IMPROVING PATIENT OUTCOMES AND REDUCING HEALTHCARE COSTS USING AZURE SERVICES
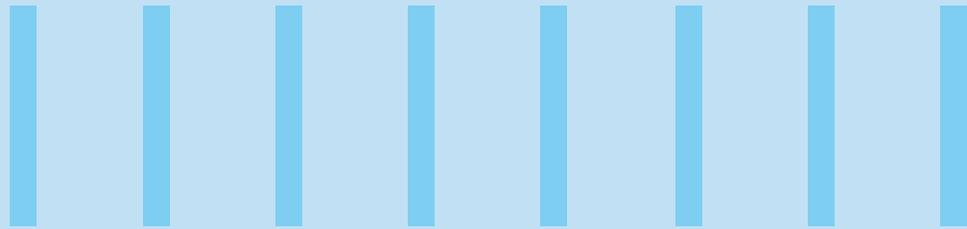
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Introduction to Healthcare

"COVID-19 has accelerated numerous existing and/or emerging healthcare trends, particularly around health equity and environmental and sustainability. Additionally, shifting consumer preferences and behavior, the integration of life sciences and the healthcare sector, rapidly evolving digital health technologies, new talent and care delivery models, and clinical innovation continue to be top of mind for healthcare executives globally. How they respond to these challenges while continuing to address the pandemic will be critically important in 2022."

- Stephanie Allen, Global Public Health & Social Services Leader

The global healthcare market was valued USD 10.3 Trillion in 2021, and it is expected to reach at USD 21.06 Trillion by 2030 with a CAGR of 8.30%. After Covid-19 expenditure on healthcare across the globe has increased extensively. The rapidly growing economy, technology advancements, changes in lifestyle, enhanced ability to survive, and standard of living can add to the growth of healthcare services. Apart from these factors, the healthcare industry is also backed up by government initiatives such as the Inflation Reduction Act 2022. Despite backing up by the government and increasing digitization, this industry still faces challenges i.e., not understanding customer's needs, lack of strategy for addressing health inequity, costs, and many more.

Azure (Microsoft Cloud) is one of the tools which can help healthcare organizations to fulfill their goals. Clinical data insights by Azure, helps healthcare institute to build a more patient-centric strategy. Azure also provides advanced analytics capabilities with the usage of machine learning and artificial intelligence, which can analyze the vast amount of data generated by healthcare organizations. For healthcare organizations to collaborate with healthcare providers, researchers, and patients. Azure provides collaboration tools that allow healthcare organizations and other providers to work together efficiently and effectively.
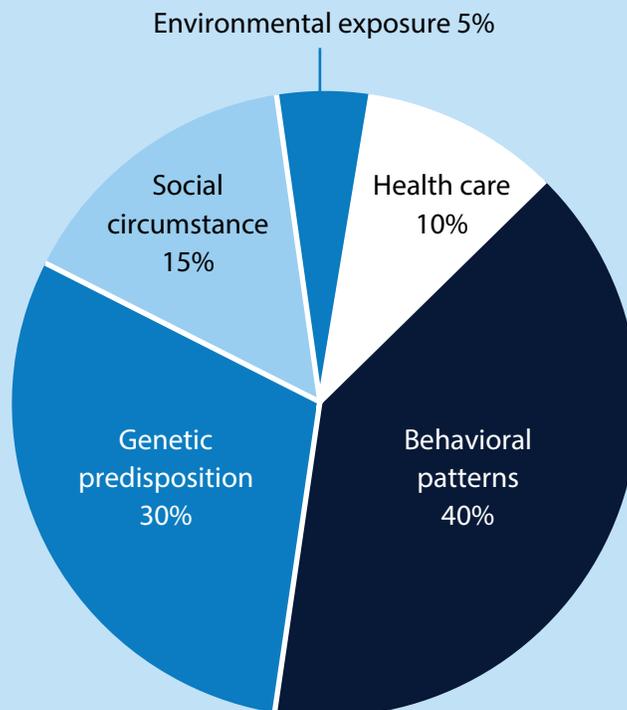
Determinants of health and their contribution to premature death

Challenges

According to the American nonprofit media organization NPR, many patients undergo multiple tests unnecessarily. Not only this, but women also get annual cervical cancer testing, which is recommended for every 3-5 years. According to an investigation done by the Washington Health Alliance, an American organization, the insurance claimed by 1.3 million patients in Washington State who received any of the 47 tests or services that medical professionals have identified as unnecessary. It was found that in a single year:

- 600,000 patients received unnecessary treatment, costing $282 million.

