Microsoft

Breaking down AI:

10 real applications in healthcare

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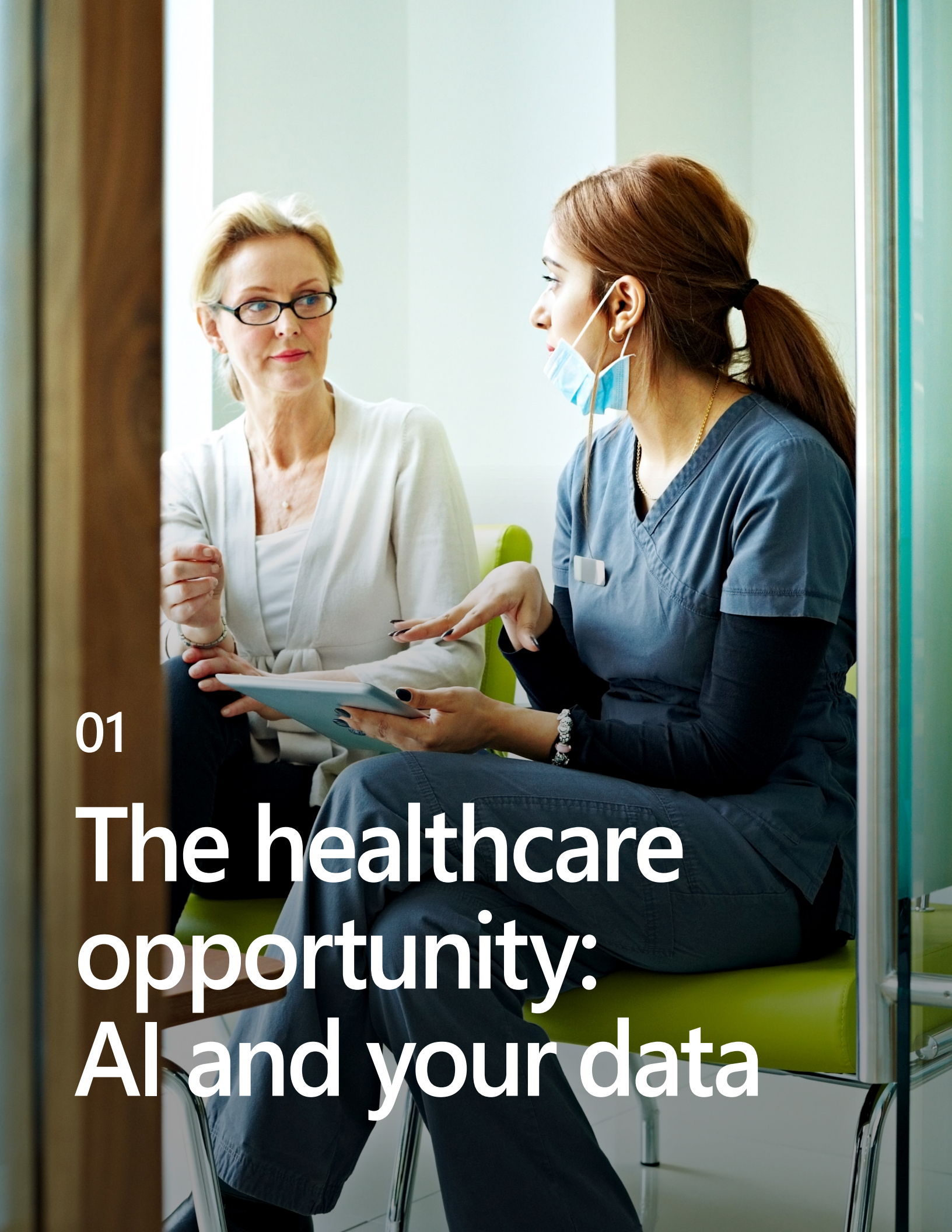


