

The Future of Data Management in Healthcare

Solving today’s healthcare challenges with technology to better face the ongoing demands of modern healthcare provision.

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Introduction

Data management has been an ongoing challenge for healthcare provision since the proliferation of electronic medical records (EMR) two decades ago. Increases in scale, complexity and volume of data generated by healthcare systems has only exacerbated this challenge, placing greater pressure on administration, operational and clinical resources. The COVID-19 global pandemic further intensified this pressure, in many cases shining a light on systematic inefficiencies and the limitations of health systems to adapt. Consequently, health systems are today re-assessing care delivery and operational process strategies, with a renewed focus on scalability, flexibility and efficiency.

From a data management perspective, there is no single “off the shelf” product that can meet a provider’s need today; instead, a combination of digital software, services, training and internal application development is required. This white paper will explore the variety of data management technology and services that are available, discuss their impact on meeting the challenges health systems are facing today and assess their impact on care quality and the patient journey. Further, this paper will look ahead to the future of care provision and the demands that will be placed on data management competency for health systems in the future, highlighting that many data management solutions available today can act as a pre-requisite to achieving more precise, efficient and connected care systems.

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Author: Steve Holloway
Principal Analyst



Data Management in Healthcare Today

Against a backdrop of rapid technology innovation, the healthcare sector has struggled to keep pace with digitalisation in sectors such as finance, consumer retail and energy. However, few of these comparators have undergone such unique circumstances. Stringent regulation, rapid institutional consolidation, an ever-changing mix of payer relationships, changing care models and over-subscribed demands for care have all factored in slowing the digitalisation efforts of many providers. The result today is a sector that has made substantial progress, yet also created a complex, expensive, unwieldy and difficult to manage system.

Healthcare providers are therefore in a perilous position today in terms of data management, investing heavily to customise applications to overcome legacy operational and clinical challenges,

which in turn limits investment into new technology to streamline data management and better prepare healthcare providers for the future.

This ongoing cycle only serves to directly impact a range of stakeholders in today's health systems. Poor data management and inefficient processes impact all aspects of the broader healthcare system, from physicians to administrators to patients. Regular tasks required for the provision of daily care services are manual, labour intensive and reactive to short-term demand. Worse still, stakeholders across health systems have limited tools and resources to make improvements or innovate, over time stifling the evolution of health systems to adapt to the ongoing challenges of modern healthcare.

Each stakeholder group is posed a set of unique challenges from a data management perspective today, as is outlined in figure 1 below. However, the impact of poor data management in each group results in a common consequence for care systems.

