for emergency treatments and higher-cost care.
- Automatically notify caregivers to potential clinical decompensation, thereby reducing the burden on resource-constrained care teams.
- Stay current with the latest evidence-based algorithms for critical condition surveillance.

Drivers

- We expect patient monitoring vendors and stand-alone solutions that specialize in critical condition surveillance to outpace the megasuite EHR vendors' limited, condition-specific offerings such as sepsis surveillance. For example, vendors such as Philips are investing and expanding their portfolio in this space with their acquisition of medical-device integration vendor Capsule Technologies.
- With their resources focused on keeping up with clinical evidence and improving their algorithms through artificial intelligence (AI) and machine learning (ML), stand-alone solutions are likely to become better predictors of clinical deterioration and expand to additional use cases.
- Widespread acceptance of these systems will require greater specificity and sensitivity to reduce false positives. Cloud-based ML on large and complex datasets, with diverse and often disparate clinical and nonclinical data sources, is starting to show superior predictive ability.

- The pandemic only added pressure on hospitals to manage increasingly complex and critically-ill patients. Given a shrinking highly skilled workforce and compelling evidence of improved outcomes, we anticipate accelerated adoption of these solutions. Mainstream use will be between five and 10 years.

Obstacles

- Critical condition surveillance requires robust and potentially costly medical device integration to continuously monitor patients using a comprehensive set of clinical data points.
- As an evidence-based platform, most stand-alone systems are also quite expensive due to the required research to develop, validate and maintain the clinical algorithms driving these solutions.
- Due to high cost and lower value proposition for smaller organizations, adoption is currently limited to larger organizations with the budget and resources to justify the investment in these solutions.
- Solutions with imprecise algorithms or alerting will only add noise to the already burdensome clinical workflow and fail to improve outcomes.
- Solutions that rely on unexplainable “black-box” algorithms will face greater provider and patient scrutiny.

User Recommendations

Healthcare provider CIOs should partner with clinical informatics colleagues to:

- Establish the need for critical condition surveillance solutions by evaluating sepsis, mortality and patient safety data. Compare what can be accomplished within the EHR and identify gaps that might be addressed by a specialist vendor.
- Judiciously vet any potential solution by examining the evidence base and update frequency for the clinical algorithms. Address clinician and patient mistrust by giving priority to vendors using explainable and well-validated AI.
- Enable your organization to take advantage of these solutions by prioritizing medical device integration and EHR interoperability.
- Minimize alert fatigue by tracking false-positive alert rates and evaluate a vendor's ability and willingness to improve their solution accordingly.

Sample Vendors

AgileMD; Hillrom; Jvion; Medical Informatics; PeraHealth; Philips

Gartner Recommended Reading

CIOs Need to Expand Their Perspective on Clinical Data and Analytics Change Efforts or Plan to Fail

2021 Strategic Roadmap for the Real-Time Health System

Reset and Accelerate Your Digital Care Delivery Agenda With Clinical Informatics Partners

Reframe and Reignite Clinical Decision Support in Response to COVID-19

E-Visits (Non-U.S.)

Analysis By: Veronica Walk, Sharon Hakkennes

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Obsolete

Definition:

An e-visit is an asynchronous, technology-enabled, structured, secure, nonurgent, remote consultation between a patient and a provider where a preexisting relationship exists. These encounters are well-defined and narrow in scope, and they can include triage, simple urgent or chronic disease care, prescriptions and patient education. They are usually delivered through a patient portal, most often tethered to an EHR.

Why This Is Important

E-visits are a valuable component of an overall virtual care strategy differentiated by the convenience of an asynchronous interaction and the ability for patients to directly connect with their established provider. The COVID-19 pandemic has rapidly accelerated virtual care adoption worldwide and also contributed to a steady increase in interest in asynchronous visits by healthcare providers, patients, payers and governments outside the U.S.

Business Impact

A well-implemented e-visit program can:

- Reduce costs
- Increase patient satisfaction and engagement
- Improve care coordination
- Enhance brand loyalty
- Increase clinician productivity
- Reduce care team burden by extending the reach of limited resources

Drivers

- Prior to the COVID-19 pandemic, there was some regional evidence of patient preference for asynchronous e-visits with their primary care provider over synchronous telephone or video visits.
- In the U.K., there was a marked uptick in e-visit adoption during the pandemic. One vendor reports more than doubling adoption of asynchronous, patient-provider interactions during the pandemic with one e-visit occurring every three seconds. However, these were not relegated to interactions between established patients and providers or via a traditional patient portal, as this profile has previously been defined.
- Increased adoption of patient portals outside the U.S. is likely to increase interest in e-visits as a modality for digital patient engagement.
- Based on the significant uptake of a variety of asynchronous modalities for virtual care, we have marked this as Obsolete Before Plateau as we believe they will be subsumed within a broader range of digital clinical encounters.

Obstacles

- E-visits are one option among a broad range of available virtual visit formats including video visits, telephone, text messaging and live chat. It will be increasingly important for these solutions to offer an efficient and effective means of receiving care to be chosen by patients over these other virtual care modalities.
- Lack of adequate reimbursement models is a challenge to clinician willingness to engage in this virtual care modality.
- The asynchronous nature of e-visits can be a barrier in terms of clinician scheduling and patient expectations for response time. It will be necessary to set aside regular time slots for e-visits, rather than just squeeze them in between regular patients or after hours.
- EHR-based e-visit solutions are typically tied to patient portal functionality, which has faced challenges in enrollment and adoption.

User Recommendations

- Evaluate e-visit vendor solutions in the context of your broader virtual care strategy. Increase visibility and adoption of e-visits by incorporating this channel as part of your existing patient portal or digital front door platform.
- Ensure the e-visit program is well understood by patients and clinicians alike by engaging clinical informatics colleagues, such as the CMIO, to set expectations for patients and clinicians, provide education on the use of e-visits, and create and enforce policies. These policies communicate the types of care appropriate for an e-visit, turnaround times and escalation paths. To this end, consider using response-time SLAs with clinicians.
- Incentivize clinician participation by enabling adequate reimbursement or credit for e-visits — likely, it will be some fraction of a traditional visit because an e-visit should take less time and effort.

Sample Vendors

Allscripts; Cambio; Cerner; Doctorlink; eConsult; Epic; TietoEVRY

Gartner Recommended Reading

Ace These Proof Points to Create a Sustainable Virtual Care Strategy Scaling Virtual Care Requires a New Look at Its Enabling Architecture

Healthcare Provider CIOs: Bridge the Virtual Care Divide Between Provider- and Consumer-Directed CareMarket Guide for Virtual Care Solutions

Semantic Interoperability

Analysis By: Mike Jones

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Semantic interoperability in healthcare is achieved when two or more information systems can exchange and process business and clinical information with an unambiguous and common understanding. Furthermore, the participating systems need not have prior knowledge of how the information will be used before any information exchange. This profile covers the technologies and working groups that support this objective.

Why This Is Important

Semantic interoperability is essential for connecting digital care across clinical settings, care teams and organizations as it enables sending and receiving systems to identify both the data and clinical context for shared information. For care providers, payers, government agencies and regulators semantic interoperability is becoming a reality as the shared goal of well-defined and enforceable standards and terminologies is increasingly essential across care ecosystems and system vendors.

Business Impact

Semantic interoperability applies to care pathways that span care providers. Use cases include:

- Regional health information exchanges (HIEs)
- Complex care pathways such as for cancer and behavioral health
- End-of-life care coordination
- Urgent care where the first responder needs access to information on current medicines, known allergies or adverse reactions

- Referral, discharge, and care coordination for planned care
- Packages of health and social care with multiple agencies involved

Drivers

- Organizations are shifting toward value-based care and global adoption of clinical standards to improve the quality of care, contain the cost of care, and reduce gaps in care.
- Increased investment at the national and regional level in HIEs is driving adoption in HIE platforms.
- The demand from consumers for patient-held records including the ability to store copies of their medical records on consumer-managed devices (e.g., Apple HealthKit and the Argonaut Project) is growing.
- Interoperability rules from regulators such as Centers for Medicare and Medicaid Services (CMS) and Office of the National Coordinator for Healthcare IT (ONC) provide deadlines for vendors to comply with semantic requirements.
- Increasing availability of Health Level Seven International (HL7) Fast Healthcare Interoperability Resources (FHIR)-based APIs in electronic health record (EHR) and other clinical systems is frequently a 'must-have' core requirement for healthcare providers procuring EHR and HIE solutions.
- Presence of enforceable procurement frameworks that translate business needs for HIE into more technical functional specifications. (For example, the U.K. INTEROPen requirements and the U.S. requirements set out by the National Association of Medicine.)
- Emergence of new architectural approaches for digital health platform construction and operation that focus on creating a common data fabric that exists beyond the proprietary control of individual HIT vendor systems. (See Tool: Healthcare Provider CIO Executive Presentation for a Composable Digital Health Initiative.)
- Hence, we project the time to maturity for semantic interoperability to become mainstream to be between five and 10 years. This will be achieved earlier in some regions like the U.S. and countries in EMEA where semantic interoperability standards and terminologies are now being enforced at a national level.

Obstacles

- Lack of enforceable national policy and legislation in some regions which dictate the pace of adoption of semantic interoperability standards by healthcare providers and local HIT vendors (e.g., local EHR, PACS and other clinical system vendors).
- Acceptance by providers for more basic methods of exchanging information (e.g., where C-CDA or scanned document with fax exchange is culturally accepted) as opposed to open APIs which expose structured clinical data and the conformance with international standards such as FHIR.
- Low incentives and investment by vendors in the means to achieve semantic interoperability or where existing means of information exchange (e.g., point-to-point interfaces) are part of a vendor's existing support fees and revenue generation strategy.

