



# Health IT Strategies in the Era of Integrated Care

Utilizing Regional Health Technology to Increase  
Efficiency and Improve Clinical Outcomes

H. Joerg Schwarz, *MSIS, Global Business Director, AGFA HealthCare*  
Richard Cotman, *MBA, Alliance Director EMEA, Orion Health*

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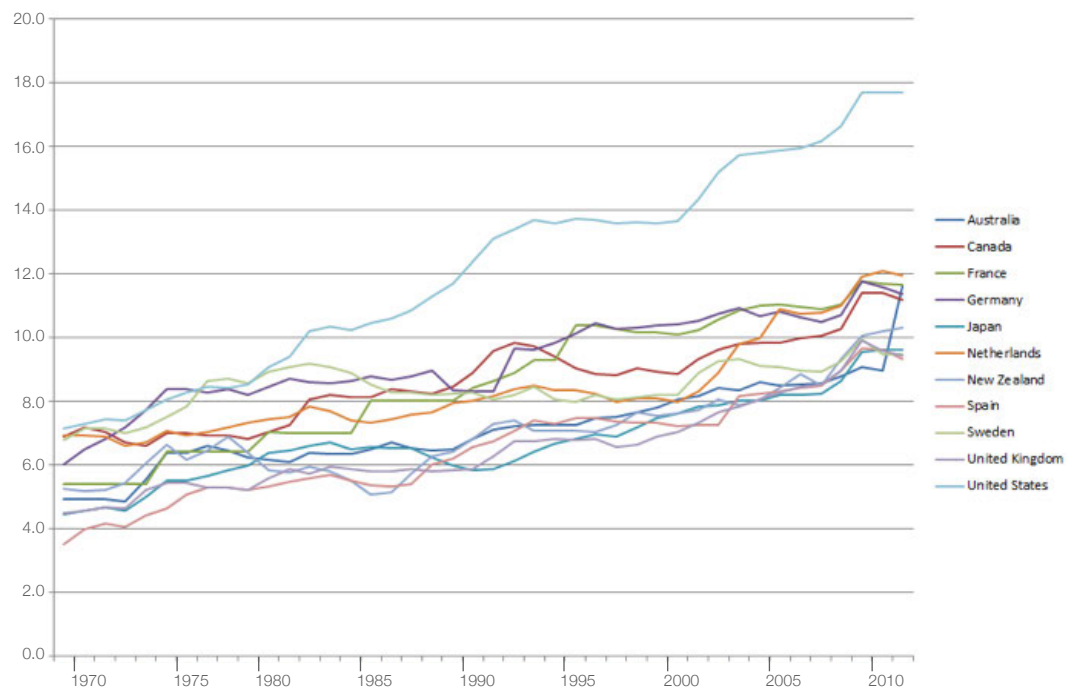
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## 1 THE ERA OF INTEGRATED CARE: WHAT IT MEANS FOR HOSPITALS AND OTHER HEALTH PROVIDERS

### DRIVERS FOR INTEGRATED CARE: IMPROVING OUTCOMES AND REDUCING COSTS

The healthcare industry is currently experiencing change at an unprecedented rate. Change is not only occurring in the technology used in diagnostics and care delivery, but this change is so fundamental that it could, and likely will, fundamentally alter the business model of the industry.

In recent years, healthcare expenditures have risen consistently and sharply in all Organization for Economic Co-operation and Development (OECD) countries, outpacing the rate of inflation. In the United States, the country with the highest overall expenditures, spending reached about 17.7% of gross domestic product (GDP) in 2009 and has since stabilized. The U.S. healthcare expenditure is significantly higher than that of other OECD countries. For example in the UK., where healthcare expenditures peaked in 2009 at 9.9% of GDP, they fell to 9.4% in 2011. Nevertheless, in all industrialized countries, healthcare costs have been steadily rising since the middle of the 20th century, as seen in Figure 1.



**Figure 1 OECD Data for Health Expenditure as a percentage of GDP**

Source: <http://www.oecd.org/els/health-systems/oecdhealthdata2013-frequentlyrequesteddata.htm>

Unfortunately, rising cost does not necessarily correlate with high quality of care or better outcomes. Ever since the initial report on errors in the healthcare systems causing unnecessary deaths and costs<sup>1</sup> was published and widely reported, many attempts to build a safer and more effective healthcare delivery system were undertaken.