FIGURE 1: BIGGEST CHALLENGES IN DATA MANAGEMENT TODAY

Care Stakeholder	Challenges Today	Data Management Challenges	Impact on Patient/Care Provision and Outcomes
Primary Care Physician	<ul style="list-style-type: none"> ● Increasing demand for services ● High administrative costs ● Outcome-based reimbursement 	<ul style="list-style-type: none"> ● Exponential increase in patient data ● Manual, time-consuming data entry ● Limited funds for new technology 	<ul style="list-style-type: none"> ● Less time per patient ● Lower care quality ● Errors and legal issues
Acute Provider: Specialist Physicians and Care Teams	<ul style="list-style-type: none"> ● Complex, multidisciplinary care ● Oversubscription of care services ● Outcome-based reimbursement 	<ul style="list-style-type: none"> ● Lack of full patient data access ● Increased data entry time, staff burnout and turnover 	<ul style="list-style-type: none"> ● Lower quality of care ● Clinical and diagnostic mistakes ● Inability to track care outcome progress
Acute Provider / Operational, Admin and IT	<ul style="list-style-type: none"> ● Spiralling cost of care provision ● Overstretched IT resources ● Ongoing cyber attacks and threats 	<ul style="list-style-type: none"> ● Limited enterprise cost-tracking ● IT workload for custom integrations and siloed manual security maintenance 	<ul style="list-style-type: none"> ● Poor visibility of resource utilisation ● Reactionary response to care needs ● Inability to leverage new technology
Outpatient Diagnostic and Treatment Centre	<ul style="list-style-type: none"> ● Increasing demand for services ● Consolidation of networks ● Limited dedicated IT resources 	<ul style="list-style-type: none"> ● Limited exchange and referral management for cases ● Manual data entry and form-fill 	<ul style="list-style-type: none"> ● Slow turnaround of tests and records ● Greater risk of legal issues ● Under-utilisation of services
Payers	<ul style="list-style-type: none"> ● Increasing cost of care provision ● Growing focus on outcome-based care ● Massive administrative complexity 	<ul style="list-style-type: none"> ● Lack of "complete" view of payee care system interactions ● Manual, labour-intensive admin process 	<ul style="list-style-type: none"> ● Higher cost of care ● Incorrect billing and care adherence ● No measurement of outcomes
Patients	<ul style="list-style-type: none"> ● Unknown care costs ● Incomplete care records ● Limited provider choice 	<ul style="list-style-type: none"> ● Limited payer-provider data exchange ● Complex range of providers with multiple administration systems ● Poor access to health records 	<ul style="list-style-type: none"> ● Poor care plan adherence ● Unforeseen costs ● Higher likelihood of re-admission



Cost is the most obvious and yet still critical factor. Manual and inefficient processes directly and indirectly cost healthcare systems billions of dollars globally each year. For healthcare providers facing unprecedented demand for services following COVID-19, finances are under substantial pressure, softened near term by unprecedented government intervention, which is rapidly drying up. Near-term, providers and payers will need to rapidly evolve care systems to be more cost-effective and financially sustainable or face future cuts and budget freezes.

Inefficiency is a substantial source of financial pressure for health systems. Manual processes, paper-based data entry, limited interoperability and weak data governance have forced most healthcare systems to invest heavily into administrative resources and costly outsourcing. With no clear long-term strategy for streamlining processes, and care complexity continuing to increase, the financial, operational and care quality impact of piecemeal digitalisation have resulted in higher costs for providers while worsening the inefficiencies. Furthermore, clinical resources are increasingly impacted, forcing physicians and clinical staff to spend more time on data entry and manual administration and less time supporting patients and focusing on care provision.

This has been especially evident in the adoption

of Electronic Medical Records (EMRs) in the last decade. While the regulated drive for digitalisation of patient records has helped move the needle in terms of broader healthcare digitalisation, stringent frameworks for deployment and limited focus on interoperability has left many health systems still facing big data management challenges. EMRs have helped bring together basic clinical and administrative data yet done little to support integration of specialist clinical or diagnostic data, resulting in incomplete patient records and a new set of manual processes required to support now mandated multidisciplinary care pathways. This was especially evident as healthcare systems endured unique and unprecedented pressure during the global COVID-19 pandemic, stunting healthcare providers in their efforts to react and evolve to meet such unique circumstances.

The last decade has also seen a transformative change in healthcare system structure in many markets. Health systems today are larger, more complex and funded or reimbursed differently. Yet the administration and data management systems that underpin many of these new systems is founded on ageing legacy technology and broken processes that have existed for decades.

Further, COVID-19 has completely re-defined care provision, intensifying focus on settings outside acute care institutions, demanding a greater level

of data liquidity and interoperability within care systems. This uprooting of traditional structure has also changed the patient-provider relationship, with access, choice and care quality the primary foci of patients. Patient access to records and medical data also lags behind, in contrast to the growing availability of virtual care in this new era of hybrid care. Yet with legacy technology as the foundation for data management, meeting the needs of this new era of care is nearly impossible.