01

The healthcare opportunity: AI and your data

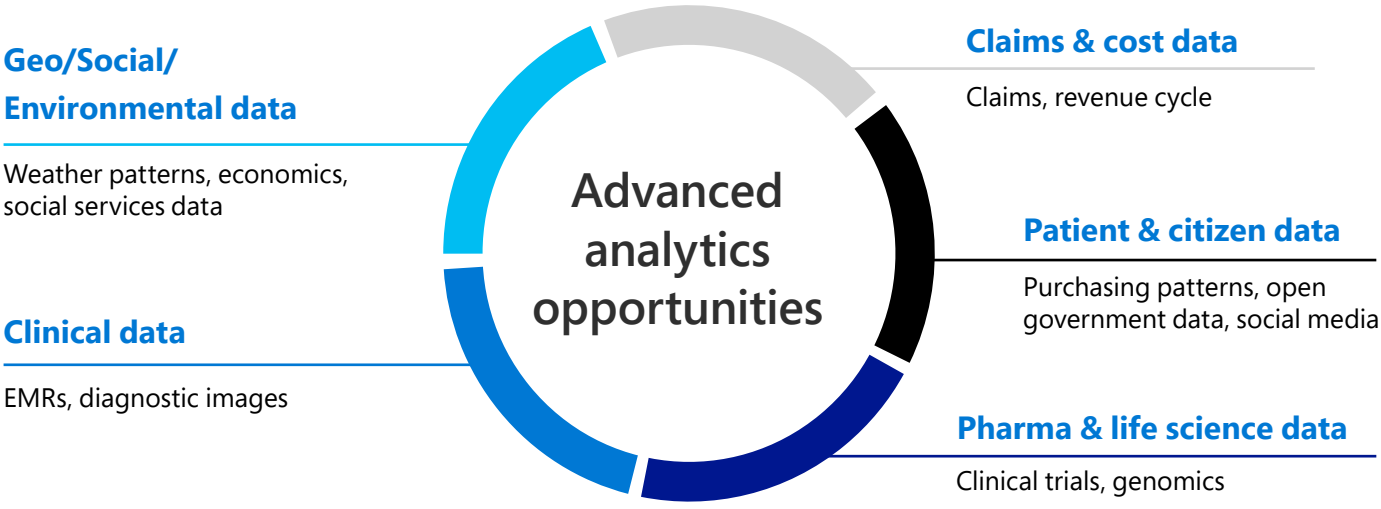
Chapter 01

The healthcare opportunity: AI and your data

Rapid advances in digital technology are redefining the way businesses operate and deliver value. Digital technologies – including artificial intelligence (AI), machine learning and augmented reality, among others – are transforming every industry. They're accelerating innovation, improving decision making, automating and speeding up processes and saving overall costs.

The healthcare industry is no exception. It's being profoundly influenced by this ongoing digital revolution. Health leaders today recognise that innovation requires moving beyond the use of electronic medical records (EMRs) and embracing key principles of digital transformation.

The care that patients receive – and the methods in which hospitals deliver care – has been dramatically transformed with the introduction of advanced technologies and the increasing availability of data. Systems of record like EMRs have laid the foundation for intelligent healthcare. Applying advanced analytics to massive amounts of data from internal and external sources like clinical analytics and environmental systems can help health organisations glean deeper insights. These systems of insight are the next evolution of digital transformation. With better access to the right data at the right time, you can reduce operating costs, improve the quality of care, increase the involvement of consumers in the care process and optimise provider satisfaction.



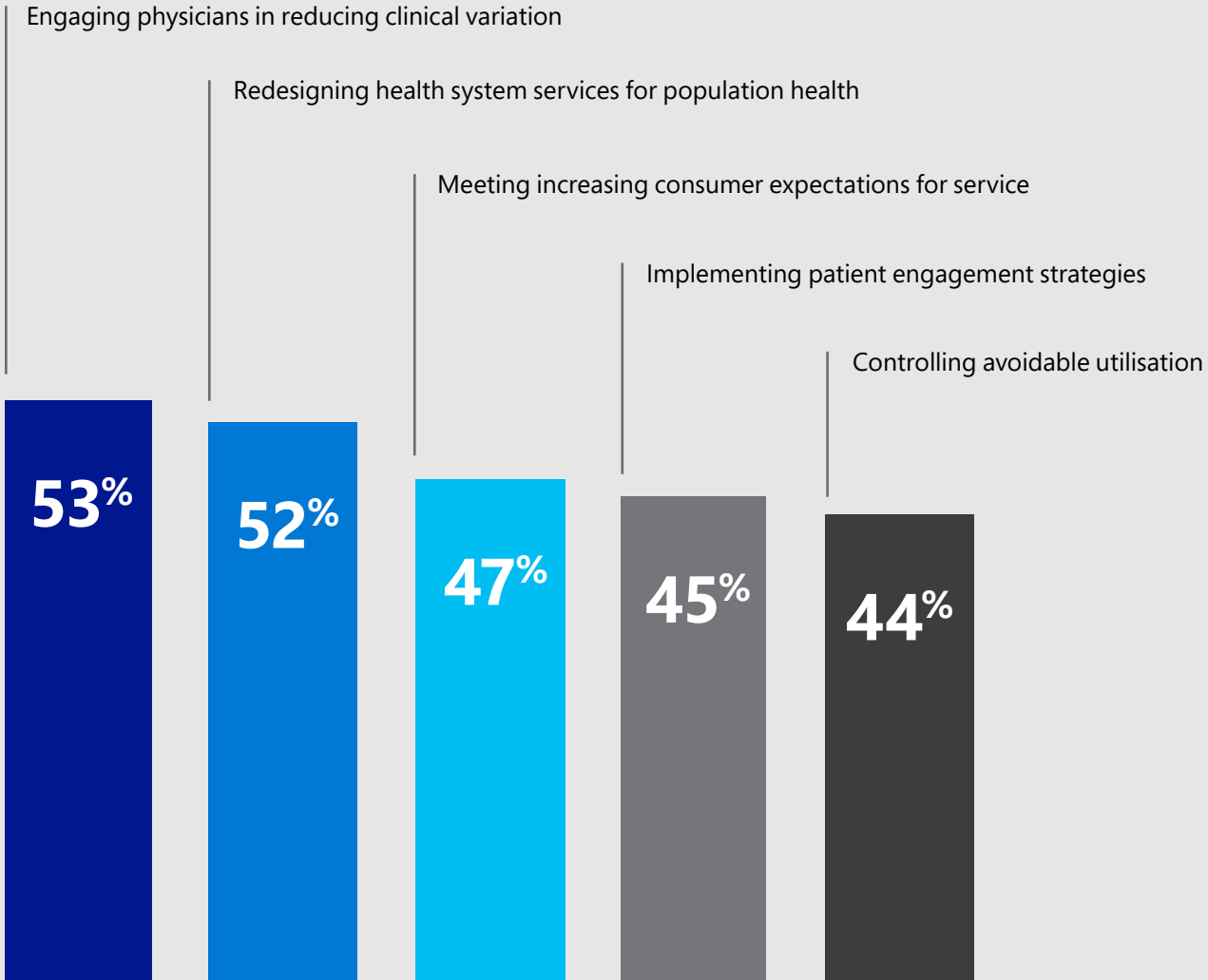
Unstructured data is the information that resides outside of organised databases such as electronic health records and lab reports. If we become capable of tapping the potential of that data, we could make patient care more efficient and cost-effective than ever before."

