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Achieving Patient Centricity Through Data-Driven Care

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Business Brief

Purpose statement

This document provides insights into how data-driven strategies in healthcare can lead to patient-centric care.

Disclaimer

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Introduction

As the world emerges from a global pandemic, now more than ever, there is a shared understanding of the critical role that data plays in the effective delivery of healthcare. When used well, data has the power to reduce costs, provide more timely, innovative, and targeted services, and ultimately produce better patient outcomes. To respond to the challenge, providers have been aiming to better use their own data and data from their ecosystem to provide more patient-centric care. Experience has shown that the key to unlocking the full potential of that data is to eliminate data silos.

Software vendors have been quick to respond with solutions and concepts, such as data warehouses, data lakes, data mesh, data fabric, and more. These solutions have a part to play, but by themselves don't address many of the underlying problems. The solutions are largely technologically focussed. This business brief, while touching on the technology, is primarily looking from the perspective of the business of healthcare, both clinical and operational, with primacy on the needs of patients.

What are the Challenges?

This business brief explores some of the significant challenges faced by the industry around data and its impact on healthcare.

- Quality of data
- Volume of data in a complex healthcare ecosystem
- Untapped data
- Data governance, security, privacy, and confidentiality
- Inequities in data
- Standards in healthcare
- Insights from Artificial Intelligence

Data Quality

Healthcare is a data-intensive industry that is reliant on information to diagnose, treat, and maintain the wellbeing of both individuals and the general population. The quality of that information is fundamental to the eventual outcome. The pandemic has brought focus on issues that have existed in healthcare, ever since the use of information technology to capture data became a fundamental part of clinical care. Drawing data out of the 'silos' and re-assembling it will achieve nothing unless there is also clarity about the reliability and quality of information that has been drawn together. The concept of 'garbage in – garbage out' dates from mid-last century[1] but is even more relevant today as the original data now may often be masked under layers of analytics or artificial intelligence.

Data quality must be assessed from the perspective of those who are reliant on the information for decision-making. There are many such users in healthcare – including patients, providers, clinicians, caregivers, researchers, and payers. Governments and healthcare payers around the world recognise that for healthcare to be sustainable and affordable in the 21st century, citizens must become much more empowered to care

"You'll never find the intersections where something new could be created if you are working in silos. And healthcare needs disruptive invention."
Stephanie Trunzo, EVP, Oracle Health.

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for themselves and their families. As reflected in the World Health Organisation's broad definition of healthcare[2], this includes concern for their wellbeing and the need to account for social determinants, which can have a major impact on health. If people are to be at the centre of their care, we must look at data from their perspective.

Healthcare Data Ecosystem

Data is interdisciplinary and we are all connected by it. If used correctly, it helps patients, providers, scientists, and the public in ways that bolster the overall health of our society:

- A traveling patient carries their unified healthcare data in a single longitudinal record

- A provider reviews a patient's entire medical history and predicts health risks in one click

- A geographically dispersed care team monitors a patient's vitals in real-time

- Researchers use de-identified data to discover root causes and develop novel treatments

- Analysts use the data to map trends in population health

As the industry evolves with new technology and legislation, the data equation gets further complicated. The International Data Corporation (IDC) predicts that by 2023, 70 per cent of healthcare organisations' attempts to scale value-based health models will fail unless they invest in data-driven governance, operations, and organisational infrastructure[3].

Keeping up with the volume of information produced from imaging, telemedicine, electronic health records, and other sources of data will inevitably lead to further data challenges in healthcare. For example, data fragmentation and lack of uniform digitisation impedes efficiency, some data is overlooked because it is stuck in silos - others remain underutilised. If hospitals and other providers are to meet and conquer those challenges, they will need the appropriate tools and the people with the skills to assess and glean insights from the data as well as effectively communicate those findings and put them into practice.

The healthcare ecosystem is complex and becoming even more so. No longer are single payer healthcare systems the only source of healthcare in a region. There are now new entrants supporting health and wellness and consumer grade options that fill in the gaps where traditional medicine just doesn't hit the mark. It means patients are creating data on their watch, in the gym, with various applications on their phone, and with non-traditional 'providers'.