- One-third of the money spent on 47 tests or services was for unnecessary care.

- Additionally, $40 million was spent on heart tests of low-risk patients.

- Around 85% of lab tests were unnecessary, costing around $86 million[5].

Apart from that, technological advancements are also one of the major contributors for increasing healthcare costs. It is reported that around 40%-50% of the increase in healthcare costs is due to technological advancements3. the mechanisms by which new medical technology affects healthcare costs:

- Scientists are developing new treatments for terminal illnesses that were once thought to be incurable, such as diabetes, kidney failure, and AIDS.

- The advancement of novel techniques for finding and treating comorbidities within a particular illness, for instance, the use of erythropoietin to manage anemia in individuals undergoing dialysis.

- The broadening of the applications of treatment over time, thereby extending the number of patients who can receive help from it.

- Advancement in clinical practice, either through significant breakthroughs or through the combined effect of gradual enhancements, broadens the horizons of medicine to encompass disorders that were previously considered outside its realm, such as mental health conditions and substance misuse.

Additionally, the growing population and people living longer also contributes to healthcare costs. It is expected that growth and aging contribute significantly to the increased healthcare spending, accounting for 23% and 12%, respectively[13].

The complex multi-payor framework is additionally one of the most compelling motivations for expanding medical service costs. In this framework, medical care costs are supported by various payors. With countless partners included, medical care organizations turn into a muddled, wasteful cycle. These failures add to the overabundance of regulatory spending. The primary contributor to excessive administrative spending in healthcare is the cost of **billing and insurance-related (BIR) activities**. These activities pertain to the overhead expenses associated with medical billing, which include tasks such as claims submission, reconciliation, and payment processing. The bulk of BIR costs are attributed to insurance company profits. Medical care suppliers likewise get a portion of the managerial expenses for errands, for example, note-taking and record-continuing during the clinical charging process.

How Azure Enables Cost Effective Healthcare Services

Azure offers machine learning tools that analyze patient data to predict which tests or procedures are necessary for a particular patient. Azure also provides clinical decision support tools that help healthcare providers make more informed decisions about which tests to order. These tools can analyze patient data and suggest appropriate tests based on the patient's symptoms and medical history. Moreover, Azure can provide secure and centralized EHRs that allow healthcare providers to access patient data quickly and easily. This can help reduce the likelihood of unnecessary tests being ordered because providers have all the necessary information in one place.

Apart from that, Azure provides hybrid cloud solutions that allow businesses to combine on-premises and cloud-based infrastructure, providing greater flexibility and reducing costs related to managing and maintaining hardware and software. Azure also provides automation tools that can help businesses streamline their operations and reduce costs related to manual processes. With the help of automation, businesses can reduce resources and the need for manual interference, which can result in a cost reduction. In addition to that, Azure also provides data analytics tools that can help businesses optimize their operations, reduce waste, and identify areas where costs can be reduced. By analyzing data related to processes, performance, and usage, businesses can identify opportunities to streamline their operations and reduce costs.

Although Azure cannot be directly used to reduce the aging population issue, it can be used to develop and deploy innovative solutions that can help reduce the burden of an aging population on healthcare systems and other social services. Azure can be used to build remote monitoring and telehealth solutions that allow healthcare providers to remotely monitor the health of elderly patients and provide timely interventions. This can help reduce the need for hospitalizations and emergency room visits, which can be costly. Azure also provides machine learning and predictive analytics tools, which can help healthcare organizations analyze large sets of data to understand patterns and trends. This can help healthcare providers to identify high-risk patients and intervene early to prevent costly health issues.

Azure can be used to develop smart home solutions that can help elderly patients live independently for longer periods. These solutions can include sensors that detect falls or other emergencies and alert caregivers or emergency services.

Use Cases

The Major use cases of Azure for healthcare services are:

Clinical analytics: Clinical analytics, together with text analytics that utilizes natural language processing, predictive analytics solutions, and patient dashboards, enable the consolidation of patient data that is dispersed across various locations. By doing so, clinical trends can be identified to enhance patient care. For instance, automated diagnostic workflows enable radiologists to prioritize critical tasks, facilitate real-time sharing of reports and images, and allow seamless communication with other departments to improve work practices and deliver timely care.