Source: PWC Report, 2017

A new paradigm for better patient care

AI has been a long-promised saviour for the healthcare industry and many providers are growing sceptical. The reality is that – while the promise of the future is very real – there are practical applications in place now that are already meeting the needs of healthcare executives.

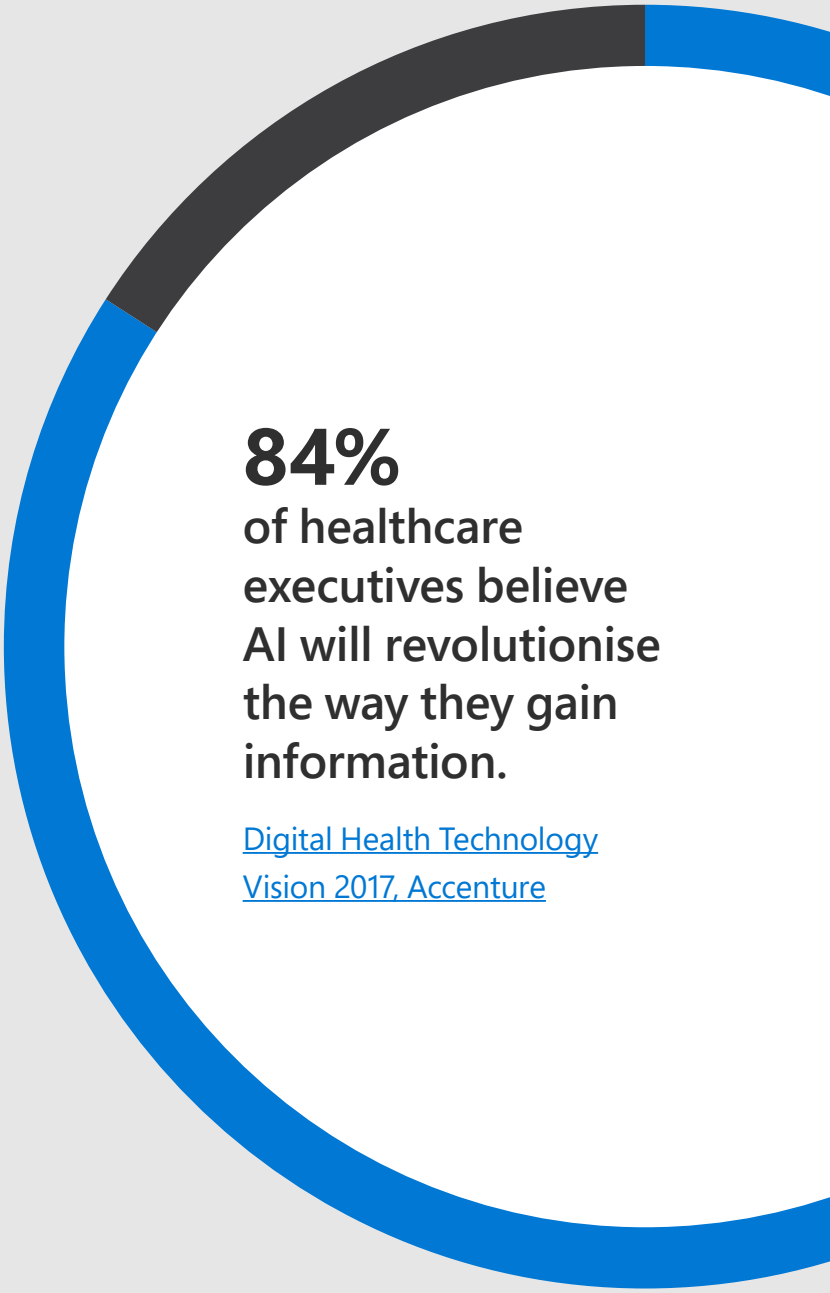
According to the Advisory Board Company's Annual Health Care CEO Survey, top areas of concern for hospital and health system executives in 2016 were:



The new paradigm for healthcare is the use of real-time data and artificial intelligence to enable a predictive and prescriptive analytical approach. You might wonder what that means. In practical terms, it means that AI is providing the capability to sense the healthcare world, comprehend, act and learn. AI uses machine learning and delivers capabilities to mimic human types of behaviour and performance – to ultimately improve patient care and outcomes. AI systems gather and crunch massive amounts of data in real time to identify patterns. They then use that information to automate and streamline healthcare processes. Here are a few examples of what these systems can do:

- Predict the future condition of individual patients based on early warning signs.
- Determine best practices in operations management by comparing data from multiple facilities.
- Recommend medications based on the successful treatment of similar patients.
- Detect and prevent fraudulent claims or other abuses.

Healthcare leaders can take advantage of AI tools to empower care teams, engage patients, optimise clinical and operational effectiveness and ultimately transform health.



84%

of healthcare executives believe AI will revolutionise the way they gain information.

Digital Health Technology Vision 2017, Accenture

02

How does AI lead to better care?

Chapter 02

How does AI lead to better care?

It's important to enable AI for everyone in the care process and understand the significant opportunities that exist for everyone. Transformation based on data and AI is delivering clinical and operational analytics solutions that can improve the quality of care for patients throughout their care experiences. Let's see how:

Clinical analytics focuses on the use of data and analytics to improve clinical treatment processes and outcomes.

For example: Clinicians can pull insights from data to help identify at-risk patients and deliver optimal treatments. Sophisticated analytics engines enhanced through machine learning and AI can provide evidence that can inform actions.

Operational analytics focuses on the use of data and analytics to improve the efficiency or effectiveness of systems used to provide and manage care processes.

For example: By using AI, healthcare teams can predict operational issues and track safety metrics, monitor equipment health, maintain the integrity of the supply chain and identify fraud.

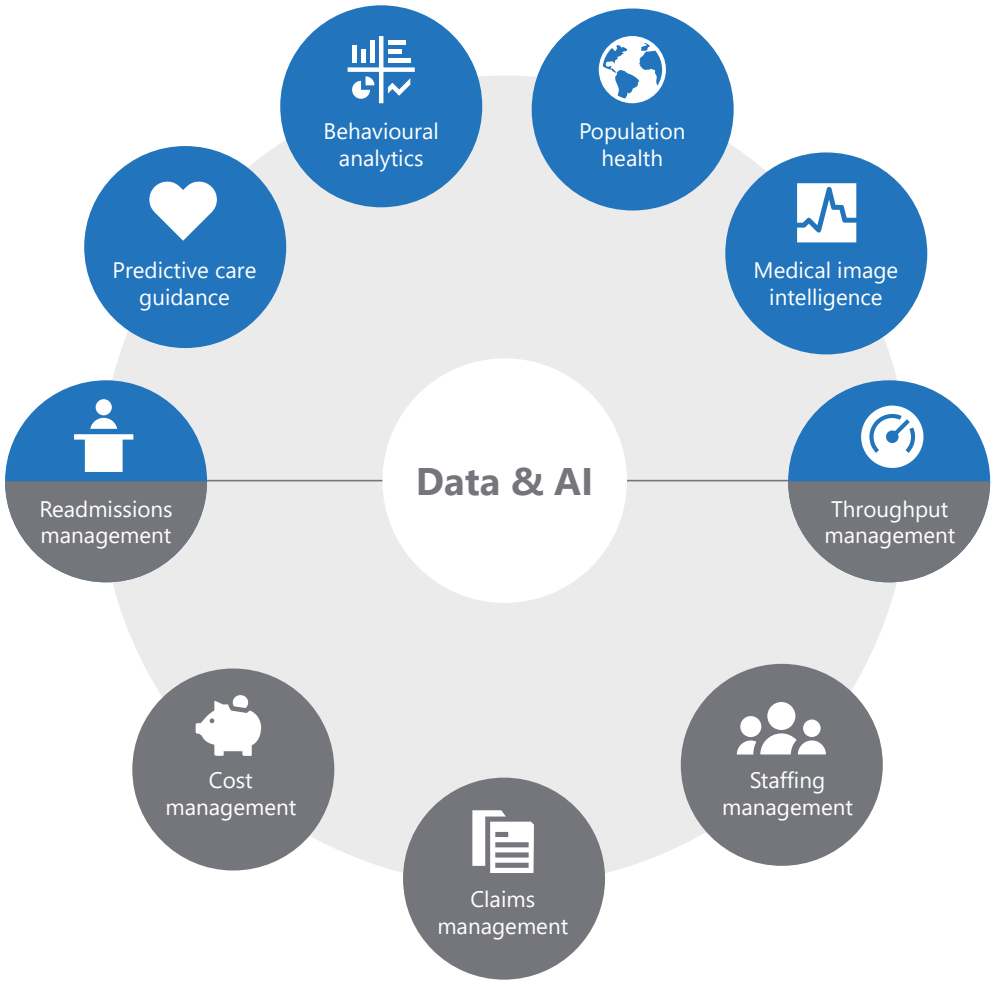
Following are some scenarios in which AI is already delivering value. They exemplify opportunities to improve both clinical quality and operational effectiveness in healthcare organisations.