Suboptimal healthcare outcomes can also be considered symptoms of system failure. A good example of this is the level of avoidable healthcare escalations for chronic disease patients. In figure 2 it is evident that the U.S. has significantly higher events per 100,000 population for escalations like amputations of limbs for diabetics, hospital admissions for congestive heart failure, or asthma than other nations in the study.

Such suboptimal healthcare outcomes have a huge impact on the quality of life for patients. In addition, they are costly, and in many cases could be prevented with better care coordination, regular check-ups, medication and improved management of chronic conditions.

While costly for health economies as a whole, expensive escalations also represent additional revenue for acute care providers. Porter and Teisberg, in their analysis of the failure of the healthcare industry to deliver higher quality and lower cost in a competitive market environment, came to the conclusion that a root cause for this failure was a misalignment of incentives<sup>2</sup>. In a fee-for-service model, healthcare providers have no incentive to ensure that care is delivered in the most cost-effective setting, which in many cases is outside the hospital.

**Hospital Admissions for Chronic Diseases and Diabetes Amputations in Select OECD Countries, 2007**

	Hospital Admissions for Chronic Diseases per 100,000 Population, Age 15 and Older					Diabetes lower extremity amputations per 100,000 population, age 15 and older
	Asthma	Chronic obstructive pulmonary disease	Congestive heart failure	Hypertension	Diabetes acute complications	
Canada	18	190	146	15	23	11
Denmark	43	320	165	85	20	21
France	43	79	276	— <sup>e</sup>	— <sup>e</sup>	13
Germany	21	184	352	213	14	— <sup>e</sup>
Netherlands	26 <sup>b</sup>	154 <sup>b</sup>	171 <sup>b,d</sup>	19 <sup>b</sup>	8 <sup>b</sup>	11 <sup>b</sup>
New Zealand	73	308	206	16	1	12
Norway	42	243	188	70	20	11
Sweden	25	192	289	61	19	12
Switzerland	32 <sup>a</sup>	100 <sup>a</sup>	155 <sup>a</sup>	55 <sup>a</sup>	12 <sup>a</sup>	16 <sup>a</sup>
United Kingdom	76	236	117	11	32	9
United States	120 <sup>a,c</sup>	203 <sup>a,c</sup>	441 <sup>a,c</sup>	49 <sup>a,c</sup>	57 <sup>a,c</sup>	36 <sup>a,c</sup>
<b>Median (countries shown)</b>	<b>42</b>	<b>192</b>	<b>188</b>	<b>52</b>	<b>19.5</b>	<b>12</b>

Age-sex standardized rates. Data not available for Australia.

<sup>a</sup> 2006.

<sup>b</sup> 2005.

<sup>c</sup> U.S. does not fully exclude day cases.

<sup>d</sup> Netherlands includes admissions for additional diagnosis codes, which marginally elevates rates.

<sup>e</sup> Data not available.

Source: OECD Health Care Quality Indicators Data 2009.

**Figure 2 Comparison of incidents for chronic disease patients**

Source: Squires, D (2011), *The U.S. Health System in perspective: a comparison of twelve industrialized Nations*, The Commonwealth Fund, *Issues in International Health Policy*, July 2011

Chronic conditions account for approximately 75% of healthcare direct costs in most developed and developing economies in the world. A small subgroup of chronic conditions: diabetes, congestive heart failure, coronary artery disease, asthma (plus other pulmonary conditions), depression, Alzheimer's and dementia are responsible for the majority of these costs<sup>3</sup>. The issue for health budgets is that expenses for people with one chronic condition are twice as great as for those without any chronic conditions. As the number of chronic conditions a patient has rises, their cost rises exponentially. This means when a patient reaches five or more chronic conditions, the associated healthcare costs are nearly 14 times greater than spending for healthy patients<sup>4</sup>.

When looked at holistically, healthcare systems face a daunting prospect of how to prepare themselves to treat this chronic disease "epidemic." Typically, approximately 45% of citizens have at least one chronic condition<sup>5</sup>. With costs rising exponentially for each additional chronic condition, treating the complex cases successfully will yield the greatest improvement in outcomes, patient quality of life and cost reduction. Research shows that just 5% of the population incur approximately 50% of all healthcare costs<sup>6</sup>. By tackling this 5%, which will be those with the greatest number of chronic conditions, a real transformation can occur.