Moreover, payers can also save a large amount of money with the help of clinical analytics. Payer respondents are examining information from diverse sources, such as laboratory data, pharmacy data, and claims data. By enhancing care coordination through health insurance exchanges and other methods of data sharing, payers can obtain valuable insights to create preventive and wellness guidelines. Additionally, it allows them to pinpoint and eliminate areas prone to fraud, waste, and abuse.

Automated Patient Management: Elective strategies in open emergency clinics in Australia have altogether diminished on account of the Coronavirus pestilence, as per information from the Australian Foundation of Wellbeing and Government Assistance. Healthcare professionals are straining to make up for the backlog of ordinary medical care because the pandemic diverts healthcare resources. Clinician burnout has also become a concern, with many healthcare workers feeling overworked, underappreciated, and frustrated. This situation has been exacerbated by the pandemic, and there are fears that the negative implications on the overall population's health may continue for years to come.

Microsoft has made HIPAA-consistent stages and innovations that might upgrade information ingestion, dissect information utilizing simulated intelligence and AI, help information coordination, and deal with apparatuses for information perception. FHIR-agreeable information might move effectively among Microsoft and outsider advances and frameworks because of the Microsoft Cloud for Medical Care.

The Cleveland Facility is one association that has incorporated these arrangements, involving Microsoft Cloud for Medical Care to find qualified patients and book arrangements for routine malignant growth screenings and vaccination visits. This technology-driven initiative led to much higher rates of appointments that were made and operations that were finished, potentially saving lives. These ideas are meant to assist healthcare practitioners in getting back on track and

lessen the pandemic's detrimental effects on standard medical care and public health in general.

Future Innovation: Life sciences organizations study the human genome to learn about our genes, their function, evolution, and how they interact with each other and the environment. This research helps us understand the factors that affect our genetic makeup, including disease. By studying the extracted data, research organizations can understand how genes can be vital when it comes to the succession of illnesses and the damage to the human body done by the illness. This, in turn, enables researchers to develop cures for various conditions.

Microsoft Genomics enhances open-source scientific workflow management systems, such as Cromwell, by leveraging the high-performance computing capabilities of Azure for genomics research. It utilizes open standards on Azure to facilitate data analytics and gain insights from genomics data. By using Azure Batch and Azure Data Storage, Cromwell on Azure can dynamically provision computing resources and storage. Additionally, the Microsoft Genomics Notebooks open-source project provides a set of pre-configured notebooks that users can easily launch and utilize. Bioconductor on Azure allows for the analysis of high-throughput genomic and biomedical data, featuring a repository of statistical and graphical software packages. The Genomics Data Science VM comes with pre-configured tools for data exploration, analysis, machine learning, and deep learning model development. Finally, the Microsoft Genomics Service is a cloud-based implementation of the Burrows-Wheeler Aligner (BWA) and Genome Analysis Toolkit (GATK) for secondary analysis of genomics data.

Patient Data Security: Microsoft Azure provides cloud security solutions that go above and beyond the necessary security standards for compliance with HIPAA and HITECH Act regulations while also ensuring the protection of sensitive health information. Azure Security Center provides users with valuable insights into their compliance status as well as the visibility and accessibility of their regulatory compliance status. This platform also offer users recommended fixes to address any compliance gaps that may have gone unnoticed. By choosing a native Azure cloud security solution, customers can avoid the costs associated with deploying and maintaining on-premises or third-party cloud solutions. Additionally, Azure facilitates compliance efforts by offering third-party audits and the ability to download compliance documentation. The Azure Security Center can evaluate the organization's cloud security posture and assess whether the technology in use adequately safeguards all protected health information in the environment, meeting technical HIPAA compliance requirements.

In addition, Azure Security Center offers Azure Defender, which safeguards hybrid cloud workloads by scanning for vulnerabilities in container images within the Azure Container Registry. This tool can also protect managed instances of Azure Kubernetes Service, and Azure Arc extends security coverage to workloads outside the Azure environment.

Technologies Offered by Azure

Azure AI and ML: By leveraging AI/ML, healthcare providers can optimize their operations and attain cost savings. It can predict the patient's length of stay, which can streamline operations by facilitating adequate staffing and asset allocation for the duration of the patient's stay without excess. Apart from this, hospitals or other healthcare providers face significant expenses while maintaining their IT data center computing equipment along with the costly IT and cybersecurity resources needed to maintain and secure it. Instead, this capital could be allocated directly to enhance patient care, for example, by investing in new kidney dialysis machines.