Clinical analytics

Transform data into prescriptive insights.

Operational analytics

Gain actionable insights to optimise performance.



03

Clinical analytics in healthcare

Predictive care guidance

Start with these questions

Do you use analytical systems that help clinicians predict the effectiveness of treatments?

If so, in what areas are you applying predictive care guidance?

If not, are there areas within the provision of care in which you would find such systems especially useful?

Key benefits

For providers

Clinical pathway prediction

Drug effectiveness

Disease progression prediction

For payers

Health risk prediction

Predictive risk scoring

What is predictive care guidance?

Predictive care guidance uses analytical solutions to search through large amounts of data from sources like EMRs, smart medical devices, patient and population demographics and the public domain to find hidden patterns and trends and predict outcomes for individual patients. Most predictive care guidance relies on AI learning models that become more precise when additional data and cases are introduced.

Predictive analytics is a data-driven crystal ball taking analytics to the next level, beyond descriptive or diagnostic methods that look backwards on what happened and why.

How can it help your organisation?

Predictive care guidance enables clinicians to determine the likelihood of disease and helps with determining diagnoses and predicting future wellness or illness. Predictive guidance can improve the quality of healthcare and reduce the costs of care. It provides clinicians with answers they're seeking for individual patients, with a focus on increasing the accuracy of diagnoses.

Here are some outcomes of using analytical models that connect symptoms to treatments:

For providers:

Clinical pathway prediction. Assess and predict which treatment option will likely produce the best outcome for a patient.

Drug effectiveness. Predict which drug will produce the best outcome for a patient.

Disease progression prediction. Predict the likely path and progression of a disease.

For payers:

Health risk prediction. Predict the likelihood that a patient presenting a certain set of symptoms is at risk for an adverse health event.

Predictive risk scoring. Assess which patients might be at risk for readmissions and hospital-acquired infections.

Predictive care guidance in action

A new artificial intelligence tool launched by Ochsner Health System **analyses thousands of data points to predict which patients will deteriorate in the near future.** Built with a machine learning platform, the tool triggers alerts to prompt Ochsner's care teams to intervene and proactively treat patients and prevent emergency situations.

During a 90-day pilot with the tool, Ochsner was able to **reduce the hospital's typical number of codes (cardiac or respiratory arrests) by 44%.** In addition to sending pre-code alerts, this predictive model is capable of predicting any patient deterioration that needs attention, based on lab values, vital signs and other data.

Watch the video to learn more about how Ochsner prevents cardiac arrests by using AI.

Behavioural analytics

Start with these questions

How well do your care providers and care recipients conform to recommended care protocols?

Does your organisation use value-based payment systems, in which quality or outcome measures affect your reimbursements?

Key benefits

For providers

Patient engagement

Readmissions

For payers

Individual health and well-being

What is behavioural analytics?

Behavioural analytics is a term used in marketing to describe the analysis of consumer behaviour patterns that informs how to market or deliver an action in a way that increases the odds of adoption.

While clinical analytics can recommend a clinical action, applying behavioural analytics increases the likelihood of the action being taken. This is sometimes called *nudging* the patient or care provider.

Other industries use behavioural analytics to suggest add-on sales or display content based on previous usage patterns. This is how Netflix recommends movies that a customer might like. The method of deriving suggestions is particularly important in healthcare, because suggestions will be put off or ignored if they're not easy to implement.

How can it help your organisation?

Incomplete application of evidence-based medicine is a leading cause of poor outcomes and increased overall cost of care. Behavioural analytics can increase the adoption of recommended practices.