#### **A CHANGING DELIVERY MODEL: COORDINATION OF CARE, CONSOLIDATION OF EXPERTISE**

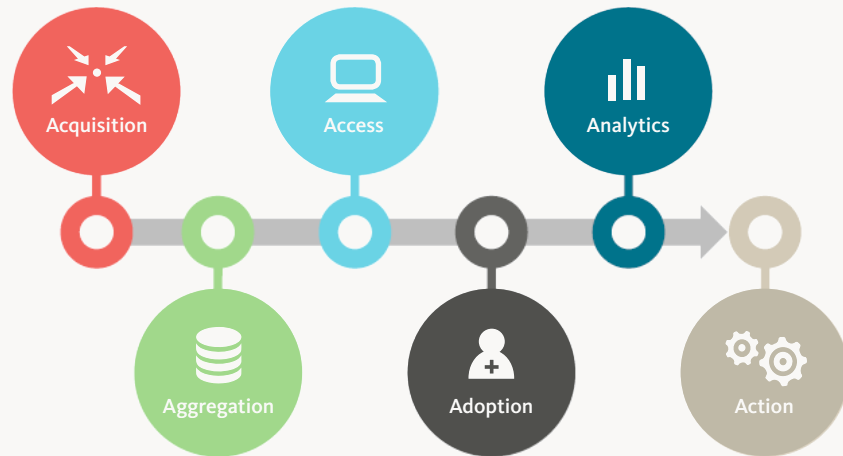
In the face of these challenges of rising costs and the impact of chronic conditions, the first decade of the 21st Century has seen the start of significant changes in the way that healthcare is delivered and organized in many different countries. In France, responsibility for the coordination of healthcare delivery is being devolved to Regional Health Authorities (*Agences Régionales de Santé*), with an emphasis on coordination of care for the population across logical geographical regions around hospitals, called *térritoires de santé*. In the English NHS, the logic of regional care coordination is being reflected in the transfer of much of the control for care funding decisions in local areas to Clinical Commissioning Groups (CCGs)<sup>8</sup>.

Beyond coordination of care, there is increasing need to consolidate the various clinical expertise required to address particular conditions and deliver care where it is most effective. In their recent paper for the Harvard Business Review, Porter and Lee describe in detail how the concept of "Integrated Practice Units" can significantly improve outcomes for patients and improve financial efficiency for providers<sup>9</sup>.

In the United States, with the Affordable Care Act of 2010, Medicare started to transition from fee-for-service payments to bundled payments for episodes of care, a model already implemented in countries like Germany, where payments are normalized on DRG codes. Even before the onset of bundled payments, healthcare organizations began forming care models focused on outcomes and paying for value. In these Accountable Care Organizations (ACO), virtual delivery organizations of hospitals and independent physicians contract to deliver all necessary care for a capitated payor with incentives for positive patient outcomes and cost control. Early results from 32 of the Centers for Medicare & Medicaid Services' (CMS) Pioneer ACOs show consistent cost savings and improved quality parameters<sup>10</sup>. But even before more robust results from these Medicare pilots are published, many private insurance carriers and integrated delivery networks (IDNs) have already begun investing into their own ACO partnerships<sup>11, 12</sup>. McKinsey&Company estimates in a recently published report that the U.S. alone could generate on upside of \$1 trillion if the entire system switched to integrated health care delivery, a model in which providers focus on maintaining health and wellness<sup>13</sup>.



## ORION HEALTH'S 6 A'S OF ACCOUNTABLE CARE



Orion Health outlines a healthcare organization's journey to accountable care in six steps:

- **Acquisition** - Efficient, real-time acquisition of data from disparate information systems and care locations
- **Aggregation** - Secure storage of structured, normalized and identified data
- **Access** - Fast, easy and convenient access to information for clinicians and patients
- **Adoption** - Community-wide clinician engagement and adoption
- **Analytics** - Management tools for population health and quality improvement
- **Action** - Continuous cycles of improvement and evidence-based care