User Recommendations

- Use industry best practices to set out and gain agreement for an interoperability strategy. (See 7 Critical Domains of a Successful Healthcare Provider Interoperability Strategy.) Focus on the specific interoperability use cases that will yield the greatest business value.
- Develop a deeper understanding of your interoperability needs by taking an outside-in view of how patients, clinicians and your business would benefit from improved access to and shareability of data.
- Form a roadmap for what you want to achieve with semantic interoperability and address questions of data ownership and oversight at the outset of your journey.
- Revisit commercial agreements with your EHR vendor and explore their capabilities for improving interoperability versus your needs. Insist on open APIs that are published on publicly available resources, have freely accessible documentation, are available free of charge for testing, and have transparent and scalable commercial arrangements for third-party use.

Sample Vendors

Better; CommonWell Health Alliance; DIPS; IHE; Marand; openEHR; The Sequoia Project; TietoEVRY

Gartner Recommended Reading

Market Guide for Enterprise Electronic Health Record Solutions

7 Critical Domains of a Successful Healthcare Provider Interoperability Strategy

Healthcare Industry Hot Topic: Debating the U.S. ONC Interoperability and Information-Blocking Rule

Use Key Performance Indicators to Gauge Healthcare Provider Interoperability Impact and Progress

Sliding into the Trough

3D Printed Surgical Implants

Analysis By: Pooja Singh, Mike Jones

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

This technology covers the use of 3D printing (3DP), tissue engineering and spacer technology to replace existing medical implant approaches and create new, specialized ones. The method matches each patient's unique shape to a surgical implant. It creates a 3DP design from computed tomography (CT) scans and magnetic resonance images (MRIs), and uses proprietary algorithms to print the implant and offer individualized surgical guides.

Why This Is Important

Hip and knee replacements are among the most common hospital procedures around the world. For example, surgeons perform more than 600,000 knee replacements and about 330,000 hip replacements each year in the U.S. and around 160,000 per year in England and Wales. As these numbers continue to rise, 3DP implants offer an opportunity to healthcare providers to improve and increase accuracy of the personalized anatomical models.

Business Impact

- Increased accuracy of the personalized anatomical models
- Improved patient outcomes and increased patient satisfaction
- Reduced risk of infections in surgical procedures
- Faster turnaround time for 3DP surgical implants when compared to conventionally manufactured implants
- Reduced overall time of each surgery, thereby allowing surgeons to treat more patients

Drivers

- Healthcare providers' growing focus on customization for patient treatment is a key driver. With 3DP, patients can access implants best-suited for their individual case, and at a faster pace, resulting in increased success when compared to traditional methods. In one example, surgeons at the University of Miami created a 3D printed titanium talus bone for a patient with sickle cell disease. Rather than fusing the patient's ankle to the hindfoot, a procedure that would have taken away her ability to move the foot, this replacement talus was able to preserve that mobility.
- Continuous increase in use cases catered by 3DP has been observed. 3DP prosthetics is one such area where traditionally a patient has to go through multiple castings, fittings that consume a large amount of time and multiple patient visits.
- Factors such as advancement in 3DP methods, along with availability of different material types to create implants, further push adoption forward. Adopting additive manufacturing processes is also supporting mass customizations, creation of porous surfaces with 3DP, which reduce chances of implants being rejected by the patient's body.
- The commercial vendors in the space now have healthcare-specific business units. Additionally, we also see an overlap in vendors in the space, as many also offer presurgical anatomical models (which are on faster adoption trajectory). This means that healthcare providers will be increasingly exposed to implants and tools as integrated solutions.
- Prestigious academic medical centers are increasing investment in these technologies and publishing case studies. Smaller healthcare providers will follow. Thus this year, we advance the technology slightly forward into the Trough of Disillusionment. We expect mainstream adoption to occur within five to 10 years.

Obstacles

- The FDA reviews 3DP implants under medical devices class. Most devices fall under the Class I category, where manufacturers have to prove that the final medical device product is substantially equivalent to a product that is already on the market. Getting reviews for traditionally manufactured one-size-fits-all implants is more feasible when compared to designing patient-specific customized implants. The FDA maintains an exemption for custom devices as well. This includes requirements such as the manufacturer makes no more than five units of the device per year, and it is designed to treat a unique pathology or physiological condition that no other device is domestically available to treat.

- Although regulatory approval has been waived in emergency situations, it is also a hurdle. Physicians report that insurance is covering hips and knees at the same rate as traditional implants, with the caveat that the patient may have to pay for scans for the design, rather than for diagnosis.

User Recommendations

- Ask one of your clinical IT leaders (such as the CMIO) to investigate the state of the art by teaming with researchers and surgeons to create a strategic roadmap and governance approach.
- Collaborate with IT leaders in identifying and negotiating 3DP and imaging vendor relationships for on-site technology and manufacturing suppliers. An increasing number of CIOs also bear responsibility for clinical engineering and biomedical technicians.
- Continue to monitor regulatory guidance within your own jurisdiction and others, as the vendor community is working across boundaries. Guidelines written by national regulators have been accompanied by ISO and ASTM guidelines, with efforts to grow adoption of global standards for 3D printing of medical devices
- Set up a center of excellence or 3D printing innovation labs where technologies can be acquired for pilots across multiple use cases.

Sample Vendors

3D Systems; Conformis; Embody Orthopaedic; Lithoz; Materialise; Stratasys

Gartner Recommended Reading

Healthcare and Life Science Business Driver: Medical Technology Innovation

Assistive Healthcare Robots

Analysis By: Kate McCarthy

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Assistive healthcare robots are self-deterministic or smart machine caregivers designed to help individuals achieve a self-sustaining life by helping them move around, performing caregiving tasks and providing companionship. This profile includes caregiver support, psychological support (motivation and companionship), and healthcare delivery support for observations, monitoring, coaching or emergency action.

Why This Is Important

Assistive healthcare robotics offer promise of improved independence and safety for care in the home for disabled, aging or isolated individuals and their caregivers. According to the International Federation of Robotics, the market for social robots is expected to grow 29% annually through 2022, while demand for rehab robots is projected at 45% per year in the same period. This growth is supported by the growing aging population and shortages of skilled and home workers.

Business Impact

Robots will become an essential part of delivering home healthcare. They will address worker shortages, decrease delivery costs of healthcare services, and improve quality of life for users and caregivers. Assistive robot applications will impact functions that directly supplement the healthcare and social service labor force, or provide innovative, new healthcare and personal services.

Drivers

Three industry changes underlie demand for assistive healthcare robotics:

- Increased care delivery in the home: Virtual care and enabling technologies like remote patient monitoring rose exponentially as a result of COVID-19. Increased utilization of virtual care is a lasting change that healthcare organizations must support with increased touchpoints, such as assistive robots.
- Aging population: By 2050, 1.6 billion or 17% of the total population of 9.4 billion will be 65 and older. This aging population trend is especially prevalent within European and Asian countries.

- Caregiver shortage: The World Health Organization forecasts a global shortfall of 18 million healthcare workers by 2030. Furthermore, because of the heightened imbalance of elderly to younger citizens and the national commitment to robotics in Japan, we look to that country as a bellwether of how these technologies may play out. There, robots have been assimilated into the daily lives of elderly citizens and have helped them extend their ability to age in place.

Other drivers:

- Assistive healthcare robots can be used across four categories to meet consumer and caregiver needs: household/daily care assistant robots, physical assistant robots, multipurpose standstill (or static) personal assistance robots (PARs), and multipurpose movable (or moving-capable, non-static) PARs.
- Assistive healthcare robots have relevance for the healthcare and related social and activity of daily living needs of patients in the home. The use of artificial intelligence (AI) and sensing technologies increases the potential value of this intervention.

Obstacles

While assistive healthcare robotics are growing in both interest and availability, three issues bely their mainstream adoption:

- Cost: Assistive healthcare robotics can run in the tens of thousands. When robotics are deployed in an enterprise, this cost can be absorbed across multiple patients and use cases. In the home, you must justify the cost against one patient. This cost justification both limits the types and volume of patients who can use this technology.
- Purpose: While use cases continue to grow, today's use cases are limited making widespread gains in outcomes hard to quantify.
- Availability: Assistive healthcare robotics are not widely available today.

In 2021, we continue to classify the benefit as moderate until value is demonstrated at scale. Innovations continue to power the technology's slow progress along the Hype Cycle past the Peak of Inflated Expectations. We expect the first wave of assistive robots will reach the Plateau of Productivity within five to 10 years.

User Recommendations

- Begin to experiment with the use of robots within proven use cases (companionship) and as more use cases become viable. Widespread use of robotics is inevitable, and will include an expanding portfolio of healthcare and socially assistive applications.
- Encourage innovation in government social welfare programs by developing use cases and participating in trials.
- Prepare for mobile robots to appear as new endpoints in healthcare IT networks as assistive robots reach functional ability and viable price levels. Moreover, robots may eventually be represented in IT systems as “virtual” human/provider end users of IT, with unique identifiers, workflows and information needs, as well as being unique devices with specific deployment and support requirements.

Sample Vendors

Aeolus Robotics; CT Asia Robotics; INF Robotics; KOMPAÏ robotics; NEC; PARO Robots; Seismic; SoftBank Robotics

Gartner Recommended Reading

Emerging Technologies: Smart Robots Will Augment Human Workers, Not Replace Them

Infographic: Artificial Intelligence Use-Case Prism for the Healthcare Provider Industry

Artificial Intelligence Primer for 2021

Market Trends: 4 Technologies That Will Revolutionize Drones and Robots

Consumer Healthcare Wearables

Analysis By: Mike Jones

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Consumer healthcare wearables are electronic devices (such as smartwatches) that are designed to collect the data of users' personal health and exercise activities. They provide consumers and their clinicians access to analytics that can contribute to health, facilitate preventive care, and aid in the management of ongoing illness and recovery.