Here are some benefits of behavioural analytics:

For providers:

Patient engagement. Engage patients and care providers to ensure conformance and increase the likelihood of the best possible care.

Readmissions. Reduce readmissions and even prevent initial admissions through proactive targeting.

For payers:

Individual health and well-being. Improve health awareness and preventive care choices in patients.

Behavioural analytics in action

Behavioural analytics can drive nudge platforms, like one from Azure partner NextHealth that **delivers recommendations to health plans to increase member conformance.** It enables increased patient engagement and risk identification—to ultimately **improve health and cost outcomes** — by using an analytics platform and personalised data to provide optimised recommendations.

Population health

Start with these questions

Which of your patient populations consume the most resources?

Is your organisation using value-based payment systems, in which quality or outcome measures affect your reimbursements?

Key benefits

For providers

Integrated care

Specialty care

Patient engagement

For payers

Cost management

Self-care management

What is population health?

The term *population health*, which is widely used in the healthcare world, covers a variety of topics.

Population health strives to influence the delivery of care to a group of individuals that have similar healthcare needs, as opposed to focusing on evaluating and treating medical conditions one patient at a time.

How can it help your organisation?

Payment systems are moving from a fee-for-service business model to one that incorporates value into the payment equation. Meeting payer requirements during this transition requires greater use of data and analytics, including better data on patient-reported outcomes, social determinants of health, patient and member risk stratification and activity-based costing.

Here are some benefits of implementing population health:

For providers:

Integrated care. Implement integrated care – coordinated treatment across care team members, including clinicians, social workers, physical therapists and behavioural health care professionals. Analytics can help identify and measure the effectiveness of care across all care settings.

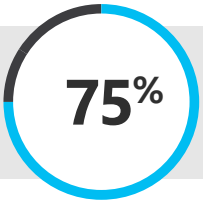
Specialty care. Use data to determine the best ways to manage health needs and outcomes for entire populations of people suffering from chronic conditions.

Patient engagement. Empower patients to more effectively manage their own health and participate in the decision-making process to improve outcomes.

For payers:

Self-care management. Use patient data to improve patients' understanding of their role in their wellness, help them stay healthier and reduce the cost per service.

Cost management. Manage the health of populations by creating better outcomes at an efficient cost.



Patients with chronic conditions consume more than 75% of healthcare spending.

Population health in action

Scientists and physicians at Johns Hopkins Medicine are gathering huge amounts of data from medical care, genomics and wearable devices to **predict disease progression and pinpoint individual treatments.** They're examining individual diseases by looking deeply into their subgroups.

Because patients in the same disease subgroups are likely to have the same biological conditions and show the same response to treatments, researchers can use this information to discover mechanisms that drive specific diseases.

The team is conducting data investigations of patients treated for prostate cancer, multiple sclerosis, cardiac arrhythmias, amyotrophic lateral sclerosis and more – to **improve diagnoses, prevention tactics and cures.**

Watch the video to learn more about how Johns Hopkins Medicine plans to change the face of disease.

Medical image intelligence

Start with these questions

Are you (or your imaging partners) doing anything to embed analytics or intelligence into the medical imaging process?

What type of analytics are you using to evaluate the effectiveness of your imaging systems?

Key benefits

For providers

Diagnosis and treatment optimisation

For payers

Speed and quality

What is medical image intelligence?

Medical image intelligence is the embedding of analytical capabilities into images to augment or improve diagnostic and treatment planning processes.

How can it help your organisation?

Medical images represent one of the largest categories of unstructured data used in healthcare.

Specialists like radiologists, oncologists, ophthalmologists and others are trained to evaluate medical images to assess medical conditions, make diagnoses and deliver treatments based on their reading of these images. Analytics technologies can increase the effectiveness of these efforts.

Here are some benefits of implementing medical image intelligence:

For providers:

Diagnosis and treatment optimisation. Assist specialists in making diagnoses, improve treatment planning and increase the efficiency of these processes.

For payers:

Speed and quality. Improve the quality of image analysis while driving down costs for payers.

Medical image intelligence in action

The Microsoft InnerEye research project uses state-of-the-art artificial intelligence to build innovative image analysis technologies that help doctors treat diseases like cancer in a more targeted and effective way.

InnerEye employs decision forests and deep neural networks to enable medical software providers to deliver tools that radiation oncologists can use in planning radiotherapy treatment. The cloud-based radiomics service is intended to enable the development of third-party products that better assist radiation oncologists and dosimetrists, allowing medical experts to focus on more detailed tasks like editing and refining results.

Learn more by watching the InnerEye video overview.

04

Operational analytics in healthcare

Staffing management

Start with these questions

What percentage of the total cost of running your organisation involves staffing?

How do you determine staffing levels for your nursing units or clinics?

How often do you face overstaffing or understaffing issues?