For IT leaders, the pressure facing IT infrastructure and resources has perhaps never been greater. Not only has care systems rapidly changed forcing expensive resource deployment and “band-aid” fixes; IT leaders also face spiralling costs and an increasingly hostile cyber environment that brings intensified risk of ransomware attacks and data breaches. Maintaining the security and operation of siloed legacy systems has stretched in-house IT resources to a breaking point yet achieved little in supporting the broader aims of higher quality and less expensive care.

Solving Today's Challenges in Data Management & Preparing for Tomorrow's Health System

These challenges are daunting and complex for healthcare leaders today. However, a robust foundation of streamlined data management processes and data governance sets a solid foundation for meeting these challenges head on.

Understanding the data governance challenges of complex care systems is in itself a difficult process, given the complexity of care systems today. However, most providers already know the major pain points in their system, but do not have the resources or tools to fix the fundamentals. Further, many have expected that an off-the-shelf software application or singular platform would do everything. Most pursuing this approach have been disappointed.

No single solution can solve a provider's data management needs. Each provider has a unique



blend of IT systems, payer structures, governance and systematic pressures. Therefore, solving fundamental data management challenges is dependent on a combination of software applications, professional services, customisation and self-build innovation. This change in strategic thinking can have a transformative effect, empowering healthcare organisations to limit compromises and craft solutions that better suit their unique data management needs, both today and in the future.

As is outlined in figure 2 below, a raft of new technology is now available to support this journey, with each playing a role in different parts of the healthcare system. For example, content services and imaging platforms can quickly remove manual processes and support consolidation of critical operational, administrative and clinical data for access within core IT system workflow. Deployed correctly and in partnership with business process automation, these tool “suites” can dramatically streamline a range of processes, lowering the manual administrative burden on clinicians and other staff while improving cost efficiency. Furthermore, the generation and structured



consolidation of this data can help clinical and operational leadership better understand healthcare services, especially when analytics are deployed. The ability to resolve areas of inefficiency, react to unprecedented demand for care teams and other staff via data-generated insights is a powerful tool for systemic change, yet is only possible if the investments are made in a foundation for content/imaging management and process automation.

FIGURE 2: SOLVING TODAY'S HEALTHCARE CHALLENGES WITH TECHNOLOGY

Content Management

- Digitalizes paper and other unstructured data for efficient processing
- Enables extraction and consolidation of data for use within core systems
- Improves decision making by closing gaps in patient/member records
- Supports enterprise ILM and governance

Enterprise Imaging Strategy

- Consolidates complex multimedia content from a range of diagnostic and clinical applications
- Federates enterprise access, management and ILM of all clinical content
- Ensures all clinically relevant data is curated for care givers regardless of setting

Business Process Automation

- Streamlines and structures complex admin, operational and financial processes
- Adapts data input workflow and ensures data is accessible and integrated
- Automates workflows to better utilise resources, lowers costs and ensures higher quality of care and patient satisfaction

Low-Code Application Dev.

- Enables rapid deployment of customised workflow and process applications
- Reduces burden on IT specialists by empowering other teams to develop workflow tools and forms
- Creates actionable operational and clinical insight quickly and at reduced cost

Operational Analytics

- Provides real-time measurement of service-line and care services
- Ensures correct data is available and actionable for operational and clinical decision making
- Supports complex ILM for IT, admin, finance and legal teams

Artificial Intelligence

- Automates classification of medical records through machine learning
- Screens and prioritizes medical images for radiologist review using ML/DL models and accelerates algorithms used in clinical trial data



Care teams can also benefit from new data management technology. Most EMR systems deployed today manage structured patient data, yet often have substantial gaps in patient history due to unstructured data that is not integrated, siloed departmental IT systems and poor interoperability of data within clinical workflows.