Why This Is Important

Consumer healthcare wearables offer healthcare providers the opportunity to use low-cost devices as a complement to medical-grade, remote patient monitoring devices when delivering care outside the hospital or clinic. As more consumers have obtained these devices, they now represent a rich data source to support care quality. These devices have enabled clinical surveillance of risk factors during the pandemic (e.g., in COVID-19 recovery or at-home monitoring).

Business Impact

- Greater compliance with prescribed lifestyle regimens.
- Market differentiation by providing a better consumer experience and increased customer intimacy
- Ability to monitor patient risk factors at a low cost per user when compared with medical-grade monitoring equipment.
- Maintaining a focus on factors that can influence outcomes, recovery times and prevent adverse events.
- Measurable improvement in mental and physical health.
- Ability to stay conveniently connected to a healthcare provider vs. face-to-face visits.

Drivers

- The global wearable device market is forecast to reach $109 billion in 2024.
- Forecast CAGR over the next three years indicates growth between 5% and 20% in terms of the number of units sold. The rate varies depending on the type of consumer device (e.g., wristband, smartwatch).
- Gartner predicts that by 2024, device makers will focus on offering smaller, clinical-grade sensors for consumer health wearables to increase monitoring accuracy by 20% over current technologies.

Healthcare provider use of lower-cost consumer wearables continues to grow as a result of these drivers because they:

- Offer an engaging user interface and user experience to help drive self-management and compliance as part of healthcare provider prescribed lifestyle regimens.
- Are available at a more affordable price point than medical-grade equipment
- Help differentiate the healthcare provider in terms of patient engagement and experience.
- Yield an additional source of data for case managers to check in with patients to see how they are coping with their treatment regimens or to respond to periods of inactivity.
- Provide an incentive to patients to change behaviors.

There is an increasingly sophisticated and more accurate range of wearables available in this space:

- Wristband-style devices (e.g., Apple Watch, Fitbit, Garmin Connect and Samsung Galaxy Watches) for measuring exercise patterns and intensity
- Consumer-grade blood pressure (BP) monitoring devices.
- Pulse oximeters for measuring lung efficiency (a leading indicator of COVID-19 progress in the body)
- Sleep monitoring and brainwave monitoring.
- Clothing that senses blood flow and respiratory rates.

As a result of these drivers, we have positioned this technology as moving quickly toward and then through the Trough of Disillusionment. We expect maturity of adoption will be closer to five to seven years in regions that also address technical and cultural obstacles.

Obstacles

- Lack of published clinical evidence on clinical effectiveness.
- Technical difficulties when integrating devices and the data collected into clinical workflow and clinical systems (e.g., EHR).
- Clinician skepticism as to the value of these devices in the clinical environment and the additional time that will be required to review and interpret consumer wearable data.
- The market is very diverse and many point solutions exist which can lead to fragmentation of apps and devices.
- Security and privacy concerns from consumers and clinicians.

User Recommendations

- Evaluate the application and effectiveness through peer-reviewed case studies, focusing on applications for lifestyle, rehabilitation, and patient engagement and retention.
- Discuss the potential and socialize the concept of use of these devices within clinical practice through the chief medical informatics officer or chief nursing informatics officer (CMIO or CNIO). This would determine the most appropriate forms of monitoring and tracking.
- Ensure to pilot implementation in a tightly scoped project with clear metrics for measuring clinical and patient adoption and impact, and be sure to consider the issues of ownership of data and consent to collect and use data.
- Assess the security and data protection requirements of your region where this information is traversing and the cloud environment of the vendor platform that aggregates and presents the information.

Sample Vendors

Alphabet; Apple; Fitbit; Garmin; Google; iHealth; Omron Healthcare; Panasonic; Samsung; Validic

Gartner Recommended Reading

Forecast Analysis: Wearable Electronic Devices, Worldwide

Enterprise Virtual Care Platform

Analysis By: Sharon Hakkennes, Mike Jones

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Enterprise virtual care platform solutions represent a set of digital capabilities and related services that enable augmentation and substitution of conventional face-to-face care delivery. This is achieved through delivery of care where the clinician is not in the same physical location as the patient, either synchronously (i.e., in real time) or asynchronously. Capabilities fall under three core categories — virtual visits, remote monitoring and digital clinical encounters.

Why This Is Important

Enterprise virtual care platforms enable healthcare providers to deliver a broad range of clinical services to enhance patient experience, branch into new populations and service lines, and transform service delivery efficiency under alternative payment models. Current platforms offer a functionality that complements or is not available in existing EHR megasuite offerings, and EHR integration is a key success factor for an efficient clinical workflow.

Business Impact

The target audience for these solutions includes healthcare providers that deliver a range of care offerings in a range of settings or are looking to expand into new business lines. Impacts include:

- Opportunities to expand into new markets, improved productivity and increased revenue.
- Improved consumer engagement, care experience and satisfaction due to more flexible models of care delivery.
- Increased quality of care leading to improved care, health and well-being outcomes.

Drivers

The impacts of COVID-19 on healthcare providers continues to drive hype and accelerate adoption of virtual care platforms:

- In their initial response to the crisis, healthcare providers scaled existing solutions or rapidly deployed new solutions to support delivery of virtual services for both inpatient and ambulatory care. Many providers compromised on functionality and integration in order to deploy these solutions quickly.
- Healthcare providers are now shifting from their tactical response to a long-term strategic approach to virtual care across their enterprise and are seeking to align technology solutions to this strategy. Reassessing the sustainability and scalability of stand-alone solutions deployed in response to COVID-19 is an essential step in this process. Investing in core platforms that can scale across multiple use cases will be essential in ensuring long-term sustainability of virtual care services.
- At the same time, coalescence of both vendors and functionality continues to increase the availability of enterprise virtual care solutions on the market. Additionally, vendors are rapidly developing their solutions, introducing more features and capabilities in order to meet new requirements of their healthcare customers.
- Mergers and acquisitions continue at pace, including Teladoc Health's acquisition of Livongo for $18.5 billion and Philips' acquisition of remote cardiac diagnostics and monitoring company BioTelemetry for $2.8 billion. Cigna's Evernorth acquired virtual care provider MDLive, indicating the broader healthcare ecosystem is investing in virtual care.

Obstacles

Virtual care platforms are rapidly sliding into the Trough of Disillusionment as clinicians become frustrated with the work arounds associated with rapidly deployed solutions and organizations identify that no single solution will meet all of their required use cases. Obstacles to adoption include:

- Ongoing uncertainty regarding long-term payment models and in the regulatory environment.
- Cost pressures and financial constraints as a result of lost revenue and increased costs experienced in response to COVID-19 is challenging healthcare provider's appetite and capacity to invest in new enterprise solutions.

- Challenges achieving required integration into electronic health record (EHR) solutions to support seamless integration of virtual care services into core clinical workflows.
- Health equity concerns regarding virtual care modalities unequally benefiting some patient demographics over others.

User Recommendations

- Justify investment in virtual care platforms by developing a vision and roadmap for enterprise virtual care across your organization. Consider expanding service models to explore new markets, including direct-to-consumer options, to build a positive business case.
- Ensure technology solutions are fit-for-purpose by reviewing use cases, including existing virtual care offerings to determine those that can be migrated to an enterprise virtual care platform and those with specialist requirements, necessitating a best-of-breed solution.
- Optimize clinician and patient experience by prioritizing modularity of solutions and availability of APIs in your procurement process. Achieving deep integration into core clinical workflows and a seamless patient experience is essential for long-term success.
- Minimize implementation costs and risks by reviewing vendor capabilities and commercial terms to ensure a scalable pricing model and compatibility with existing medical devices and network policies.

Sample Vendors

Amwell; GE Healthcare; Medocity; Philips; Teladoc Health; Vivify Health

Gartner Recommended Reading

Market Guide for Virtual Care Solutions

Scaling Virtual Care Requires a New Look at Its Enabling Architecture

Best-Practice Exemplar: Palvelukeskus Helsinki Scales Innovation in Virtual and Digital Care Delivery

Ace These Proof Points to Create a Sustainable Virtual Care Strategy

Genomics Medicine

Analysis By: Sachin Dev, Michael Shanler

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Genomics medicine technology enables the use of genetic information for medical research and treatment (e.g., diagnosis, therapy, risk management). It is a component of precision medicine and focuses on leveraging genomic data and insights derived to treat patients. Technologies include gene sequencing, variance calling, high-performance computing, artificial intelligence (AI)-informed risk assessment and clinical decision support.

Why This Is Important

Genomics medicine is already saving lives, and its promise to improve health outcomes is driving adoption in healthcare. Upstream technologies supporting research and gene sequencing data collection are well developed and yield increasing amounts of efficiency in genomics. Technologies that use genetic information in clinical care delivery are progressing toward delivering quick, reliable and actionable patient-specific insights.

Business Impact

The value of genomics medicine is demonstrated across multiple areas, including:

- Targeted therapies for cancer and rare diseases.
- Accurate and patient-specific clinical diagnosis and treatment decision.
- Specific and targeted diagnostic tests based on a patient's genetic profiles eliminates or reduces extra cost.
- Precision care for prenatal and genetics-directed chemotherapy.
- The business and population health impact of genomics medicine are substantial and a key component of precision medicine.

Drivers

- Healthcare and life science organizations with notable success in genomics medicine demonstrate many genomic programs and studies to utilize the molecular-level insights, from genes to personalize treatments, and improve healthcare outcomes. The emergence of a new class of next-generation sequencers (NGS) is enabling vendors to bring new capabilities at end-user level, broadening the utilization of genetic information across multiple clinical specialties (such as chronic disease management) and beyond oncology.
- Technology and services related to genomics are steadily progressing as the cost of genomic sequencing continues to go down and as research has identified more practical uses in diagnosing and treating patients. For example, companion diagnostics is rapidly expanding in biopharma whereby an individual's receptivity for a specific medicine is measured by matching a specific genetic biomarker. Research in the field is investigating many other uses of genomics, ranging from genetic testing for rare and undiagnosed diseases, gene therapy, testing for treatment receptivity, precision cancer treatment and gene editing to "correct" for abnormalities, among others.
- Adoption will continue to grow as researchers identify more correlations between genetic biomarkers and health, disease prevention and treatments. Advances in gene discovery and specific drugs that target them (PGx) will have the most direct impact. The accelerated adoption rate of electronic health records (EHRs) now pervasively deployed throughout the world creates rich sources of health data ripe for epigenomic exploration. Data analytics, including AI techniques such as machine learning, now have great potential to aid in new discoveries leveraging that data. For these reasons, we move this profile further along on the Hype Cycle with five to 10 years to the mainstream.