Key benefits

For providers

Improved staff retention

Staff training

Staffing level assessment

What is staffing management?

Staffing management is the process of modelling and predicting optimal staffing levels based on factors like predicted patient volume and the type and complexity of patients being treated.

How can it help your organisation?

Staffing is the single largest expense of any medical organisation delivering services to patients and consumers. In most hospitals, staffing represents more than half of all total expenses.

Data and AI systems allow healthcare organisations to predict staffing levels with optimal accuracy and efficiency.

Here are some benefits of implementing staffing management:

For providers:

Improved staff retention. Improve retention of hard-to-find specialty clinicians to maintain sustainable teams. Use predictive analytics to understand when an employee is at risk of resigning.

Staff training. Measure the success of training programmes to improve them. Good training is critical in health care because clinician performance has a direct impact on the well-being of patients.

Staffing level assessment. Predict staffing levels and skill sets to optimise them based on the number of patients and the level of acuity of care to be provided.

Staffing management in action

Healthcare Employee Retention is a solution that uses client data to estimate employee flight risk. It includes a predictive model and reporting that identifies which employees might resign based on historical information from previous team members. The solution includes technologies for data exploration, machine learning and results delivery.

Claims management

Start with these questions

What percentage of filed claims are being denied or require rework before being paid? Are you seeing changes in this trend?

What are the top reasons for claims being denied?

Key benefits

For providers

Claims management

Denials and revenue management

For payers

Claims and fraud management

Denial management

What is claims management?

Claims management is the organisation, billing, filing, updating and processing of medical claims related to patient diagnoses, treatments and medications.

How can it help your organisation?

Claims fraud, waste and abuse are significant issues worldwide. They encompasses a wide spectrum of activities, including deceptive billing for services not rendered, performing unnecessary medical services and abusing payment rules by coding services at higher levels than actually performed.

Denied claims represent extraordinary administrative costs to health providers and payers.

Claims analytics helps you efficiently predict patterns and detect anomalies to fight fraud and waste.

Here are some benefits of implementing analytics for claims management:

For providers:

Claims management. Improve the identification, management and collection of patient service revenue.

Denials and revenue management. Reduce the number of denied claims, a primary contributor to bad debt that represents millions in lost net patient revenue every year.

For payers:

Claims and fraud management. Assess the appropriateness of a claim and predict anomalies within the entire claims data universe to prevent fraudulent activities. For payers, claims management is a critical aspect of determining whether to pay or deny claims and of determining the rate of payment for services a health provider bills to the payer.

Denial management. Use analytics to track the number of claims filed by providers that a payer denies. For payers, denied claims create large overhead costs.

Claims management in action

CGI ProperPay is a medical claim analytics solution that helps healthcare payers audit, detect and prevent inaccurate payments of inpatient, outpatient and professional claims. It uses advanced algorithms to detect hidden patterns and anomalies within a payer's complete claims universe to point out which claims should be put on hold or rejected and which paid claims have a high possibility for recovery.

The solution uses perceptual intelligence, machine learning and the cloud.

Learn more about CGI ProperPay by watching this video.

Cost management

Start with these questions

How do your operating costs compare to reimbursements?

What are your top cost drivers?

Do you have systems in place that help you predict costs so you can better manage them?

Key benefits

For providers

Staffing optimisation

Supply cost management

Throughput management

For payers

Fraud detection

Shorter patient stays

Claims denial management

What is cost management?

Cost management is a broad category relevant to all aspects of care delivery. It encompasses evaluation of all major provider and payer systems that determine the eventual cost of providing and paying for health and medical services.

How can it help your organisation?

Most provider and payer organisations today exist on razor thin operating margins. In most countries, the cost of providing and paying for care is rising faster than reimbursements increase.

Health providers and payers are using solutions that improve the management of costs while maintaining the quality of services provided.

Cost management solutions use analytics to evaluate and improve the efficiency of major systems used in providing health and medical services.

Here are some benefits of implementing analytics for cost management:

For providers:

Staffing optimisation. Match staffing requirements – typically the largest single cost – to the current and future mix of patients.

Supply cost management. Evaluate which supplies are most cost effective.

Throughput management. Optimise the flow of patients through facilities – typically the second highest cost – including hospitals, emergency departments, operating theatres and imaging departments.

For payer:

Fraud detection. Spot potentially fraudulent claims, including those miscoded to generate higher payments.

Shorter patient stays. Predict lengths of stay for covered services to estimate and minimise costs.

Claims denial management. Predict which claims will be denied, reducing the number of denials and the cost of managing them.

05

Holistic analytics in healthcare

Readmissions management

Start with these questions

What level of inpatient readmissions rates is your organisation currently experiencing?

Has your current performance with respect to readmissions affected your level of reimbursement?

Do you have a way to proactively assess which patients have the highest risk of readmission?