One area where many providers are addressing this issue is with enterprise imaging consolidating all diagnostic imaging and associated content into a structured platform. In doing so, clinician access to richer patient data is improved, supporting improvements in care quality. Furthermore, this consolidation also supports legacy application retirement across the patchwork of ageing legacy diagnostic software applications, lowering the burden of maintenance and security on IT resources. While there is no “one stop” solution to achieving enterprise imaging, the best offerings today combine a robust mix of standards and interoperability with cutting edge life cycle management and diagnostic imaging workflows, all within a platform that offers streamlined integration (often via pre-determined APIs for common applications) and inherent adaptability for more specialised or unique needs.

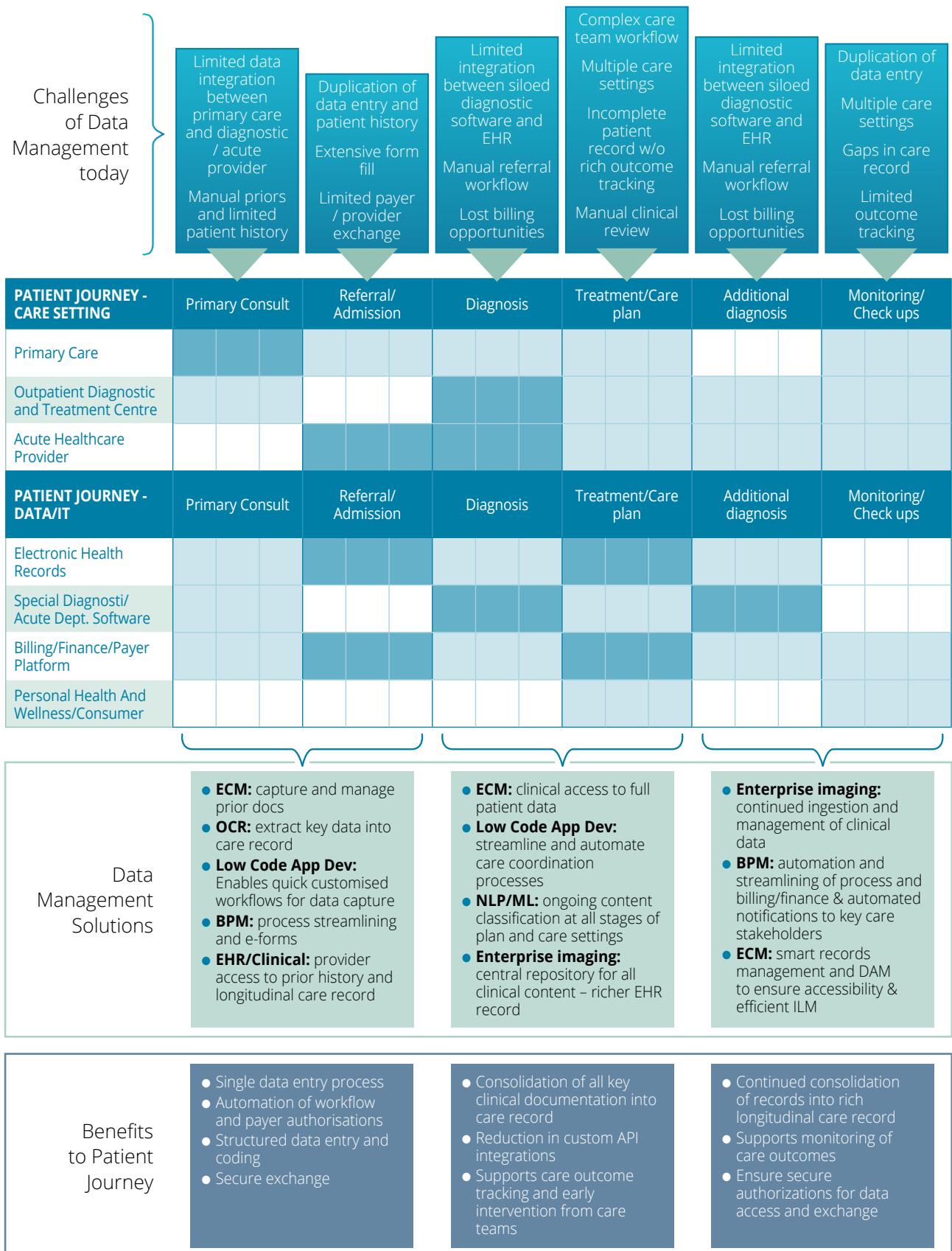
However, even with adoption of content services to streamline processes and support richer longitudinal patient records, health systems also need the ability to build applications to meet their unique and rapidly evolving needs. Often this requires IT resources to develop new applications placing a burden on already over-stretched