Volume of healthcare data

Today, approximately 30% of the world's data volume is being generated by the healthcare industry. By 2025, the compound annual growth rate of data for healthcare will reach 36%. That's 6% faster than manufacturing, 10% faster than financial services, and 11% faster than media & entertainment[4].

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Structured and Unstructured Data

Legacy systems may lead to information silos between hospital systems and domains. Hospitals can hoard treatment data and are often unwilling to share with other research centres. The lack of collaboration inhibits innovation, limits data-driven decision-making, and ultimately affects patients. Paper records continue to be used, adding to the operational overload in an age when mobile clinicians can capture and analyse data at a patient's bedside on advice. Healthcare organisations acquire tools for specific needs; these tools lack the benefits of comprehensive solutions that improve the patient's overall journey. Integrating platforms that offer comprehensive solutions provide better patient outcomes.

Whether on-premises, in the cloud, or in a SaaS model, traditional applications typically have their data stored in structured databases. These are systems such as, enterprise resource planning, human capital management, and supply chain management. These applications are usually set up in a manner to feed a data warehouse that consists of high-quality, known structured data, to run reporting and other business analytics. However, many disparate data types exist at healthcare providers, such as paper forms, PACS/DICOM images, and data from other sources such as clinics, labs, and external provider EMR systems.

At Oracle, we try to make it simple to visualise where the silos exist across the enterprise and help identify what data, process, and technology is not supporting the enterprise to make the right impact. Having a holistic view helps reduce underutilised data, improve data management, and get the right access to the right data to the right consumer at the right time.

Today, the data most businesses understand, and have the tools to manage effectively, is in the centre of the picture below – structured data: their existing database and application data. As you go out from the centre, the data becomes harder to manage in the same way as traditional relational data sets. But this is where you find the data that can lead to really differentiated outcomes for patients, this is untapped sources of value. This is where there has been a gap in the tools and platforms to exploit this data effectively.
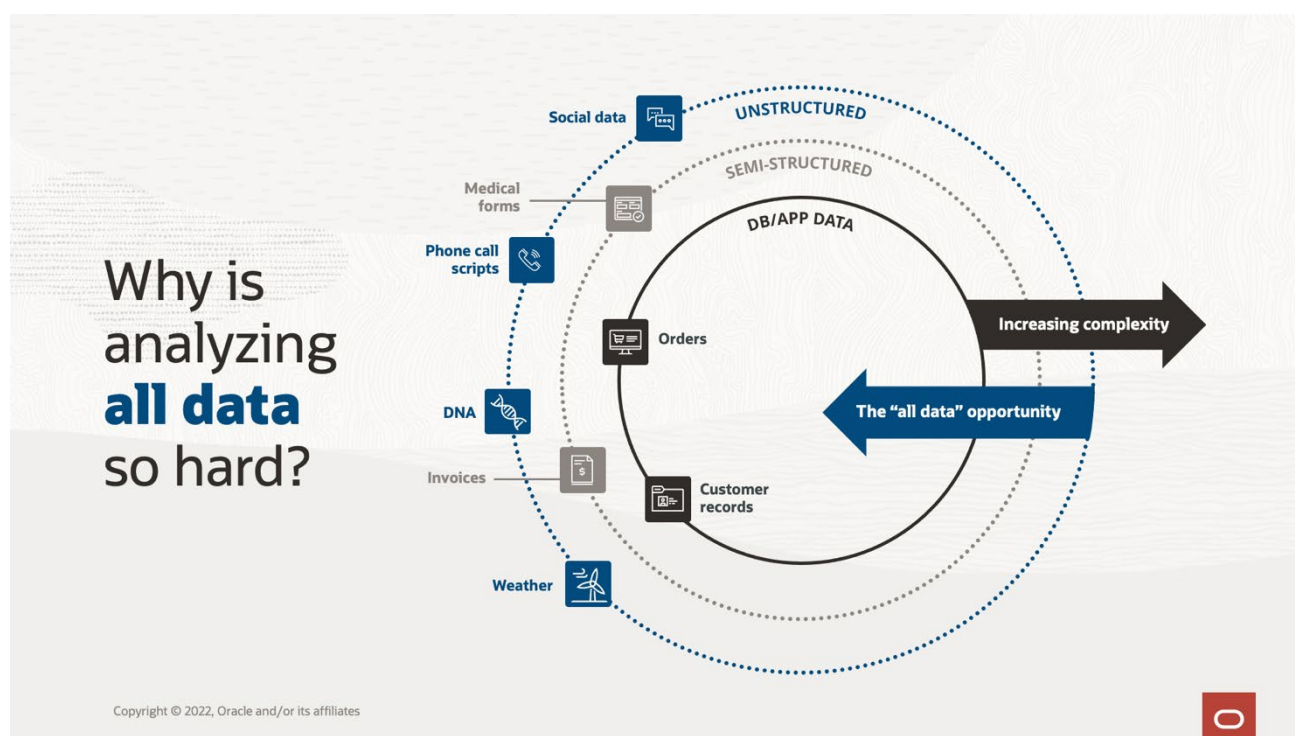