Azure IoT: Continuous patient monitoring is a crucial factor in improving patient outcomes, managing chronic diseases, and minimizing re-admissions in the healthcare IoT domain. It can be classified into two categories:

- **In-Patient Monitoring**: Medical wearables and other devices are utilized by care teams to monitor patient vital signs and medical conditions without needing to physically check on the patient several times a day. Notifications can be sent to the care team in case a patient requires immediate attention, allowing for better prioritization of their time.

- **Remote Patient Monitoring**: Medical wearables are used by care teams to monitor patients outside of the hospital, reducing the risk of readmission. Data collected from patients with chronic illnesses and those undergoing rehabilitation can aid in ensuring adherence to care plans as well as alerting care teams to any patient deterioration before it becomes critical.

Apart from that, according to healthcare organizations, IoT can reduce human error, costly downtime, inventory spoilage, cost reduction, minimize carbon footprint, and promote better staff satisfaction, patientexperience, and better outcomes.

Mixed Reality: With the help of HoloLens 2 and mixed reality technology, healthcare professionals can now access patient data, connect with remote experts, and even view Magnetic Resonance Imaging (MRI) images in 3D at the point of care, going beyond traditional X-rays. Healthcare teams can collaborate with Microsoft, and by utilizing Microsoft mixed reality solutions, i.e., Microsoft HoloLens 2, Microsoft Dynamics 365 Remote Assist, and Microsoft Dynamics 365 Guides, healthcare can be more efficient and reduce the time-to-care. According to a commissioned study by Forrester, the Total Economic Impact of Mixed Reality Using Microsoft HoloLens 2 ("HoloLens 2 TEI Study"), healthcare organizations experienced the following benefits:

- Healthcare professionals can now complete ward rounds 30 percent faster, resulting in an average hourly savings of $41.

- The use of mixed reality has also reduced training time by 30 percent, which translates to an average savings of $63 per labor hour.

- Furthermore, the adoption of mixed reality technology has led to a 75 percent reduction in annual PPE costs, resulting in a savings of $954 per employee[1].

The Total Economic Impact of Mixed Reality Using a Microsoft HoloLens 2 Study commissioned by Forrester indicates that the return on investment for HoloLens 2 and mixed reality technology in healthcare is estimated to be 177 percent, with a net present value of $7.6 million over three years. The payback period for this investment is expected to be 13 months.

Azure Cognitive Services: Azure Cognitive Services for Healthcare is a collection of cloud-based Artificial Intelligence (AI) services offered by Microsoft that are specifically designed to address the unique needs of the healthcare industry. These services include prebuilt models and APIs for natural language processing (NLP), computer vision, and decision making. Some examples of Azure Cognitive Services for healthcare include Text Analytics for Healthcare, which helps extract and categorize medical information from unstructured text, and Computer Vision for Healthcare, which uses image analysis to help diagnose and treat medical conditions. Other services include Anomaly Detector, which can detect unusual patterns in healthcare data, and Personalizer, which can help personalize patient experiences based on their needs and preferences.
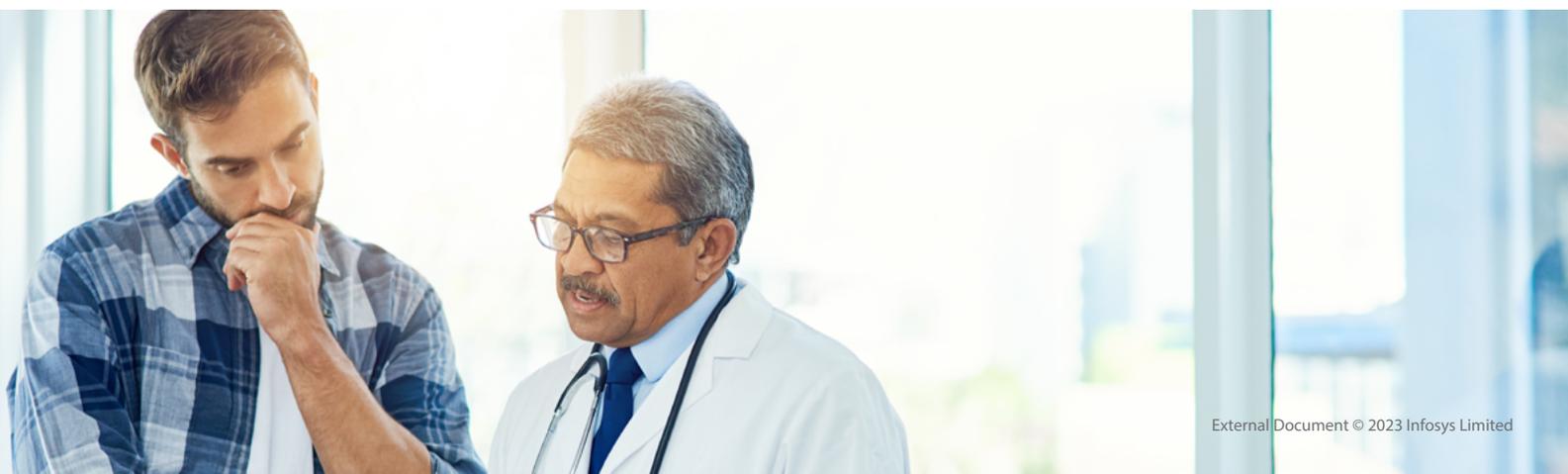
Partner Solutions