Obstacles

- Progress in genomic medicine proceeds at the pace of scientific discovery. It requires decades of extensive research to translate genomic data into actionable clinical practices.
- It is equally challenging to make this knowledge actionable by physicians, as many are not well-trained to incorporate an actionable insight from genomics within their workflows.
- Although new genetic markers are constantly being discovered, they require frequent reanalysis of patients' sequencing data that hinders the development and regulatory approval of new tests, drugs and therapies.
- Researchers, life science and healthcare providers demand genomics raw sequencing data, analysis and recommendations from sequencing data are integrated in their EHR system. Interoperability remains a barrier to information exchange among scientists, providers, patients and families for collaboration and counseling.

User Recommendations

- Establish a surveillance process to stay updated with the practical use of genomics in diagnosis and treatment, and the implications for IT. Initiate discussions with peers as to whether it is worth pursuing an in-house genomics center of excellence, or outsourcing this function.
- Outline business process, compliance, laboratory, regulatory and IT implications when including genomics medicine disciplines for decisions about research, therapies and business opportunities, while ensuring patient privacy.
- Architect an IT infrastructure, inclusive of outside services, that supports the acquisition, storage, collaboration and analytics requirements demanded by genomic datasets and therapy delivery.
- Evaluate your EHR vendor for their plans to support genomics medicine needs. This includes the ability to record, store, secure and access genetic marker data from patients, and their ancestors and family members, within the individual patient's record.

Sample Vendors

DNAnexus; Genedata; Helix; IBM Watson; Igenbio; Illumina (GenoLogics); L7 Informatics; NantHealth; Sema4; Seven Bridges

Gartner Recommended Reading

Healthcare Provider CIOs' COVID-19 Cost Optimization Action Plan

Cool Vendors in Life Sciences

Healthcare and Life Science CIO's Genomics Series: Part 1 — Understanding the Business Value of Omics Data

Healthcare and Life Science CIO's Genomics Series: Part 2 — Formulating an Omics Vision

Healthcare and Life Science CIO's Genomics Series: Part 3 — Prioritizing Omics Investments

Medication Compliance Management

Analysis By: Veronica Walk, Pooja Singh

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Medication compliance management systems are designed to monitor and support medication compliance with a prescribed regimen. These systems leverage a range of technologies from patient portals and mobile apps to emerging technology such as programmable pill boxes and RFID-tagged smart pills. These solutions monitor compliance and alert the patient, family members or caregivers that the patient has failed to take a medication.

Why This Is Important

Medication compliance can improve therapeutic efficacy, thereby preventing or controlling disease progression, improving patient outcomes, and reducing costs of care. These solutions are especially valuable to pharmaceutical companies with major investments in drug development that hinge on participant compliance in clinical trials. Healthcare providers and payers seeking to advance population health and value-based care may also benefit from these complementary solutions.

Business Impact

Medication compliance management systems can be used by healthcare payer, provider and life sciences organizations for a variety of use cases, such as:

- Chronic condition management where noncompliance can lead to disease progression or clinical deterioration requiring higher acuity, more costly care.
- Postoperative care such as transplant patients where noncompliance can result in organ rejection.
- Clinical trials where noncompliance can lead to inaccuracies in observed efficacy or drug safety.

Drivers

- Despite the availability of multiple technologies and sponsors, adoption of medication compliance systems is still limited to only a small percentage of patients — predominantly within clinical trials. This use case is likely to grow as digital clinical trials become more common.
- Compliance management will also be a critical part of risk-sharing contracts in which a pharmaceutical company is paid based on the medication's outcomes.
- Adoption of medication compliance management systems is also expected to increase in alignment with the adoption of value-based care as medication noncompliance is a significant contributor to hospital readmissions.
- Postpeak positioning is based on penetration in the U.S., which has higher adoption than we observe in other countries. However, global increases in virtual care adoption will contribute to the popularity of these complementary solutions.

Obstacles

- Medication compliance management focuses on monitoring and enforcing a prescription regimen but does not address other causes of nonadherence such as inability to fill a prescription (for example, due to cost or transportation limitations) or undesirable side effects.
- Healthcare payers and providers may be enticed to invest in solutions or programs that address a broader set of medication compliance issues rather than whether or not the patient has taken their medication as prescribed.
- These solutions also require an engaged care team to address and manage issues in noncompliance, which may warrant additional resources or paying for services to support patients using these tools.
- Healthcare payers and providers may be inclined to leverage existing solutions, such as consumer engagement platforms, to stay connected with the patients and make sure they are able to fill their prescriptions and maintain their prescribed regimen rather than investing in these niche solutions.

User Recommendations

Payer, provider and life science CIOs:

- Facilitate evaluation of medication compliance management systems by partnering with your clinical colleagues to identify a pilot use case. Use pilot findings to inform lessons learned, opportunities for technology and workflow improvements, and best practices for a larger rollout.
- Set patients up for success by selecting technologies specific to their use cases and preferences. For example, an elderly dementia patient will benefit from different tools than a parent of a child with asthma.
- Empower the care team to identify noncompliance and intervene with education or alternative therapy regimens by integrating compliance data into clinical workflows.
- Enhance effectiveness of medication compliance management systems by pursuing partnerships with community pharmacists who have their own medication adherence programs that may address other aspects of medication compliance.

Sample Vendors

AdhereHealth; AiCure; Cureatr; emocha Health; Philips; Propeller Health; Xhale

Gartner Recommended Reading

Best-Practice Exemplar: Palvelukeskus Helsinki Scales Innovation in Virtual and Digital Care Delivery

Prepare for Aging Epidemic by Extending Your Virtual Care Strategy to Support Aging in Place

Best Practices for Reimagining Your Life Science Company as a Digital Business Technology Platform

Healthcare and Life Science Top Actions for 2021: Consumer Engagement

PHI Consent Management

Analysis By: Mike Jones

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Protected health information (PHI) consent management is the combined system, process and set of policies for consumers to establish how care providers can access or exchange their health information. Individuals can confirm participation in patient portals and health information exchanges (HIEs), and dynamically update granular privacy, access and usage preferences for their health data.

Why This Is Important

PHI consent management provides patients, providers and health organizations with the confidence that health information is protected regardless of where or how it is utilized. Health organizations must ensure that transparency is built into their electronic record systems (e.g., their HIE or local electronic health record [EHR]), and is present within the interoperability solutions that permit the exchange of information among care providers, payers and other third parties.

Business Impact

- Without effective PHI consent management, it is difficult to scale the secondary use of health data for population health, clinical trials, precision medicine, and genomics or algorithmic medicine
- Healthcare providers must ensure permitted use policies are retained as PHI moves between entities. Intended use policies, for which the disclosing provider remains accountable, should not be overridden by downstream systems.

Drivers

- The development of new capabilities for PHI consent management has been accelerated by continuing regulatory shifts across the privacy landscape at the regional, country and state levels. This is further compounded by increasing consumer demand for transparency on how health data is processed and shared outside of the immediate care delivery domain (e.g., for research into vaccines or for recruitment of patients into clinical trials).
- Improvements and increased adoption of interoperability standards and networks across the healthcare provider sector are leading to a greater number of systems and workflows that can now share health information (e.g., ONC 21st Century Cures Act Final Rule Announcement Summary).
- There has been an increase in the funding and formation of national and regional HIEs in many regions outside of the U.S. where shared care records are part of national or regional healthcare reforms.
- International efforts to tackle COVID-19 pandemic have led to massive demand for information-sharing platforms to provide cross-border access to PHI for vaccine development, measuring the interventions' effect, measuring treatment outcomes, and planning vaccine distribution and digital certificates or vaccine passports.
- As a result of increased global interest in privacy and protection of citizen data, and the increased threats and risks that result from ineffective PHI protection, we have advanced this profile toward the Slope of Enlightenment.

Obstacles

- Central to most privacy laws is the challenge of providing users clarity about control over their personal data. Translating these regulations into operational systems and protocols for a variety of regions means that vendor solutions often require considerable configuration prior to deployment.
- Many organizations have found themselves constrained by their product choices within 12 months of deployment as demand for additional capabilities develops rapidly due to market shifts and a greater need for granularity in first-party consented data.
- Capabilities chosen and deployed in isolation of consultation with patients and providers are rarely representative of consumer needs, resulting in weak adoption, and loss of time and investment.

User Recommendations

CIOs, CMIOs and those involved in information privacy, security and compliance (e.g., CISOs) should:

- Review regional legislation, and determine what is required from internal systems to reach and remain compliant with PHI protection clauses.
- Evaluate existing application portfolios to determine how these systems record consent and authorize users or external systems to access PHI.
- Identify the target level of transparency through analysis of customer preferences and documenting consumer expectations.
- Avoid purchasing an overly “fitted” solution by defining a clear list of requirements based on future, rather than immediate, needs.
- Offset the volume of subject right requests commonly associated with modern privacy regulations by advancing the maturity of the organization’s PHI consent management offering from reactive toward a self-service model.
- Build a strong business case by addressing emerging requirements early in the process through collaboration with clinical leadership.