Image 1: Simplifying the complex

Oracle provides a common platform for these data through its Data Lakehouse solutions. Healthcare organisations can use tools that are easily accessible to developers, for transforming paper forms from a mobile in-house call into usable digital information, to take patient calls and convert them into digital text, or Natural Language Processing (NLP) to automatically perform data prep and sentiment analysis against all forms of

unstructured digital information. By extending the reach of the data available for analysis, this data can now be merged with the traditional data from traditional applications to drive greater insight, to transform existing data models, or to build completely new data models.

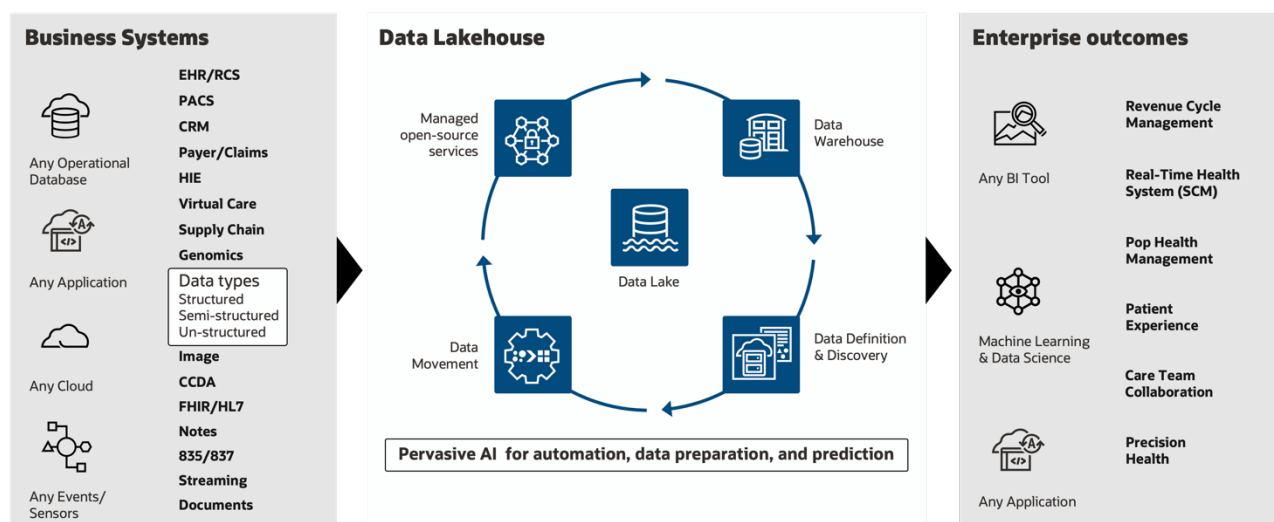## Data Lakehouse for Healthcare on OCI

Image 2: Data Lakehouse for Healthcare on OCI

Information Governance

Healthcare organisations recognise the increasing risk of securing and managing personal data, and governments globally are implementing strict legislation to ensure they do. Transparency and traceability are critical elements to support these digital ethics and privacy needs.