Key benefits

For providers

Readmittance risk analysis

For payers

Reduced hospital readmissions rate

Reduced emergency department bounce-back rate

What is readmissions management?

A *hospital readmission* occurs when a patient who has been discharged from a hospital is admitted again within a specific time interval. Avoidable readmissions are a strong indicator of a fragmented health care system that too often leaves discharged patients confused, consumes resources that are already stretched thin and produces higher treatment costs.

How can it help your organisation?

Analytics solutions can be used to evaluate and predict which patients are at risk for readmission, so hospitals can create a plan to reduce that risk.

Here are some benefits of implementing readmissions management:

For providers:

Readmittance risk analysis. 'Risk rate' patients before a hospital stay, as they go through treatment and recovery and as part of the discharge process to assess their likelihood of being readmitted following discharge.

For payers:

Reduced hospital readmissions rate. Use analytics to help with reporting readmission rates and penalising providers whose rates are high.

Reduced emergency department bounce-back rate. Reduce bounce back – an inpatient readmission that occurs when a patient seen in an emergency department returns after discharge because the condition doesn't improve after the treatment.

Readmissions management in action

KenSci's risk prediction platform assists health systems in determining population health risk, optimising clinical results and improving operational efficiency.

The platform helps answer these questions:

Who is likely to get sick?

How sick would they get?

How can care be optimised for outcomes and cost?

Sepsis accounts for considerably more hospital readmissions and related costs than any of the other medical conditions tracked by the government. KenSci's solution helps executives reduce the total cost impact of sepsis by identifying patterns and estimating patients who are at high risk. This enables care managers to prevent the responsible condition, readmission and mortality.

Learn more by watching these videos:

KenSci clinical analytics on Microsoft AppSource

Using machine learning and AI to reduce hospital readmissions

Throughput management

Start with these questions

What is the average occupancy of your inpatient facilities?

How often are your facilities at capacity?

Do you ever have issues like long wait times in your emergency department caused by variance in demand for services?

Key benefits

For providers

Hospital bed optimisation

Improved patient satisfaction scores (HACPHS)

Shorter wait times

Improved patient transfer process

What is throughput management?

The process known as *throughput management* includes systems and processes used to manage the cycling of patients through a health organisation's physical facility.

Scenarios include moving an inpatient through the hospital or moving an urgent care or trauma case through the emergency department to either discharge or admission.

How can it help your organisation?

With increasing patient demand and constrained physical resources, optimising throughput is an essential operations management strategy. The use of data and analytics to optimise inpatient throughput enhances patient access, reduces unit cost and improves service levels, leading to measurable value in metrics like reduced wait times, better use of capital and an increased return on assets.

Improving throughput allows more patients to receive care at each facility, reducing the need to add expensive new facilities or beds.

Here are some benefits of implementing throughput management:

For providers:

Hospital bed optimisation. Determine/predict the flow and progression of inpatients through a system, thereby maximising use of patient rooms and facilities.

Improved patient satisfaction scores (HACPHS). Correlate outcomes and experience data to patient journey paths. Identify reengineering opportunities by observing correlations and other data.

Shorter wait times. Predict and manage variables like staffing to improve efficiencies in care delivery in emergency departments.

Improved patient transfer process. Help staff spot and resolve bottlenecks in patient transfers within a facility (for example, a patient waiting to be admitted to intensive care, where a bed is available, but not yet cleaned).

Throughout management in action

Inefficiencies leading to patient overcrowding in the emergency department can impede patient throughput. Nursing informatics and prediction can play an important role in improving emergency departments and staffing. Evergreen Health is using predictive analytics in its emergency department to align its staff with patient demand. Obtaining actionable data from patient in-flows helps Evergreen optimise staffing, reduce patient wait times and ensure that patients receive the care they need when they need it.

KenSci has also developed predictive machine learning models that use data analytics. Actionable insights from KenSci's predictive analytics tools empower:

- Nursing leadership and staffing management to facilitate appropriate staffing and maintain nurse-patient ratios.
- Nurses to spend more time with patients and deliver high quality care.
- Administrators to improve the emergency department environment and to reduce both burnout and turnover.

Learn more by watching this video on how predictive analytics is helping nurses manage patient throughput.

06

Keeping up with the digital revolution

Because of bulk record keeping and strict regulatory requirements, healthcare is a data-intensive industry. AI and machine learning are helping healthcare providers and payers extract the real-time information necessary to make effective clinical and operational decisions. Improving the quality of care, identifying at-risk patients, engaging patients at all levels with personalised care and reducing overhead costs are some of the areas in which AI and data have had the greatest impact.

The digital transformation revolution is deeply embedded into the improvement of nearly every aspect of the healthcare industry and the trajectory extends forward, limited only by the time it takes to think up, develop and implement new models.

To keep up with the latest uses of AI, visit Microsoft Health.