Sample Vendors

Deloitte; Global Public Inclusive Infrastructure (GPII); InterSystems; IQVIA; Jericho Systems; OneTrust; Optum; ZeOmega (HealthUnity)

Gartner Recommended Reading

Proactively Protect Patient Information With IGA and PPM

Healthcare CIOs: Prepare for Granular Patient Consent

Contact Tracing Apps Demand the Reshaping of Consumer Privacy Rules

7 Critical Domains of a Successful Healthcare Provider Interoperability Strategy

EHR Support of Virtual Care

Analysis By: Mike Jones, Sharon Hakkennes

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Electronic health record (EHR) support for virtual care is the set of capabilities integral to a core EHR product suite that enables the remote delivery of care when the clinician and patient are not colocated. These interactions include both asynchronous and synchronous remote video visits, as well as remote patient monitoring (RPM).

Why This Is Important

Healthcare CIOs face a long-term investment decision on what digital capabilities they need to support increasing and sustained levels of virtual care. Growth in virtual visits is leading to further interest in RPM and wider use of virtual health assistants for clinical triage (e.g., the U.K. NHS App, which includes a COVID-19 symptom checker). Many EHR vendors lag in building native support for virtual care, despite strong interest and a need for seamless integration with clinical workflows.

Business Impact

The transformation to value-based care, and consumer convenience, will encourage hybrid models that span face-to-face and virtual care. All healthcare provider workflows, including virtual care delivery, depend on access to core systems, including the EHR, giving clinical context and aiding clinical decision making. Virtual care requires specific digital capabilities that EHR vendors have not historically delivered, and EHRs fall short on functionality versus enterprise virtual care platforms.

Drivers

- COVID-19 significantly increased healthcare providers' appetite and need for virtual care capabilities. Many providers had to scale solutions quickly at the expense of full integration with EHR data and functionality.
- EHR vendors were unprepared and initially struggled to deliver timely comprehensive virtual care capability during the pandemic. Vendors instead focused on integrating basic platforms for videoconferencing and collaboration (such as Zoom, Microsoft and Twilio). However, building native virtual care capabilities is now a core component of EHR vendors' strategic product development roadmaps.
- Regional funding and reimbursement models for virtual care have been adjusted considerably in the past 12 months. In some regions (such as the U.S. and specific EMEA regions), the reimbursement for virtual care has achieved parity with face-to-face care delivery.
- Healthcare providers are now moving from their initial investments in tactical virtual care solutions to building long-term, strategic virtual care capabilities. Their EHRs must accommodate these needs and the associated technologies into clinical and administrative workflows.
- Significant advances have been made in providers' adoption of a range of stand-alone virtual care solutions. EHR vendors have made recent commitments to increase the range of native functionality and the degree to which third-party platforms can seamlessly interface with the EHR. Thus, we advanced this profile to early mainstream on the Slope of Enlightenment.

Obstacles

- Not all regional funding models have achieved parity between virtual and face-to-face care, and in some regions, payers are seeking reductions in virtual care reimbursement due to the perceived efficiencies of virtual care. This increases provider resistance to adoption.
- EHR-based virtual care solutions have been slow to match the full range of capabilities available through stand-alone, or best-in-class, products (such as remote device integration and the ability to work outside of an EHR-centric patient portal). Some EHR vendors are hesitant to allow third-party integration, which has slowed progress.
- Clinicians will actively resist a shift to virtual care delivery when the administrative burden of using EHR and virtual care technology outweighs that of face-to-face care.

User Recommendations

Healthcare provider CIOs seeking to use the EHR for virtual care delivery:

- Develop effective policies and procedures that, in part, set patient expectations, determine what is appropriate to deliver virtually, and decide how clinicians' time will be scheduled and accounted for. This is to ensure that the EHR capabilities will enable efficient and effective virtual care delivery.
- Work with EHR vendors to ensure that their current offerings and roadmaps address the capabilities required. Also, if an external platform has been selected, ensure that your EHR vendors will support integration through a comprehensive set of EHR APIs and SDK tools.
- Evaluate how your EHR can also securely capture and integrate data provided by patients, using virtual care modalities (such as IM, SMS, and video or photo sharing). Refresh data processing, privacy and consent policies to incorporate these new forms of data.

Sample Vendors

Allscripts; Cerner; Epic; Intersystems; MEDITECH; Philips Healthcare

Gartner Recommended Reading

Market Guide for Virtual Care Solutions

Accelerate Virtual Care Adoption Using the 5-Tier Approach to Virtual Care Services

Scaling Virtual Care Requires a New Look at Its Enabling Architecture

Healthcare Provider Top Actions for 2021: Prioritize Virtual Care and Care Team Collaboration

3D Printed Presurgery Anatomical Models

Analysis By: Pooja Singh, Mike Jones

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

3D printed presurgery anatomical models combine an individual patient's CT scans and MRIs with software and 3D printing (3DP) devices to produce highly accurate three-dimensional replicas of a patient's surgical site. The model can include dimensional details beyond those discernible by surgeons just from the images. Physicians can use these models to visualize the anatomical landscape applicable to a wide variety of surgical and educational situations.

Why This Is Important

3D printed models provide physicians with a reference to efficiently and safely plan surgical procedures (including sizing and fitting), enhance patient consent processes, and improve intraoperative visualization for both routine and highly complex cases. These capabilities can lead to improved clinical outcomes and patient experiences.

Business Impact

- Improved diagnostic ability and accuracy as well as process efficiency during procedure selection
- Increased clinical productivity as one can prepare and practice prior to surgery, which helps to reduce time in surgery and improve operating room utilization while minimizing risk of complications and saving costs
- Enhanced patient experience and consent process through better discussions about upcoming procedures
- Greater education of new physicians on pathological conditions, along with improved communication with multidisciplinary surgical teams

Drivers

- With the growing prevalence of chronic disorders among global populations, there has been an increase in the number of surgical procedures every year. 3DP presurgical models improve diagnostic ability and accuracy, and clinical productivity during surgical procedures.
- 3DP presurgical models can help in optimization of elective surgery backlog, as they provide a faster way to improve preoperative planning so that surgeons get the information they need faster.
- Emergence of new service models provides speed and accuracy, which leads to increased adoption of the technology. One of the recent developments in this direction includes Axial3D partnership with Fast Radius to provide a model-to-print service to healthcare providers. This service uses patients' 2D scans to create the 3D printed models within 48 hours, which can be used by physicians and patients for procedure planning.
- We have also seen an expansion in the number of surgical specialities where 3DP presurgical anatomical models are used. Common specialities include orthopedic, cardiothoracic, vascular, oral and maxillofacial, oncology, plastics, reconstructive, urology, and pediatrics.
- Reimbursement for using 3DP presurgery anatomical models will eventually improve adoption. In the U.S., the American Medical Association (AMA) has approved reimbursement under Current Procedural Terminology (CPT) Category III reimbursement codes.
- Increased evidence of value demonstrated by surgical guides and custom-printed implants also drives sales of 3DP anatomical models, as these models are often included as a part of total solutions.
- Based on the developments listed above, we see this profile moving out of the Trough of Disillusionment at post-trough 15%, about to climb the Slope of Enlightenment in the next few months. We expect time to mainstream adoption between two to five years.

Obstacles

- Most of the barriers to model-only uses are around the practical translation of the technology to regular use. Barriers include awareness, joint planning and prioritization procurement, execution for multiple uses, and users across multiple hospital and physician locations.
- Many healthcare providers may perceive technology as “nice to have” as opposed to essential. Making a business case and asking for investments can be difficult for many healthcare provider CIOs health systems. Most of the adoption comes from large academic medical centers and integrated delivery systems as they can create their own capability. Smaller healthcare providers hospitals cannot really sustain this yet and will need a service bureau or partnership.
- High cost associated with maintenance of 3D printing devices.

User Recommendations

CIOs looking to enable 3DP presurgery models in their healthcare provider organization should partner with their CMIOs to:

- Define their health systems’ strategies and roadmaps across physician stakeholders, use cases, technologies and vendors for medical 3DP capabilities.
- Consult the legal department during planning and procurements to address risks and medical liabilities.
- Focus on supporting surgical data models, workflows, medical imaging technology, design software and 3DP.
- Prioritize system development to bridge the different disciplines and domain expertise to develop more-realistic 3DP preoperative preparation tools and surgical guides.
- Establish a center of excellence (COE) for surgical planning tools and simulation, empowering a team approach that spans individual departments, where 3DP workflows can be optimized.

Sample Vendors

Axial3D; Embody; Formlabs; Materialise; MEDICAL IP; Stratasys

Gartner Recommended Reading

Healthcare Business Driver: Medical Innovations in Therapy, Diagnosis and Care Delivery

Predicts 2019: 3D Printing Accelerates, While 4D Printing Is Getting Started

Market Guide for 3D Printer Manufacturers

Patient Portals (Untethered)

Analysis By: Sharon Hakkennes, Veronica Walk

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Patient portals enable a secure digital patient-provider communications channel that provides access to clinical, financial and administrative functionality; educational information; and personal health maintenance tools. This profile tracks patient portal technologies that are untethered from an electronic health record (EHR). Untethered portals provide access to both EHR data and a wide range of tools and services beyond the EHR.

Why This Is Important

For healthcare providers, the increasing adoption of virtual care services has served to heighten the importance of digital patient engagement. Patient portals are an important component of an overarching consumer engagement strategy. Untethered patient portals are the optimal solution for providers with multiple EHRs that lack adequate portal functionality or those with a desire to differentiate on consumer engagement.

Business Impact

Untethered patient portals provide many benefits, including:

- Improving patient engagement, activation and satisfaction while also increasing patient physician and healthcare system loyalty.
- Providing patients more meaningful and lasting involvement with their health and treatment plans.

- Generating insights into individuals that can be the underpinning of effective wellness, prevention and chronic care management campaigns — thereby making them the cornerstone of a personalized health strategy.