Beyond privacy issues, due diligence is important to avoid drawing incomplete or erroneous conclusions from the data. Large data sets can contain inherent biases or represent only a sliver of a larger or more complex situation. Users drawing insights from them, therefore, need to consider how data is collected and analysed, including any inherent bias it may contain, and how the story fits into a larger picture. Maintaining such safeguards requires robust policies [5].
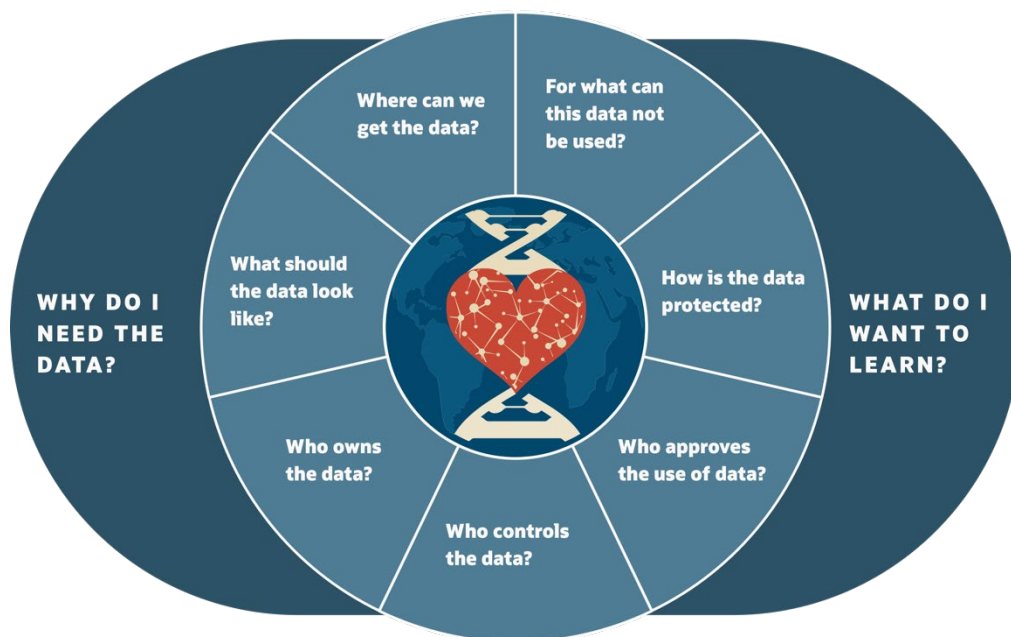

Image 3: Data Governance

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The types of decisions required in healthcare and the information to support them is many and varied. Our hospitals and offices are filled with lots of different kinds of people, and their needs are different. A one-stop dashboard doesn't help everyone. The needs of a senior nurse on a surgical floor, and the needs of a supply chain lead are very different. But the data going into the systems may be very similar. Both need to understand the patients in the ward. Both need to understand the supplies needed for the day, or the week. But the people working inventory don't need to have detailed patient information. The nurses need all the patient information but may not need anything associated with cost. Understanding what information is needed by which 'decision makers' and how best to present that to them, at the place and time where it matters, is paramount.

Citizens want to know information about the state of their health, care and treatment options, access to services, quality indicators, *etc*. and this leads to some basic concerns about the data underlying that information. As Gartner notes, people are increasingly aware that their personal information is valuable and are demanding greater control[6]. Citizens want to know where their data comes from, the processes involved, and how it was produced (data provenance). In practice, most lack the capacity or time to investigate to this level of detail and so rely on a trusted regulatory authority or compliance process (*e.g*.: HIPAA[7], GDPR[8],*etc*.) to provide some assurance that there are appropriate processes in place.

Privacy and Confidentiality

Privacy is a human right that is usually supported by legislation and, in the case of personal healthcare data, often also by specific legislation that recognises its sensitive nature. Health specific legislation typically imposes obligations on the custodians of health data to maintain the confidentiality of that information in accordance with the wishes of the person to whom the data relates. The legislation may provide for exceptions to this general rule, for example, if the data are de-identified prior to disclosure or use of identifiable data with some form of independent ethical oversight.