### WHAT DOES THIS MEAN FOR HOSPITALS AND THEIR CURRENT BUSINESS MODEL?

In a traditional fee-for-service model, hospitals generate revenue primarily through billed acute care services (in-patient services), and additionally through outpatient procedures without hospitalization. In recent years, community hospitals in the U.S. experienced a shift toward a higher share of outpatient revenue as part of their overall revenue<sup>14</sup>. Outpatient procedures are a great way to leverage capital investments in expensive machinery, such as imaging modalities, and the expertise of employed specialists. However, much of the desired preventive care happens outside the hospital, and if prevention works successfully, escalations will occur less often. Indeed, the results of the aforementioned ACO pilots demonstrate that cost savings are a composite of reduced cost for hospitalization and increased financial incentives for long-term preventive care outside the hospital. The net result of this shift is lower overall costs on a population basis, which represents an incentive for insurance carriers, employers (which ultimately pay most of the cost in the U.S. system), governments, or even patients, yet at the same time represents a potential revenue decline for hospitals.

Some hospitals have already begun preparations for this strategic business model shift<sup>5</sup>. One way to mitigate potential revenue loss is vertical integration, which can be accomplished virtually through IT integration, or permanently through fusion of clinics and outpatient facilities. This integration strategy allows hospitals to play a bigger role in the overall patient care, especially for chronically ill patients, even outside the hospital. At the same time, they can eliminate redundant resources (for example, multiple imaging centers, PACS systems, etc.) and therefore streamline overall costs, maintain or expand the revenue base, while delivering better outcomes via more coordinated care.

### Is U.S. data applicable to the rest of the world?

OECD data shows that the U.S. has currently the biggest spending problem in healthcare, but the core problems are similar across OECD countries, as is the shift away from the fee-for-service model. While some countries are further ahead, there is still a universal need to re-vamp the IT infrastructure to support integrated care delivery.

Vertical integration can also mean more outsourcing of services to where they can be most efficiently delivered. Long known in manufacturing and other services areas are the beneficial effects of volume. Service providers who provide a certain service often times are getting better at delivering the service – an effect known as the learning curve. This same effect has been reported in various healthcare domains, from child care<sup>6</sup> to heart transplant surgery<sup>7</sup>.

In an environment without cost transparency, actual costs (and outcome quality) were not correlated with revenue potential. Hospitals traditionally offered any type of service and contracted based on annual volume, not based on quality or cost. However, in a capitated reimbursement environment, it becomes important to deliver any given service at optimal cost in order to optimize the overall bonus potential. This means hospitals need to benchmark their costs. In all likelihood, there will be certain services that are performed frequently, and therefore cost should benefit from the learning curve. Other services might be performed only infrequently, and therefore might be costly compared to the benchmark. Vertical integration could mean that services a hospital cannot provide with cost efficiency could be outsourced to external specialized service providers that offer both better costs and better outcomes. As a result, the hospital could incorporate these lower cost services to increase overall competitiveness and patient outcomes.



**Figure 3 Vertically Integrated Delivery Network with in-sourced and out-sourced services**

As depicted in Figure 3, a hospital could prepare itself for the business challenges of integrated care by:

- a) Expanding the revenue base with preventive care services in the community and outpatient procedures, either by purchasing such service providers or by partnering with them
- b) Lowering overall costs by in-sourcing low volume services from specialized providers with higher volume
- c) Offering new services to patients and their caregivers, including providing patients with the tools to participate more in their own self-care, where this is proven to improve outcomes

As a result of both strategies, such an integrated delivery network (IDN) can compete for capitated risk and bundled payments with an optimized cost base and excellent clinical outcomes.

#### **THE PATIENT AS THE ULTIMATE CARE PROVIDER: A SIGNIFICANT SOURCE OF COST REDUCTION AND QUALITY IMPROVEMENT**

One of the major ways to help reduce costs, improve patient outcomes and quality of life is to prevent the development of chronic disease in the first place and to keep patients adherent to therapy once diagnosed. This can often only be achieved by making a patient and the rest of their circle of care a central part of the healthcare team, not just merely a recipient of care. Achieving this requires major behavioral change by the patient<sup>18</sup>.

Patients are an underutilized resource in the circle of care. Health systems are now recognizing that there is a reliance on the patient's family and other individuals taking responsibility for people to play a key part in supporting the patient's change in behavior. The circle of care is far wider than just the patient and the clinicians. The issue has to be about how a health system can help people make better decisions about their health. Open communication between providers and patients, coupled with easy-to-use technology, will help transition patients from being passive recipients of care with the potential for noncompliance to becoming a fully-engaged



participant of the care team. Education and communication can help lead to behavioral change, increase compliance, and ultimately lead to better outcomes and health.