Apart from offering their own solutions to healthcare institutions, Microsoft Azure also offers various partner solutions, which consist of:

Allscripts: Allscripts, a prominent healthcare software producer catering to physician practices, hospitals, health plans, and Big Pharma, has recently adopted Microsoft Azure to upgrade and securely host its software applications. Within a short span of three weeks, the company moved multiple purchased applications that were operating on 1,000 virtual machines to Azure, achieving reliability and scalability. Furthermore, Allscripts is leveraging Azure's platform as a service to develop software, enabling significant savings and quicker time-to-market gains. Allscripts aims to address current healthcare challenges, where medical services and needs are no longer restricted to a specific location. Telehealth through mobile options, cloud solutions, and other distance-enabled delivery methods are no longer futuristic goals. Moreover, the providers who have adopted these solutions, like telehealth, are already experiencing early benefits, such as avoiding costs, reducing re-admission rates, and serving a larger number of patients.

Allscripts also have a revenue cycle, which helps in services like:

- Keep pace with complex reimbursement requirements.

- Access RCMS expertise and maintain consistency.

- Better managing reimbursement cycles with access to advanced analytics.

- Resolve inefficient billing workflows and work toward continuous improvement.

Sophia Genetics: Sophia Genetics has partnered with Microsoft Azure to enhance its data display module with AI and machine learning capabilities, enabling scalable data curation. Sophia Genetics' AI and machine learning platform can analyze various types of data, including clinical, biological, genomics, and radiomics, and may eventually incorporate digital pathology, proteomics, and metabolomics. This platform is already being used by hospitals, laboratories, and biopharma institutions worldwide for research purposes.

By using Sophia Genetics' platform on Azure, healthcare providers can easily combine different data types to extract insights within their existing workflows, leading to improved clinical outcomes and more personalized patient care.

KenSci: By utilizing a predictive platform powered by AI, KenSci aids practitioners in making intelligent cost-cutting decisions. This is achieved through the identification of various clinical and financial factors and the analysis of data from diverse sources such as electronic medical records, public records, demographics, claims data, and devices.

KenSci's man-made intelligence stage offers hearty and expandable information that the board includes, giving an ongoing information pipeline reasonable for cutting edge examination use cases. The stage's champion component is its late-restricting concentrate load-change (ELT) capacity, which makes it more straightforward to move information into the KenSci's man-made intelligence stage from different wellbeing information sources, including electronic clinical records (EMR), protection claims, affirmation, release, and move records (HL7 ADT), and information from clinical gadgets. In this way, the information is converted into normal organizations for downstream examinations, like quick medical care interoperability assets (FHIR) and standard information diagrams. Information perception instruments from Microsoft Power BI are integrated to empower the interior examination on top of the information pipeline. Auto-created KPIs, framework-wide measurements, and pre-assembled connectors that easily integrate with Microsoft Power Applications, Microsoft Groups, and fundamental EMRs are accessible to investigation groups, speeding reception. A new examination-based application might be created, and conveyed rapidly, involving the stage surprisingly fast without requiring relentless customization work thanks to its capacities.