This is a complex issue and resolving the complexity is essential for delivery of effective care to individual patients and for conducting the research needed for the whole community. It is made even more difficult because although legislation in most countries reflects a set of agreed principle developed by the OECD[9], there are subtle variations in how these principles are interpreted in Europe, the US, and elsewhere. This was a challenge for organisations across the globe as they looked to share data in support of research into vaccines and treatment for COVID-19.

Through its global healthcare footprint, Oracle understands this complexity. It has solutions to deal with patient authorisation and consent on the use of their data and setting boundaries on how their data can be used. This includes access to many different data masking and anonymization techniques.

Cybersecurity

Cyber security and IT professionals are familiar with the term Zero Trust Security. The slow erosion of an organisation's network perimeter has received a lot of focus for the last few years within IT security. However, the COVID-19 pandemic accelerated this shift, almost overnight, particularly in healthcare organisations that scrambled to establish solutions to enable their workers to continue working securely from their homes.

Oracle builds security into all our cloud solutions at the architectural level, ensuring full-stack protection and a platform that's secure by design, including capabilities such as isolated network virtualisation, hardware root of trust, and tenant isolation.

Oracle has an extensive cloud compliance program designed to help customers operate globally in a complex and rapidly changing business and regulatory environment. Oracle manages more than 80 global, regional, and industry-specific programs to provide third-party attestations like SOC, ISO, HIPAA, and FedRAMP, and advisories for standards like GxP, NIST, GDPR, and FISC. Data privacy regulations vary from region to region, and Oracle actively maintains programs to comply with local standards. Oracle further protects privacy by providing services that are region-specific by default, with additional privacy features, as well as published data processing standards and regular reporting of law enforcement requests.

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Equitable Use

Kimberle Crenshaw[10], a civil rights advocate and scholar, coined the term intersectionality in the late eighties. This term describes how certain individual characteristics intersect and overlap to create systems of disadvantage for individuals. During the pandemic, this powerful approach remained underutilised in revealing inequities in data, such as the role of demographics and other social factors on COVID-19.

Disparate data standards and algorithmic bias obstruct population health advancements and reduce health equity due to skewed outcomes. Additional layers such as race, ethnicity, and language data can provide more equitable results. Some experts[11] have recently suggested that equity should now be a fifth element added to the "Quadruple Aim" of improved patient experience, better population outcomes, lower costs, and clinician wellbeing.

Standards

The wide range of need has meant most large healthcare organisations have been building out their technical workflows and capabilities over the course of the last decade or two. Ultimately it means mission critical efforts are split between multiple applications, on premise, in the cloud and homegrown solutions, usually in siloed instances. While our collective view of standards in healthcare has now evolved and there is wide acceptance that Fast Health Interoperability Resources (FHIR) [12] is a solid interoperability standard and the way of the future. There is less agreement on the path to get there. It will take time for this transition to occur. FHIR is still being developed and extended, and it's likely that legacy systems won't be modified to work with it. What if all your data from key systems is not FHIR ready? Most organisations have HL7 (v2 and v3), proprietary and other code sets (*e.g.,* SNOMED, ICD-10, LOINC) in their eco-system. Systems will need the capability to operate in both worlds for some time and be able to draw data together in a meaningful way to support their analysis. This will be enabled by modern hybrid-cloud approaches that will be able to work with the FHIR protocols.

Artificial Intelligence

One area of strong recent focus for standards bodies and regulators has been the use of artificial intelligence (AI) as a type of Software as a Medical Device (SaMD) - which is defined by the International Medical Device Regulators Forum as "software intended to be used for one or more medical purposes that perform these purposes without being part of a hardware medical device".

Different levels of control are required depending on the extent to which the person is reliant on the software, *i.e.,* are they fully dependent on the software to make their decision or is the software only providing information to help them determine the action needed. This is closely related to the concept of "augmented intelligence" as compared with "artificial intelligence".