IT staff. Low-code, drag and drop application development tools can completely change this dynamic, providing non-technical employees the ability to build and deploy applications with minimal support. By simplifying the process of application deployment, health systems can more rapidly innovate and deploy customised data management tools without having to wait for specialist IT resources to become available. This allows systems to become more proactive to business needs, solve problems more quickly and innovate more effectively.

Data Management and the Patient Care Journey

When assessing the viability and impact of new technology, many health systems will focus only on the direct and obvious impacts of adoption, such as a reduced need for manual administrative resources or near-term impact on IT costs. However, the indirect impact on care provision and care quality should not be overlooked, especially given that reimbursement is increasingly evolving towards multidisciplinary, outcome-based care models. Therefore, while harder to measure, the indirect impact of faster application deployment or more efficient data management can lead to substantial improvements in patient care and the patient journey through health systems. To exemplify this impact, we have outlined the broader effect of improved data management on the major phases and enterprise systems common to most care providers in figure 3 on the next page.

FIGURE 3: THE PATIENT CARE JOURNEY – ROLE OF DATA MANAGEMENT SOLUTIONS



Specific Examples

It should also be noted that in each phase of the patient journey, a different “mix” of data management technology is required, both “off the shelf” and self-developed, given that each phase has a unique need at each provider. To provide some further detail on the impact that digital data

management technology adoption can offer, the examples below provide clear outcomes and benefits for specific aspects of the patient care journey. In each example, providers can improve patient care quality, more efficiently deploy resources and better solve care provision challenges.



Case Study 1: Medicaid Patient Transportation

HEALTHCARE PROVIDER CHALLENGE:

- Rapid development and deployment of new workflow to organise transportation for Medicaid patients to treatments
- Short time-period for deployment (8 weeks), Limited IT resources
- Critical to ongoing care services and financial impact on healthcare provider and payer if not provided

Solution used: Low-Code Rapid App Development

- Low code enabled a non IT specialist to build, test and deploy a new patient transportation app with a form fill, associated workflow routing and integration with core systems in a short time period
- Allowed healthcare provider to rapidly adapt services to meet payers requirements
- Enabled the right transport provider to be matched to each patient’s specific needs, e.g. wheel chair ramp, Spanish speaking driver



Case Study 2: Tumour Board Clinical Access

HEALTHCARE PROVIDER CHALLENGE:

- Preventing errors and adverse patient outcomes due to missing/incomplete data
- Labour-intensive classification of medical records sent via fax and paper from external providers
- Content is not easily accessible by care team, may result in duplicate testing and delays to patient care



Solution used: Enterprise Content Management, Business Process Automation, Intelligent Capture, ML

- Use of intelligent capture and machine learning expedites classification of external medical records in significantly less time than prior manual system, freeing staff for other work
- ECM platform enables patient data to be integrated within patient context in EMR workflow
- ECM allows streamlined clinical access to complete patient record and full imaging history, to support improved care decisions and quality of care