Infosys Helix: Infosys Helix is a platform-powered, AI-first, people-centric suite that helps healthcare organizations transform their data into actionable insights. The suite offers three platforms with several modules that solve specific problems in healthcare:

- **Provider Lifecycle Management Platform**: Infosys Helix Provider Lifecycle Management Platform is a cloud-based solution that helps payers manage the entire provider lifecycle, from recruitment to termination. It is a modular platform that can be customized to meet the specific needs of each payer. The platform offers a variety of features that can help payers improve their provider network, including:

  - **Provider recruitment**: The platform can help payers recruit providers that meet their specific needs. It provides a variety of tools for payers to post job openings, screen applicants, and conduct interviews.

  - **Provider credentialing**: It also provides a variety of tools for payers to collect and verify provider information, such as licenses, certifications, and malpractice claims.

  - **Provider contracting**: Payers can also negotiate contracts with providers. Tools like track contract negotiations, manage contract terms, and generate reports help payers to negotiate contracts with providers.

Payer On Cloud Platform: Infosys Helix Payer B2B Platform is a cloud-based solution that helps payers engage with plan sponsors to facilitate buying, managing, and servicing the health of their employees through insightful

and intuitive self-service digital tools to increase satisfaction and retention of plan sponsors. The platform is composed of several modules that can help payers deliver a comprehensive experience for employer groups, including:

- **Plan sponsor engagement**: This module helps payers build relationships with plan sponsors and understand their needs. It provides a variety of tools for plan sponsors to learn about payer offerings, compare plans, and get quotes.

- **Benefit planner**: This module helps plan sponsors design benefit plans that meet the needs of their employees. It provides a variety of tools for plan sponsors to compare plan features, calculate costs, and see how different plan options impact employee take-home pay.

- **Network designer**: This module helps plan sponsors select provider networks that meet the needs of their employees. It provides a variety of tools for plan sponsors to compare networks, see provider ratings, and get quotes from providers.

- **Wellness manager**: This module helps plan sponsors promote wellness programs for their employees. It provides a variety of tools for plan sponsors to track employee health data, create wellness challenges, and provide resources to employees.

Infosys Equinox: It is a digital commerce and marketing platform that helps healthcare organizations create personalized and engaging experiences for patients, providers, and payers. Equinox uses Azure's cloud-based infrastructure to deliver these experiences to any device, anywhere in the world.

Azure Solutions: Transforming the Future of Healthcare

By integrating Azure solutions in the healthcare industry, its security features will help healthcare organizations protect patient data, including network security groups, firewalls, and virtual private networks. Azure will also provide compliance certifications such as HIPAA and HITRUST, which help organizations meet regulatory requirements. Moreover, by using Azure's secure services, healthcare organizations can identify potential health issues before they become severe by analyzing patient data using machine learning tools. This can lead to earlier interventions and better outcomes for patients. Apart from this, healthcare organizations can use data analytics to identify trends and patterns in patient data. This information can help healthcare professionals make more informed decisions about patient care and treatment. Healthcare firms may spot possible health issues before they become serious, thanks to Azure's machine learning features, which can evaluate vast amounts of data.

Conclusion

The rising cost of healthcare services has become a major concern for patients and healthcare organizations around the world. The reasons behind these increasing costs are many, including unnecessary medical tests and procedures, technological advancements, a growing population, and complex multi-payor systems. In this situation, Azure comes to the rescue by leveraging its services that can help eliminate unnecessary tests in healthcare, provide more informed decision-making for healthcare providers, and reduce costs for businesses. Azure's machine learning and clinical decision support tools can analyze patient data and suggest appropriate tests based on symptoms and medical history. Azure's centralized and secure EHRs can help reduce the likelihood of unnecessary tests being ordered by providing all necessary information in one place. Azure's hybrid cloud solutions, automation tools, and data analytics tools can help businesses streamline their operations, reduce waste, and identify areas where costs can be reduced. Clinical analytics and telemedicine solutions enabled by Azure can revolutionize the way patients interact with healthcare providers and enable remote examinations, reducing the need for physical visits. Electronic health records (EHR) solutions and FHIR standardization can simplify the management and sharing of health data while ensuring its security. Furthermore, Azure can help payers reduce costs and identify fraud and abuse, providing better value for patients and insurance providers. Overall, Microsoft Azure can help the healthcare industry become more efficient and effective while delivering better patient outcomes.

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Authors

Ritu Kumari Singh
Senior Associate Consultant, Infosys Center for Emerging Technology Solutions (iCETS)

Chandan Malu
Principal Technology Architect, Infosys Center for Emerging Technology Solutions (iCETS)

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For more information, contact askus@infosys.com