The future of clinical AI extends far beyond the interpretation of medical images, pathology slides, and radiographs. AI is being developed to detect critical, highly complex, and time dependent conditions such as, adverse drug reactions and sepsis in acute care environments where timely nuanced communication is pivotal. It is likely that in coming years, AI-based protocols will replace many of the threshold-based protocols that are presently providing acute care diagnostic and treatment decisions.

An advantage of AI is that it can analyse more relationally complex portions of a patient's dataset. However, a major disadvantage is that the complex decision processing of the AI may be substantially opaque if not designed to provide transparency and nuanced communication (the 'black box problem'). Effective communication from an AI must not be inferior to communication from a human. Trust in the data is fundamental for both clinicians and consumers and there is a strong demand for 'explainable AI'.

AI is a rapidly evolving space and in recognition of that, the International Organisation for Standards (ISO) has established a Task Force on standards for AI in healthcare[13]. In the interim, a Harvard Business Review article has noted four actions needed to increase confidence in AI-assisted decisions: creating reliable AI models that deliver consistent insights and recommendations, avoiding data biases that skew recommendations, making sure AI provides decisions that are ethical and moral and being able to explain the decisions made by AI instead of the 'black box' situation[14].

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Key Use Cases

Population Health

Population Health Management is concentrated holistic care management to improving health delivery outcomes of a group of people that have a specific disease or share other characteristics *e.g.,* a geographic area.

The global move away from patient fee-for-service to a value-based model, which links care payment to the quality of the care outcome, has made managing population health a focus for health care providers, insurers, and countries as they strive to deliver quality care at a lower cost.

By stratifying patients by risk profile and designing holistic and coordinated care programs for a targeted group of patients, population health management programs improve the outcome of patient care while controlling costs.

Actionable and aggregate data is paramount to population health management. The foundation for 'Population Health Management' is aggregated clinical, financial, social, and demographic data to lead data-driven, holistic, coordinated patient care programs.

Oracle provides a unified scalable data infrastructure that aggregates clinical, hospital, claims, and social determinants data of all types (structured, semi-structured, and unstructured) from disparate data sources. With the integrated data, we also support creation of ML models that stratify patient risks, predict patient readmission risk, and recommend preventative care for patient self-management. With analytical dashboards, care providers can monitor patient cohort trends to evaluate care program effectiveness, identifying areas of treatment overuse and monitor care delivery quality and cost.

Patient Experience

Patient experience encompasses the range of interactions that patients have with a healthcare system, including their health plans, doctors, nurses, and other health care facilities as well as enabling them to schedule appointments, obtain prescriptions, pay a bill, answer questions late at night, *etc*.

As the healthcare delivery ecosystem becomes increasingly competitive and new reimbursement models continue to be adopted, organisations are more focused on the patient experience than ever before. There are many factors that contribute to patient experience but one thing that organisations know is they must capture and analyse this data to move the needle.

Whether the data is captured through surveys of Patient Reported Outcome or Experience Measures[15], online reviews or social media, Oracle provides a singular platform to bring all the disparate data sources together for analysis, reporting, and data science to identify opportunities for improving patient satisfaction.

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Conclusion

The digital revolution in Big Data analytics, AI, and ML is helping providers connect data across different disciplines, across geographies and across lifetimes. As healthcare organisations become agile in adapting to these technologies and moving towards precision health and value-based care, maintaining data integrity, and integrating data insights and information assets into their care delivery model is becoming more critical now than ever.

Today, Oracle Health is developing patient-and provider-centric solutions as rapidly and securely as we have for commercial enterprises in the past. Oracle Health is harnessing Oracle's number one asset - data - to create interoperable, Cloud-native applications across areas like genomics, virtual care, and extending existing capabilities with artificial intelligence and machine learning.

About Oracle Health

Improve patient outcomes and reduce healthcare costs by using your data to better plan, operate your business, support your team members, and develop evidence-based care approaches. You can also better prepare for new healthcare delivery models, such as value-based care, while strengthening compliance across your organisation.

To learn more, see …

> *Oracle for Healthcare*
> *Healthcare Analytics*
> *FHIR: The Tipping Point for the Future of Healthcare*
> *Oracle Healthcare Cloud*
> *Oracle Security, Identity, and Compliance*

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