One part of the healthcare system that has been very successful at behavioral change in developed and developing countries is dentistry. The vast majority of the population do brush (and even floss) their teeth, and research in the late 1970s showed that the greatest determinant for people to brush their teeth was not the fear of the medical consequences, but rather that they could see a path to better health. When patients believe they can take control of their own health by doing things within their ability, they can actually make a real difference to help improve their health or reduce their risks of developing chronic disease<sup>9</sup>.

### **CHOOSING AN IT STRATEGY TO SUPPORT NEW CARE MODELS**

Information technology plays an important role in organizing care coordination within this network by enabling data aggregation and utilization of information for improving overall outcomes.

At a private, commercial level, one option to achieve this integrated information system is purchasing a single solution for all inpatient and outpatient services. The advantage of a single solution is coherent data semantics and workflows, better interoperability and the ability to provide holistic, integrated views of health data for patients, clinicians, and care managers. However, experience around the world has shown that no one system, no matter how well architected and designed, can address all the care requirements of providers inside and outside the hospital. In addition, a 'rip-and-replace' of existing systems can be a costly and lengthy strategy and is not feasible at a regional or national level. A single system solution also does not enable virtual vertical integration with specialized low cost/high volume external service providers.

A better alternative enables both hospital-driven initiatives and regional organizations to accomplish the same benefits of an integrated system by leveraging existing systems and standards with a health information exchange (HIE) infrastructure. The next Section will outline how organizations can implement a successful HIE and achieve sustainability at each step of the journey through the intrinsic benefits the HIE delivers.

## 2 A 5-STEP EVOLUTION TOWARD IT FOR INTEGRATED CARE

Healthcare organizations should think of the process of moving toward fully integrated care as a journey that involves all members of the healthcare ecosystem – providers, payers, clinicians, patients and caregivers. The 5-step process below is a suggested roadmap that will help healthcare organizations prepare for new value-based payment models.



### STEP 1 – RESULTS DELIVERY AND MEDICAL IMAGE CONSOLIDATION

A good place to start with regional data aggregation for integrated care is results delivery for medical images. Medical images are a good place to start for several reasons:

Medical imaging procedures are a major source of cost in the health system: in the U.S., the average cost of an MRI was reported in 2009 as US\$1,200 (the most expensive OECD country), compared to US\$179 in the UK (the least expensive country). In the U.S. there were 91 exams per 100k population (the most of any of the reporting OECD countries)<sup>20</sup>, many of them considered to be medically unnecessary and therefore financially redundant<sup>21</sup>. In a bundled payment model, and even more so in a capitated risk environment, providers have an incentive to perform fewer exams, so it makes sense to invest in an infrastructure that provides secure, reliable, and fast access to available images across organizational boundaries, for example, within a vertical integrated delivery network, to save the considerable cost of redundant images.

With DICOM, there is an existing standard that allows capture and aggregation of data from multiple modalities into a single vendor neutral archive (VNA). Storing images in a single archive saves costs, as only one infrastructure stack is required to scale, backup, and fail-safe. IHE RAD profiles define web services that utilize conventional DICOM archives (PACS systems) to register DICOM studies in a central xds.b registry, allowing regional aggregation. This concept is fairly mature and has been implemented successfully in many regional and national projects (Canada<sup>22, 23</sup>, Europe<sup>24</sup>).

## A quick primer on IHE XDS.b

IHE XDS.b is a web service specification that allows secure information exchange of clinical documents (pdf or XML CDA) or medical Images (DICOM). Each xds.b affinity domain has one document registry, one enterprise master patient index (EMPI) and one or many repositories. Documents can remain in their source repository, as long as they can be identified with a unique document identifier and are accessible when needed – this is usually called a federated repository model. The same is true for images – they can either be moved into a central VNA for long term archiving or temporary caching, or remain distributed on their local PACS systems. The economies of scale mentioned in the text can be optimized with a central VNA that also acts as an XDS-I.b repository. However, in regional contexts, a federated model is often preferred.