Data Management and the Future Direction of Healthcare Provision

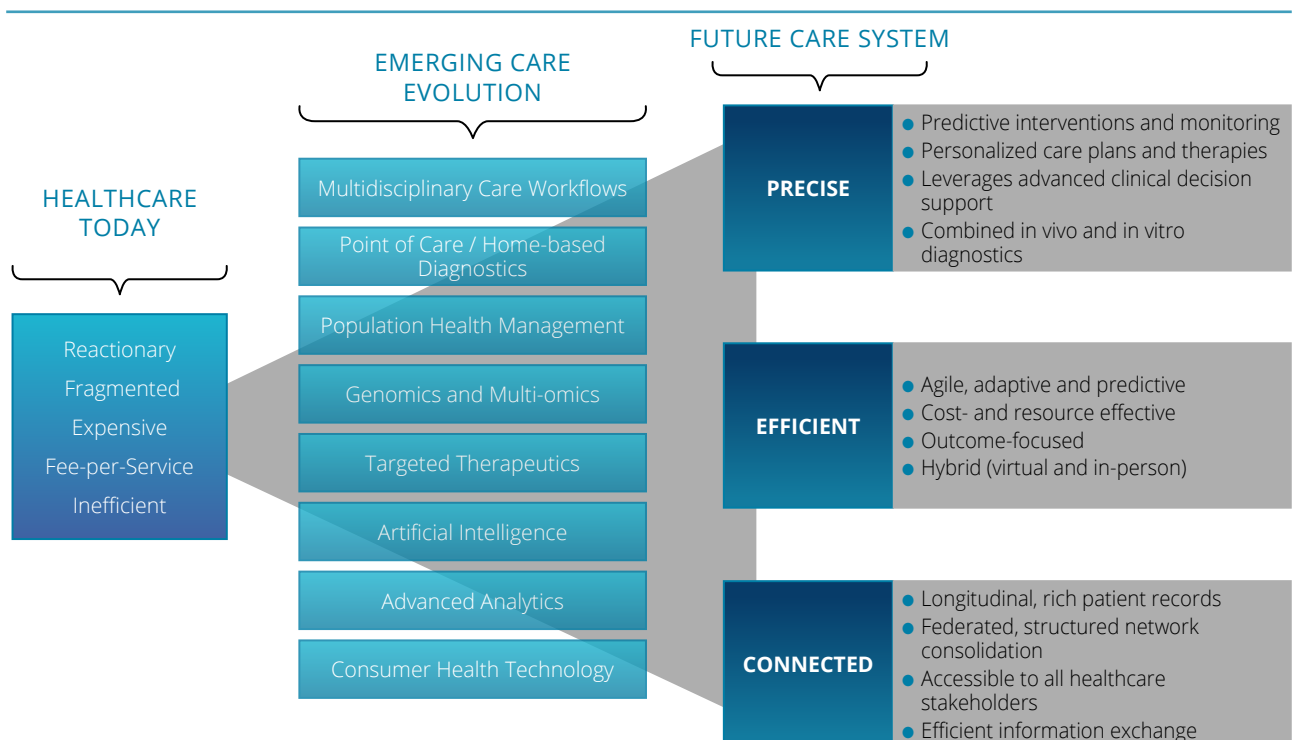
Many of the examples and digital data management technology described so far has focused on addressing the immediate challenges facing healthcare providers today. However, it is also clear that data management will play a substantive role in the evolution and transformation of future care system provision. Across our research, the concept of digital precision medicine is already starting to penetrate all aspects of healthcare technology, while also playing a massive role in the design of new care models. Precision medicine focuses on provision of care on an individual patient basis, combining a raft of diagnostic data types and personalised therapies and treatment plans to improve the efficacy of care for each patient. From a diagnostic aspect, this requires the collation of a multitude of different in vivo and in vitro tests to create an individual profile of a patient’s genetic and physiological make-up. Further, predictive population health data and predictive analytics can be used to catch the markers and risk factors of disease earlier,

before administrating a more specific treatment intervention tailored to the individual.