Drivers

- EHR-tethered portals are frequently criticized for their limited number of services and accessibility challenges. In contrast, untethered portals are not limited to providing patients access to services offered by an EHR and thus offer a more personalized consumer experience.
- Increasing healthcare provider interest in untethered portals is being driven by their relative advantages, including the following abilities: (1) to enable patients to access data and services without needing to have a preexisting patient ID or forcing them to authenticate using passwords; (2) for healthcare providers, to present an unlimited number of health and healthcare services to consumers through their choice of best-of-breed solutions; (3) for patients, to see their data aggregated across multiple providers and their use of different vendors or instances of an EHR; and (4) to collect a wide range of consumer-generated health data, including biometric monitoring, patient-reported outcomes and environmental monitoring.
- Outside the U.S., untethered patient portals are the leading portal choice for healthcare providers because of the need to integrate with multiple EHRs, patient administration systems, social services, wellness and prevention services, and chronic care management systems.
- Countries and regions including Denmark, Estonia, Sweden, Andalusia (Spain), Lombardy (Italy) and the U.K. are also driving adoption of untethered patient portals. These stand-alone portals have experienced substantially higher adoption by citizens. For example, the Denmark Sundhed.dk portal has more than 1.7 million unique users (31% of the population) using it each month.

Obstacles

- From a patient perspective, barriers to adoption include a preference for in-person communication, poor digital and health literacy, lack of awareness and perceived benefit, internet access, and privacy concerns.
- For healthcare providers who have made significant long-term investments into EHR solutions, justifying the time and cost required to transition to an untethered portal is a significant barrier to adoption.
- Technical challenges are also impeding adoption of untethered patient portals. This includes challenges with achieving required interoperability, especially with core EHR solutions and complexity in the vendor landscape. A variety of different solutions exist, such as dedicated patient engagement solutions, low-code platforms and multiexperience platforms, and healthcare providers may require more than one solution to meet all their patient portal requirements.

User Recommendations

- Choose the right vendor partner(s) for your untethered portal by evaluating solutions against your long-term consumer engagement strategy. Prioritize patient experience and multiexperience engagement capabilities.
- Accelerate time-to-value realization by taking an agile approach to development. Deploy a minimum viable product and continuously iterate and improve your solution based on consumer feedback and lessons, and changing business and clinical requirements.
- Drive adoption by identifying and mapping different consumer personas and identifying their unique preferences and barriers. Develop a tailored marketing strategy aligned to each of your identified personas and engage clinicians to support delivery of these messages.
- Maximize portal utilization by building a comprehensive support model including processes to support patient onboarding, education in portal use and addressing technical issues. Ensure adequate resourcing to support these processes.

Sample Vendors

Appian; Bridge Patient Portal; Get Real Health; Medix; OutSystems; Pegasystems; Progress; SymphonyCare; TriFin Labs

Gartner Recommended Reading

It's Time for Healthcare Delivery Organizations to Adopt a Digital-First Strategy

Healthcare Provider CIOs: Bridge the Virtual Care Divide Between Provider- and Consumer-Directed Care

Innovation Insight for Consumer Experiences in Healthcare and Life Sciences

The Evolution of Healthcare Consumer Engagement Hub Architecture

Magic Quadrant for Multiexperience Development Platforms

Magic Quadrant for Enterprise Low-Code Application Platforms

Climbing the Slope

Enterprise EHR Systems (Non-U.S.)

Analysis By: Mike Jones, Sharon Hakkennes

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Enterprise electronic health records (EHRs) are clinical systems optimized for use in acute care, ambulatory or outpatient clinics. They capture and maintain patient-centric information about health status and care, support tasks and events directly related to patient care, facilitate clinical pathways and documentation, and provide clinical decision support. This profile tracks non-U.S. adoption of enterprise EHRs.

Why This Is Important

Enterprise EHRs provide a broad set of capabilities spanning clinical documentation, scheduling, clinical decision support, computerized physician order entry, e-prescribing and analytics. These capabilities are critical for healthcare providers who want to optimize care quality and safety through data-driven improvement. The level of EHR adoption needs to increase in non-U.S. regions to achieve the quality, safety and access goals of healthcare providers and government health systems.

Business Impact

An enterprise EHR system can provide support for a wide variety of clinical activities that affect all caregivers and patients. It can reduce the rate of medical errors, eliminate unwarranted practice variations, improve operational efficiency and compensate for the shortage of skilled healthcare workers. Although the potential benefits are considerable, it takes substantial planning, money and vendor collaboration to obtain the full value of an EHR.

Drivers

- Regulatory and policy drivers include the need for electronic record sharing across health and social care agencies to support safe transitions of care.

- Population health management requires that EHRs provide a source of data for risk stratification and a tool for carrying out recommended actions and activities for specific cohorts of individuals.
- Improved revenue cycle charge capture is a key driver in many regions as EHRs enable coding and billing at scale.
- EHR adoption is most active in Australia, Canada, the U.K., Germany, Switzerland, Latin America, parts of the Middle East and Benelux and Nordic regions.
- EHR adoption has continued to expand globally as governments encourage their use and more hospital leaders recognize the value of fully integrated EHRs.
- Sales cycles remain very long and procurements complex. With COVID-19 being the main focus of attention for healthcare providers in 2021, a number of large regional EHR procurements and in-flight implementations have been stalled or stopped indefinitely due to spending pressure on other priorities.
- For these reasons, we have advanced this profile marginally toward mature mainstream adoption, as rates outside the U.S. are now above 20% but generally below 50% in the majority of countries.

Obstacles

- Time to value (or ROI) for an enterprise EHR is typically five years or more from initial strategy formulation to benefit realization.
- Total cost of ownership (TCO) is significant and systems require advanced levels of configuration and adoption support requiring ongoing investment.
- The main focus of attention for healthcare providers in 2021 and 2022 will be COVID-19 pandemic recovery. Funding for large regional EHR procurements and in-flight implementations have been stalled in many regions.
- SaaS-based EHR solutions are not mature yet outside of the U.S., which means more traditional capital expenditure programs are needed for implementation.
- Sales cycles remain long and procurements complex
- Alternative clinical system architectures are becoming more popular. Vendors of these approaches offer more affordable cloud-based SaaS solutions for modular packaged capabilities, such as e-prescribing, virtual care and clinical care records.

User Recommendations

- Work with senior clinical leaders to help promote the benefits of these systems and to also ensure that their organizations have fully understood what is involved in implementation and benefit realization.
- Evaluate vendors in terms of benefit, cost and risk, noting that each vendor has a different profile when it comes to TCO, usability and the speed at which benefits are realized.
- Adopt a life cycle approach from initial strategy through to selection and optimization once deployed. Use Toolkit: Best Practices for EHR Success — Life Cycle Stage 5, Operate and Evolve to do this.
- Establish clinical informatics roles, including a CMIO partnered with a chief nurse and midwifery officer (CNMIO) to ensure that deployment, adoption and clinical content life cycle management work are accomplished.
- Focus optimization activities on creating evidence-based order sets and care plans, defining clinical workflows to reduce unnecessary and unwarranted variation in care.

Sample Vendors

Allscripts; Cambio Healthcare Systems; Cerner; ChipSoft; Epic; InterSystems; MEDITECH; Philips; System C; TietoEVRY

Gartner Recommended Reading

Toolkit: Best Practices for EHR Success — Life Cycle Stage 3, Select

Toolkit: Best Practices for EHR Success — Life Cycle Stage 4, Deploy

A Healthcare Provider CIOs Playbook on Lessons Learned From Global Electronic Health Record Projects

Gauge Readiness and Mitigate Risk to Succeed in EHR Implementations

Healthcare Provider CIO Top Actions for 2021: EHR Optimization

Market Guide for Enterprise Electronic Health Record Solutions

OpenNotes

Analysis By: Sharon Hakkennes, Mike Jones

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

OpenNotes is an initiative to give patients convenient access to their clinical notes stored within electronic health records (EHRs). This is accomplished through local healthcare delivery organization (HDO) initiatives, most commonly using a portal tethered to the EHR, or through regional and national initiatives to provide patient access to shared care records.

Why This Is Important

OpenNotes is a growing international movement, rather than a product. Founded in 2010, the effort is based at Beth Israel Deaconess Medical Center in Boston, Massachusetts, with collaborators around the U.S. and overseas. Shared notes document interactions patients have with doctors, nurses and other clinicians, and make up “the story” of a person’s healthcare. HDOs decide which type of notes they will open to patients, which roles are included and the scope of which departments participate.

Business Impact

OpenNotes supports improvements in healthcare delivery through greater information transparency. Many studies have now demonstrated the value of OpenNotes, including:

- Empowering individuals to become active participants in their own care.
- Enhancing patient understanding of their health and medical condition(s).
- Increased collaboration and trust between patients and clinicians.
- Improved adherence to treatment and care plans (e.g., medication management).
- Improved accuracy of clinical documentation.

Drivers

U.S. HDOs’ 5 April 2021 compliance date with the 21st Century Cures Act’s Interoperability, Information Blocking and the ONC Health IT Certification Program Final Rule is accelerating adoption of OpenNotes. Specifically:

- The rule is designed to advance interoperability; support the seamless exchange, access and use of electronic health information; and address information blocking.
- The rule applies to all clinical users across all clinical settings and specifies eight different types of notes that must be shared as defined in the United States Core Data for Interoperability (USCDI). These include consultation, progress and procedure notes.
- In October 2022, the restrictions limiting required information for sharing to the USCDI will be lifted — at which time patients will have the right to access all of their electronic health information.

The movement has also attracted a lot of interest in other regions across the globe where government-led regulations and initiatives are driving adoption. For example:

- In the U.K., general practitioners (GPs) are committed to providing patients with online access to their full record, including the ability to contribute their own information from April 2020. Patients can access their records through the national NHS App or through a number of commercially available solutions.
- In Estonia, the eHealth Record is a nationwide system integrating data from Estonia's different healthcare providers to create a common record that every patient can access online. Patients access their records through an e-Patient Portal, and blockchain technology is being used to assure the integrity of retrieved records as well as system access logs.
- Across Canada, adoption of OpenNotes is occurring at both the HDO level (for example, University Health Network myUHN) and the provincial level (for example, Alberta Health Services Connect Care).