A regionally integrated medical image archive also has operational advantages. Primary reading can be both outsourced and insourced by separating the modality location, diagnostic evaluation, and the consumption of that information. Enabled through disintermediation, expert radiologists do not have to remain idle in multiple locations, but can work efficiently in a single location. This use case is especially important in rural areas with low volume – a modality and a nurse can be onsite to capture the image while the radiologist performs the evaluation remotely. The subsequent radiology report written in the Radiology Information System (RIS) of the attending specialist can be transferred via HL7 ORM or IHE RAD web services into the same IHE XDS-I.b repository as the DICOM Study. Study and report are linked by a unique patient identifier and study instance ID or accession number. As a result, physicians at any participating organization can access both the actual DICOM image and the corresponding report.

With the infrastructure in place to deliver access to DICOM images and imaging reports through a web portal, hospitals and imaging centers can increase the usability of their services and reduce costs and times for conventional delivery on media. Faster access to images can also be provided to health professionals across the community.

The same infrastructure can be utilized to deliver other examination results, for example, lab-tests and discharge letters. Lab tests are lower in cost than imaging procedures by one or two orders of magnitude, so the economic benefit from redundancy elimination is less, but a longitudinal aggregation of lab results has a strong diagnostic value - an important feature of vertical data integration.

A major implementation step is the definition and implementation of a data-governance model and consent policy. While particular data privacy and security rules vary regionally, there is generally a need to define and enforce rightful access policies and access controls and allow patients to opt-in (expressly consenting to data sharing) or opt-out (consent is assumed unless a patient expressly removes consent for data sharing).

## STEP 2 – REFERRAL WORKFLOWS

Additional benefits can be achieved with an integrated referral flow across a region, an IDN or coordinate entity. In a scenario where any referring physician can log into a clinical portal and start a referral workflow for a given

patient, for example to order a medical image procedure or lab test, the ordering process can be simplified and streamlined. As part of the referral workflow it should also be possible to upload pertinent information, including patient demographics, so that the referral target can re-use as much of the preceding diagnostic work as possible.

For example, when a general practitioner orders a consult from a cardiologist, the GP's medical history of the patient can be uploaded or shared (either as a scanned document or as a CDA/CCD document) along with recent laboratory results. The attending cardiologist can then focus on providing a consultation in the context of the patient, not only restricted by a singular diagnostic procedure, but in a holistic way. Any images or films generated previously should be accessible to the referring physician, along with the report, for further evaluation in the same portal that was used to order the consult. The ordering physician should be notified when new results pertaining to an order are available in the regional shared repository/registry.

Clinical decision support tools can help further improvements in quality and outcomes. In the context of radiological images for example, there is concern about patient safety from overexposure of patients to radiation, which itself can cause cancer<sup>25</sup>. If the regional image aggregation service is equipped with a functionality that allows longitudinal tracking and calculation of radiation exposure by patient, the referral workflow could include a request to the radiation exposure monitoring database<sup>26</sup> and enable the ordering physician to make an informed decision if further radiation exposure might be detrimental to patient health. While this type of radiation monitoring is currently already performed at a departmental or organizational level, it is clearly beneficial at a regional level to capture potentially all relevant data from different modality types (DR, CT, MRI, etc.) and become part of the patient's longitudinal care record. A cancer patient, who might be treated within different facilities over time, might not exceed radiation exposure in either of the individual places of care, but could at an aggregate level.

### STEP 3 – CONNECTING THE HOSPITAL EMR WITH THE WIDER CARE COMMUNITY

Many hospitals currently utilize electronic medical record systems (EMR), which were designed to record patient specific information, structured by encounters, about problems, medications, procedures, allergies etc. Some EMRs also support intra-organizational workflows, for very specific treatments and processes like radiotherapy or certain types of surgery.

#### Terminology: EMR vs. EHR

While the terms electronic medical record (EMR) and electronic health record (EHR) are used synonymously in the U.S., most other countries differentiate between a single organizational EMR and a multi-organizational EHR, which is the notation used in this paper.

Traditional hospital EMRs were not designed for inter-organizational collaboration. Level 6 of the current HIMSS Analytics Electronic Medical Record Adoption Model (EMRAM), for example, can be accomplished without receiving or submitting one bit of information with providers outside of the organization surveyed<sup>27</sup>. Level 7, however, can be accomplished with CCD<sup>28</sup> capabilities to share data, which reflects the necessity for organization

to both receive data, i.e. from primary care physicians, in order to prepare for acute care, and share data with outside providers, i.e. for post-discharge coordination. The infrastructure for the exchange of such information (consent management, data routing and transformation) is not part of the EMR itself, just the ability to produce and ingest CCD documents.