While the green shoots of precision medicine are evident in many of the advances in cutting-edge diagnosis and treatment, health systems are still woefully underprepared to deploy precision medicine at scale. This is in part due to an inherent limited competency in data management. Precision medicine demands access to massive arrays of clinical and diagnostic data, including unstructured data, to craft targeted, individualised treatment pathways

Robust data management competency is therefore a pre-requisite for healthcare systems to move towards the future of care provision. As is outlined in the diagram below, healthcare providers must design and execute new strategies for data management that have not only the near-term challenges in mind, but also that can lay the foundation for the next era of care. This new approach should focus on three core principles: precision, efficiency and connectivity.

FIGURE 4: THE FUTURE OF CARE SHOULD FOCUS ON THREE CORE PRINCIPLES: PRECISION, EFFICIENCY AND CONNECTIVITY





These three fundamentals also act as a clear blueprint for assessing data management technology and broader data management implementation strategy. Broken down further, in leveraging the wealth of new technology available today, providers should be aiming for systems that offer a structured, centralised platform for data management, thereby decreasing the burden on maintenance of multiple fragmented systems, while also providing a basis for data aggregation and federation at scale. In addition, more centralised and structured data management consolidation allows centralised governance, ensuring data “hygiene”, compliance, and security. Common workflow and processes across systems must also be streamlined and automated wherever possible, reducing the manual processing burden on resources and lowering operational costs, while improving the efficiency of services.

Core platforms for data management should also have common characteristics, founded on a basis of robust standard competency, simplified integration and access-anywhere deployment architecture, with hybrid on-premises and cloud deployment serving as the most tangible direction for most providers offering a balance of performance and cost efficiency.

Combined, this centralised approach should enable more elasticity and scalability of the data management platform, enabling health systems to

better cope with unforeseen demand and adapt more readily and efficiently. Further, this approach can also transform the deployment of IT resources, allowing focus to shift to ensuring robust security governance and utilising specialist IT resources for projects focused on improving care quality and cost efficiency rather than tackling near-term legacy challenges.

Ultimately, healthcare providers embarking on the transformation of data management in their organisations should be cognizant not only of the near-term benefits and cost savings, but also have a clear framework and strategy that meets the pre-requisite needs for care provision in the future.

Conclusion

In summary, the data management challenges facing healthcare providers today have never been more acutely felt nor more critical to solve. However, with the advent of a new generation of data management technology solutions, providers now have the tools to better face the ongoing demands of modern care provision.

As outlined, there is no single off the shelf solution to solve these challenges; instead, modern data management strategy requires a hybrid mix of software, services and rapid application development capability. Further, a clear blueprint and understanding of both the near-term and longer-term aims of adoption is vital to ensuring

new technology deployment and innovation meets not only immediate IT and administrative challenges, but also plays a substantive role in solving broader enterprise problems.

Healthcare is evolving towards a more precise, efficient and connected future. Therefore, solving the data management challenges of today should also be viewed in the context of also laying the foundation and pre-requisites for future care provision. Compromises and short-cuts to tackle near-term issues today will only serve to intensify the pressure on systems mid-term yet leave many woefully underprepared for a new era of care. Data management has a vital role to play in supporting care systems evolution towards more personalised care.

Partnerships are crucial to healthcare providers embarking on this transformative journey. Deployment of new technology is rarely successful when not combined with ongoing commitment to supporting services and consulting from product vendors. Providers should look to build a select network of partners with a clear track record of success, including case-studies of real-world deployments and a clear understanding of the core strategic aims of the provider. Technology solutions should evidently mature in terms of standards, interoperability and deployment and allow customisation to better fit the unique needs of the provider. Furthermore, contracting



and business models should actively reward all parties for meeting clearly defined strategic goals, while also opening-up new opportunities for collaborative, long-term partnership.

Fundamentally, the well-executed deployment of new digital data management can support improvements in care service for all stakeholder groups, actively supporting care givers in providing better quality and more cost-effective care, at all stages of the patient journey. With an intensifying shift towards outcome-based care models and ever-growing demand for care services, few providers can afford not to tackle data management head-on.



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