Obstacles

- Clinician resistance due to the perception that workloads will increase as a result of additional time required to write each note or increased communication from patients reading the notes.
- Clinical concerns that access to electronic health information may create undue patient anxiety due to misinterpretation of information or through access to distressing information — such as real-time patient access to laboratory and imaging test results.
- Lack of access to medical record information in an electronic format limits the adoption of OpenNotes for HDOs outside of the U.S., where universal adoption of EHRs has not yet been achieved.
- Variable maturity of EHR systems in enabling OpenNotes initiatives, particularly in relation to providing controls required to restrict sharing for legitimate reasons such as concerns over privacy or potential harm.

User Recommendations

As a CIO planning OpenNotes initiatives, you should:

- Position OpenNotes as a strategic priority by ensuring that transparency in data sharing is a core component of your organization's consumer engagement strategy.
- Enable seamless patient access to their electronic health information by partnering with your EHR and patient portal vendor(s) to map current capabilities against your organization's requirements and agree on a development roadmap for identified gaps.
- Address clinical concerns and minimize risk of adverse impacts to patients by developing policies and processes to exempt patients from online access to parts of their records in circumstances where access would be detrimental to the individual.
- Maximize patient value derived through OpenNotes by establishing systems and processes to support patients in their access to and use of their electronic health information.

Sample Vendors

Allscripts; Apple; Cerner; CommonHealth; Epic; InterSystems; MEDITECH; Patients Know Best

Gartner Recommended Reading

Healthcare Industry Hot Topic: Debating the U.S. ONC Interoperability and Information-Blocking Rule

Healthcare CIOs: Prepare for Granular Patient Consent

Healthcare Innovation Trends: Bridging Consumers' Engagement Gap With Their Health

Best-Practice Exemplar: Andalucía Health System Builds a Citizen-Centered Digital Care Ecosystem

Healthcare Interoperability

Analysis By: Barry Runyon

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Interoperability refers to sharing, exchanging and effectively using electronic health information (EHI) to manage, deliver and coordinate care. In the context of this profile, interoperability includes the adoption and advances in healthcare interoperability rules, standards, frameworks, platforms and initiatives. Rather than plotting adoption and progress individually, we express the adoption and maturity of interoperability in aggregate, and its effect on the healthcare industry.

Why This Is Important

Interoperability makes it possible for organizations and disparate IT systems to share EHI in a standardized manner to facilitate patient access, care delivery and care coordination. Interoperability enables clinicians to safely access a patient's medical history regardless of where it resides. Hospitals can also share a patient's encounter activity and test results with community clinicians as they become available to optimize patient care outcomes and contain costs.

Business Impact

Recent interoperability policies have set the stage for:

- Convenient, safe access to EHI
- Standardization through open APIs, trust frameworks and expanded United States Core Data for Interoperability (USCDI)
- Increased payer/provider collaboration
- Mitigating information-blocking practices
- England's chief clinical information officer for health and care outlining seven priority interoperability areas
- The recognition in Australia that healthcare information systems do not interoperate

Drivers

- Value-based care approaches global adoption to improve the quality of care and contain the cost of care.
- There is a need to increase access to care, enhance care collaboration and improve care coordination.
- There is a need to improve semantic interoperability such as the uniform and pervasive adoption of clinical terminology standards worldwide.
- The 21st Century Cures Act, signed into law in December 2016, defined interoperability and prohibited information blocking.
- The ONC Cures Act Final Rule promoted and incentivized the adoption of APIs and trust frameworks, expanded the set of core clinical data elements (the USCDI), created information blocking exceptions and interoperability certification requirements for relevant actors within the rule.
- The U.S. Centers for Medicare & Medicaid Services (CMS) issued a complementary rule that required government health plans as well as health plans offered through the Affordable Care Act to provide patients increased access to their HIPAA EHI.
- The CMS rule improved 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.
- The ONC and CMS rules have brought interoperability to the fore in the industry and have set the stage for more effective and meaningful patient and member access to EHI and health information exchange.
- The HL7 Da Vinci and Gravity projects will further these goals. The goal of the Da Vinci Project is to help payers and providers to positively impact clinical, quality, cost and care management outcomes.
- The Gravity Project defines Social Determinants of Health (SDOH) information so it can be documented in and exchanged across disparate digital health and human services platforms.

Obstacles

- The complexity of interoperability is considerable. It includes a plethora of wire protocols, data exchange standards, trust frameworks, information models and domain vocabularies.
- It involves standard development organizations, clinical vendors, interoperability platforms and networks and industry alliances such as CommonWell Health Alliance, and Carequality.
- The inherent complexity of interoperability is often exacerbated by overoptimistic vendor claims and unrealistic user expectations.
- Interoperability 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. Meaningful semantic interoperability depends largely on data quality and relevant enrichment and remains an industry challenge.

User Recommendations

- Evaluate interface/integration platform plans to support more robust interoperability requirements and industry timelines.
- Participate in regional health information exchange networks that take advantage of existing interoperability standards, trust frameworks and industry alliances.
- Promote 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 suspected information blocking by referring to the guidelines set forth within the ONC rule. Legitimate information-blocking exceptions should be taken into consideration.
- Strengthen patient engagement by preparing for consumer-mediated health information exchange. Investigate notable industry alliances and advocacy groups such as the CARIN Alliance and government initiatives such as MyHealthEData and Australia's Personally Controlled Electronic Health Record (PCEHR).

Sample Vendors

Carequality; CARIN Alliance; CommonWell Health Alliance; Health Level Seven International; Integrating the Healthcare Enterprise; Surescripts

Gartner Recommended Reading

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

Establish Interoperable Application Ecosystems Early in Your Composable Healthcare Provider Roadmap

Prepare for ONC Information-Blocking Exceptions

On-Demand Virtual Visits

Analysis By: Pooja Singh, Mike Jones

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Definition:

On-demand virtual visit systems broker a remote healthcare connection (initiated by the consumer) with a network of clinicians that are often available 24/7 for nonemergency care, by means of communication channels such as phone, video and secure messaging. Treating clinicians may not have a formal and preestablished relationship with the consumer prior to becoming a patient.

Why This Is Important

On-demand virtual visits have emerged as an option for healthcare providers to provide convenient access to care for remote patients and overcome the uneven availability of clinicians. These systems enable individuals to triage symptoms, initiate an immediate visit, schedule a future visit or wait for an available clinician, and often include decision support to choose the right medical specialty clinician.

Business Impact

- Immediate and convenient access to healthcare from home for minor medical conditions, and exacerbations of chronic diseases.
- Accessible care to patients with mobility challenges, chronic diseases, and highly sensitive conditions, such as behavioral health.
- Reduction in the number of uncompensated emergency room and urgent care visits.
- Improved patient outcomes through timely access to appropriate levels of care.

Drivers

- The COVID-19 pandemic has driven rapid adoption of on-demand virtual visits across health systems globally. The technology helped providers to manage costs and maintain their health system scalability during the crisis. This year we see this profile climbing up the Slope of Enlightenment, about to enter the Plateau of Productivity in the coming days. Time to mainstream adoption will be less than two years.
- The U.S. government's move to temporarily expand telehealth benefits for Medicare beneficiaries, has helped HDOs gain experience in equipping themselves with the right set of tools when it comes to payment and reimbursement of the services (see U.S. Provider CIOs' COVID-19 Action Plan to Improve Revenue).
- Electronic health record (EHR) vendors have enhanced the ability to conduct on-demand visits from within their platforms. At the same time, there is an increase in the number of new entrants offering on-demand virtual care solutions.
- Advancements in access to the internet and the evolution of solutions to support multiple modalities for on demand visits (e.g., secure messaging) are improving consumer accessibility.

Obstacles

- Some questions about the cost-effectiveness of these services have arisen, in part due to the ease by which convenience can lead to increased treatment for conditions that might not warrant clinical intervention (for example, a simple cold).
- Reimbursement of services still remains a question across geographies. For example, in Australia, the eligibility for virtual visit will be contingent on a patient having an existing and continuing relationship with the general practice (GP) physician (click here for more details). Patients who have not had a single in-person consultation with their GP physician in the last 12 months will not be reimbursed.

User Recommendations

- Identify the scenarios under which on-demand virtual visits can reduce the most costs, and improve care access and quality by collaborating with business leaders.
- Increase chances of successful execution early on by selecting the right technology platform (cloud-based). It should have the ability to integrate with your current IT landscape, and capabilities such as e-prescribing, ability to import patient records to EMR and billing of virtual visits either through the platform or via a separate interface for patient accounting.
- Ensure that on-demand virtual visits are a part of patients' care continuum that includes prevention and follow-ups, especially for patients with chronic conditions, by aligning them with the existing clinical care pathways. Information sharing between remote and face-to-face clinicians needs to be managed carefully.
- Be aware that real-time virtual visit services will compete with the integrated delivery systems (IDS) for patients. It is, therefore, essential to monitor competitive activity and to consider offering similar services.

Sample Vendors

Amwell; Doctor on Demand; Intellivisit; MDLIVE; Teladoc Health; Zipnosis; 98point6

Gartner Recommended Reading

Defining the Virtual Care Market and Its Opportunities

Market Guide for Virtual Care Solutions

Ace These Proof Points to Create a Sustainable Virtual Care Strategy

Healthcare Providers: Combat COVID-19 With Virtual Care

Scaling Virtual Care Requires a New Look at Its Enabling Architecture

Accelerate Virtual Care Adoption Using the 5-Tier Approach to Virtual Care Services

Personal Health Management Tools

Analysis By: Jeff Cribbs, Mike Jones

Benefit Rating: Low

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Personal health management tools (PHMTs) aid consumers in managing health and wellness, providing interactive functionalities, such as tracking symptoms, diet, exercise and routine care; monitoring chronic illnesses; or connecting to a wearable or device. PHMTs may be recommended by a clinician, but generally are procured directly by consumers, are not reimbursed by healthcare payers, do not have robust evidence of efficacy at present and support minimal clinical data integration.