Specific information technology solutions can be used to bridge this gap and extract information from one or many EMRs, i.e. in form of CDA documents or HL7 ORU messages, so that it can be shared and imported into other EMRs, or viewed by other care providers across the community in their own systems or via a clinical portal. The collection of information available within a care community becomes a patient oriented, longitudinal, cross-organizational electronic health record (EHR).

Such integration architecture can also improve how hospitals communicate with referring clinicians in the community. Using the concept of a clinical portal, clinicians only need a browser to have secure access to the single best patient record, aggregated from contributions from multiple information sources inside and outside the hospital. Hospital clinicians can still work within their own EMR for administrative and clinical functions, while also benefiting from a more complete picture of the patient within the EHR. A portal can also be used for referring patients, viewing results from other encounters and raising orders. In addition hospitals that integrate primary care data into this single best patient record can also realize major benefits, especially for emergency admissions to reduce duplicate tests and improve prescribing and treatment decisions.

While data sharing and many benefits of improved information flow can be accomplished with the exchange of documents or images, for example PDF files of scanned forms, it is beneficial to also exchange discrete data elements, such as laboratory test results or prescription information. While the document format is recommended for unstructured data, such as a consent documents with a patient signature, or a transcribed radiology report, a discrete data format is recommended for structured data, such as a lab report, discharge summary (including the medication list), or a list of allergies.

#### **STEP 4 – PATIENT ENGAGEMENT**

Putting patients in control of their own healthcare also requires empowerment of patients. Healthcare has to be made more convenient, easier to access, and far simpler to perform administrative tasks, such as making appointments, checking and changing appointments, receiving reminders, seeking advice and coaching on lifestyle changes. Most people can book a round the world trip with flights and hotels without having to talk to any administrator or booking agent, but they cannot even check a hospital appointment online.

Supporting patient self-care is vital in chronic disease care. By enabling patients and their representatives to become an integrated part of the care delivery team, providers can benefit from additional patient-provided data to inform the care plan and also support patients and their representatives to actively perform some basic care tasks themselves, where this makes sense.

A patient portal or mobile application can be deployed to sit across a unified patient record, providing patient access to their connected record, including information in the hospital EMR and beyond. Information and advice

can be distributed to patients automatically and directly, and patients and their caretakers can provide feedback to the healthcare providers on their progress and also note any apparent errors in their health data.

This information flow can be enabled in a 'multi-channel' approach by using website-based interaction, native mobile applications and text messaging.

**STEP 5 –MOVING TOWARD A “POPULATION HEALTH MANAGEMENT” APPROACH**

With a single best patient record, clinical workflow can be optimized, pathways defined and followed with software deployed within the clinical portal to support cross-continuum care. It helps ensure that clinicians have access to support tools to complete tasks and render evidence-based treatment to their patients and engage them in their care.

Benchmarking, measuring and reporting of clinical data, as well as sharing of information, are paramount to successfully meeting requirements of value-based payment models. Population Health Management is the final 'Action' phase of Orion Health's 6 A's of accountable care. This level of care coordination among all members of the circle of care (clinicians, caregivers and patients) will help enable healthcare organizations globally to move toward a learning health system.

**FINANCIAL SUSTAINABILITY PARAMETERS AND USE CASES**

The evolutionary development of information systems needed to support integrated health care delivery requires commitment and financial investments. In some cases, part of this investment is provided by a payer – which is only natural, given that payers benefit from lower costs and improved outcomes. In other cases, governments subsidize initial investments, for example in cases where the government is also a payer and, therefore, benefits in the same way as would a private payer. But these third-party investment subsidies are not sufficient to justify investment and sustain the ongoing operation of a regional health infrastructure.

Benefits from IT investments are usually classified into tangible and intangible benefits. Tangible benefits would be cost avoidance or revenue generation, and intangible benefits have no direct monetary value (such as improved patient health and satisfaction), but can be quantified through qualitative scales or secondary financial benefits (for example more patients as a result of improved patient health and satisfaction).