Why This Is Important

Healthcare organizations have a significant interest in promoting better consumer engagement as a way to improve outcomes, lower medical costs and differentiate themselves from their competitors. PHMTs represent efforts by direct-to-consumer technology developers to promote patient self-management and activation. There has been continued interest in creating more synergistic value between these efforts with better data and process integration.

Business Impact

PHMTs have evolved from being a harbinger of a consumer-centric healthcare revolution to a cautionary tale about the fickle attention of consumers, the dangers of proliferating silos of data and experiences, and the fundamental challenges of health-related behavior change. Healthcare leaders must heed the lessons of PHMTs as they weigh their investments in today’s emerging consumer engagement technologies.

Drivers

- In several developing regions, consumer technology infrastructure is generally starting with mobile first, skipping the “desktop” phase altogether, contributing to the accelerated maturity of the consumer mobile market.
- Clinicians’ and payers’ growing belief in the value of patient-facing applications, especially for management of highly targeted chronic populations (see AMA Digital Health Care 2016 and 2019 Study Findings).
- Medical communities are actively developing best practices for incorporating PHMTs into clinical service delivery and disease management pathways (see Nature’s Beyond Validation: Getting Health Apps Into Clinical Practice).The path forward will require policy and regulatory organizations to adopt consistent standards for evaluation and efficacy of PHMTs, such as Xcertia mHealth App Guidelines or NICE’s Evidence Standards Framework for Digital Health Technologies.
- We advance PHMTs to mature mainstream adoption in recognition of the fact that this generation of technology has reached more than 50% of the consumers likely to adopt. This will be its final appearance on the Hype Cycle, as the attention shifts to emerging engagement technologies that incorporate clinical data and process integration, multiexperience fluidity, and portability.

Obstacles

- Finding the best way to promote adoption and effective use of high-quality PHMTs when consumers most often choose their PHMTs themselves, is difficult.
- Most PHMTs rapidly fall into consumer disuse because they fail to deliver ongoing value in convenience, health outcomes or financial value (such as incentives). In addition, they lack the trust and authority conferred by clinical oversight.
- Even when consumers use devices with persistence (like when device use is mandated for participation in a study), there is sparse evidence that PHMTs achieve the health outcomes they purport to drive.

User Recommendations

- Ensure an appropriate level of vetting for PHMTs that account for the specific context of the consumer, clinician and the care pathway. For example, in some general wellness scenarios, a broad range of lifestyle tracking apps might be appropriate. In more complex care pathways, a higher threshold should be set for PHMT design, efficacy and data integration.
- Work with senior business and clinical leaders to establish relatively simple governance of PHMTs — a recommendation for CIOs. In practice, this most often means documenting what criteria will be used in vetting PHMTs for clinical recommendation to patients, for data integration with the EHR, and for devoting resources to patient education for the use of PHMTs. CIOs are often best-positioned to alert other leaders to the potential risk of creating data, care processes and consumer experience silos that work against other efforts to streamline and coordinate consumer journeys.

Sample Vendors

Garmin; healow; Keep; MyFitnessPal; Ovia Health; Patient Journey App; Qinbaobao

Gartner Recommended Reading

Innovation Insight for Consumer Experiences in Healthcare and Life Sciences

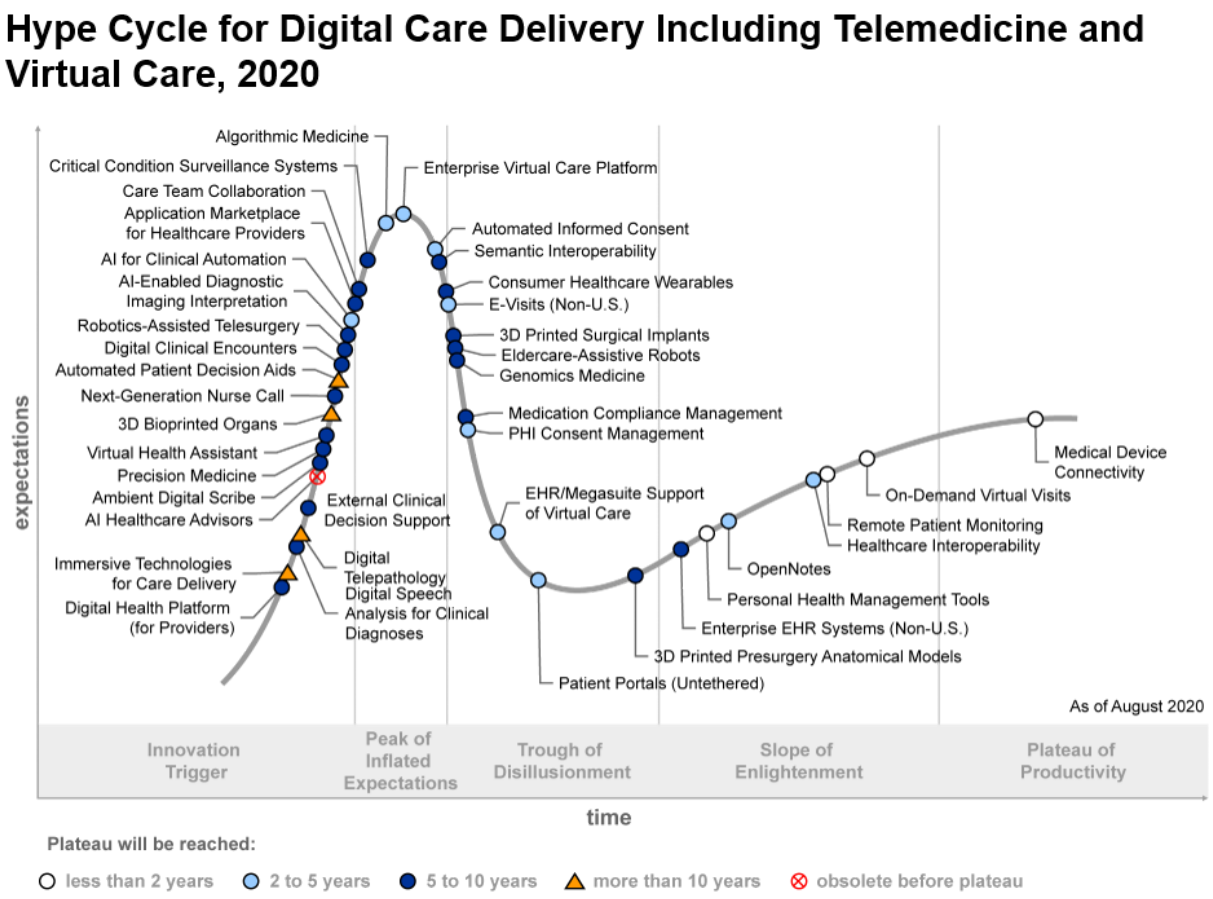
Survey Analysis: Healthcare Provider CIOs Must Prepare to Compete on the Basis of Customer Experience

Create Connected Care Pathways That Bridge Consumer and Healthcare Provider Activities

Healthcare CIOs Will Enable Three Generations of Consumer Engagement

Appendixes

Figure 2. Hype Cycle for Digital Care Delivery Including Telemedicine and Virtual Care, 2020



Source: Gartner (August 2020)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant media 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 innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
Trough of Disillusionment	Because the innovation 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 innovation'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 innovation 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 innovation to reach the Plateau of Productivity.

Source: Gartner (July 2021)

Table 3: 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 2021)

Table 4: Maturity Levels

(Enlarged table in Appendix)

Maturity Levels ↓	*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 2021)

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Create Your Own Hype Cycle With Gartner's Hype Cycle Builder

Toolkit: Board-Ready Slides for Your Digital "Healthcare Without Walls" Initiative

Best-Practice Exemplar: Palvelukeskus Helsinki Scales Innovation in Virtual and Digital Care Delivery

Market Guide for Virtual Care Solutions

Predicts 2021: Healthcare Providers Must Accelerate Digital Transformation to Address Disruption

Table 1: Priority Matrix for Digital Care Delivery Including Virtual Care, 2021

Benefit	*Years to Mainstream Adoption*			
↓	***Less Than 2 Years*** ↓	***2 - 5 Years*** ↓	***5 - 10 Years*** ↓	***More Than 10 Years*** ↓
Transformational		Algorithmic Medicine	Autonomous Monitoring Care Team Collaboration Digital Clinical Encounters Digital Health Platform Genomics Medicine Next-Generation Nurse Call Precision Medicine	
High	On-Demand Virtual Visits	EHR Support of Virtual Care Healthcare Application Marketplace Healthcare Interoperability Patient Portals (Untethered) Virtual Health Assistant	3D Printed Surgical Implants AI-Enabled Diagnostic Imaging Interpretation Ambient Digital Scribe Critical Condition Surveillance Systems Digital Clinical Voice Analysis Enterprise EHR Systems (Non-U.S.) Semantic Interoperability	3D Bioprinted Organs

Benefit	*Years to Mainstream Adoption*			
↓	***Less Than 2 Years*** ↓	***2 - 5 Years*** ↓	***5 - 10 Years*** ↓	***More Than 10 Years*** ↓
Moderate		3D Printed Presurgery Anatomical Models Automated Informed Consent Enterprise Virtual Care Platform External CDS OpenNotes PHI Consent Management	Assistive Healthcare Robots Consumer Healthcare Wearables Digital Telepathology Medication Compliance Management Robotics-Assisted Telesurgery	Automated Patient Decision Aids Immersive Technologies for Care Delivery
Low	Personal Health Management Tools			

Source: Gartner (June 2021)

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Phase ↓	Definition ↓

Source: Gartner (July 2021)

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