**Table 1 Tangible and Intangible benefits of Regional Health integration**

USE CASE	ENVIRONMENT	TANGIBLE BENEFITS	INTANGIBLE BENEFITS
<b>Portal for Image &amp; Results Delivery</b>	Hospital collaborating with independent physicians	Decrease cost of results delivery; eliminate redundant Imaging cost; allow virtual vertical integration (allows additional revenue and cost reduction)	Increase care integration; Increase quality of outcomes ; Disintermediation of image taking and reading (can lead to quantifiable efficiencies)



USE CASE	ENVIRONMENT	TANGIBLE BENEFITS	INTANGIBLE BENEFITS
	IDN connecting disparate systems	Reduce integration costs; reduce cost of redundant storage, archiving and retrieval	Decrease access times
	Regional Collaboration	Avoid Redundant Procedures and associated costs	Decrease access times
<b>Portal for Image &amp; Results Delivery, Ordering &amp; Referrals</b>	Hospital collaborating with independent physicians; IDN; regional collaboration	Reduce cost and time for orders & results delivery; increase integration and outpatient procedure revenue	Bidirectional Information Flow improves clinical decision making; reduces errors
<b>Linking Hospital EMR with wider community</b>	Hospital collaborating with independent physicians; IDN; regional collaboration	Reduced costs of duplicated data and procedures Reduced physician time searching for information	More integrated and consistent referral and discharge behavior between hospital and community
<b>Engaging Patients and the Representatives</b>	Patients and their families/ representatives actively participate in care and provide data to inform care plans	Delivery of more care at home or in the community; Reduced reliance on expensive nurse/physician resources for basic care tasks	A better-informed and engaged patient population will help reduce avoidable escalations of conditions

After analyzing both failed<sup>29</sup> and successful<sup>30</sup> regional health infrastructures, patterns have emerged that distinguish successful, sustainable infrastructures from failed investments. Successful regional networks should be:

- **Cost effective:** implement and therefore pay only for the level of integration that delivers immediate value, as described in the aforementioned multi-step approach. Another important aspect of cost-effectiveness is the re-utilization of existing technology and standards in order to benefit from the learning-curve effect, rather than building a custom integration
- **Generate administrative savings:** Cost reductions have a direct impact on the bottom line of any organization, so improving workflows and eliminating wait times are quantifiable benefits through opportunity cost calculation
- **Utilize existing IT staff and capabilities:** The integration of IT resources, i.e. through image aggregation, should be implementable with existing staff since it utilizes existing technologies; through aggregation of services resources can be re-deployed towards vertical integration

- **Increase financial incentives** through pay-for-performance, bundled payment and ACO options that require vertical integration, clinical trial participation and advanced data analytics services, such as quality reporting

## CONCLUSION

The healthcare Industry is in a rapid transformation process. The historic delivery model centered on individual clinical disciplines, in which providers are incented to perform individual tasks, is evolving toward an integrated care model, in which providers are incented to work in a more coordinated approach and to engage patients in their care to manage population health and improve outcomes. Information systems that were designed and built for the historic fragmented care delivery model now have to be integrated to become useful and interoperable within this new environment.

Readily available information technology can be deployed to connect extant systems into vertically integrated delivery networks, across organizational boundaries, at the local, regional and national levels. While these integrated systems can provide economic benefits for the providers even in the current fee-for-service model, they become essential in bundled payment and capitated risk economies.

This paper explained the drivers and economic benefits at different implementation levels in a simple 5-step approach that begins with the aggregation of medical images and electronic delivery of other test results through a secure clinical portal for providers, progresses to referral and order management, then EMR integration and patient engagement to allow all major stakeholders secure access to relevant information.

This model successfully builds an IT foundation for the next evolutionary step in the movement toward a learning health system, where clinical decision support and population health management will be increasingly important. Experience shows that a step-by-step approach with clear stakeholder benefits and engagement at each level will help avoid costly and frustrating failures and yield a higher degree of user acceptance and adoption.

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#### **CONTACT:**

##### **Agfa HealthCare**

Joerg Schwarz

[Joerg.Schwarz@agfa.com](mailto:Joerg.Schwarz@agfa.com)

##### **Orion Health**

Richard Cotman

[Richard.Cotman@orionhealth.com](mailto:Richard.Cotman@orionhealth.com)



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