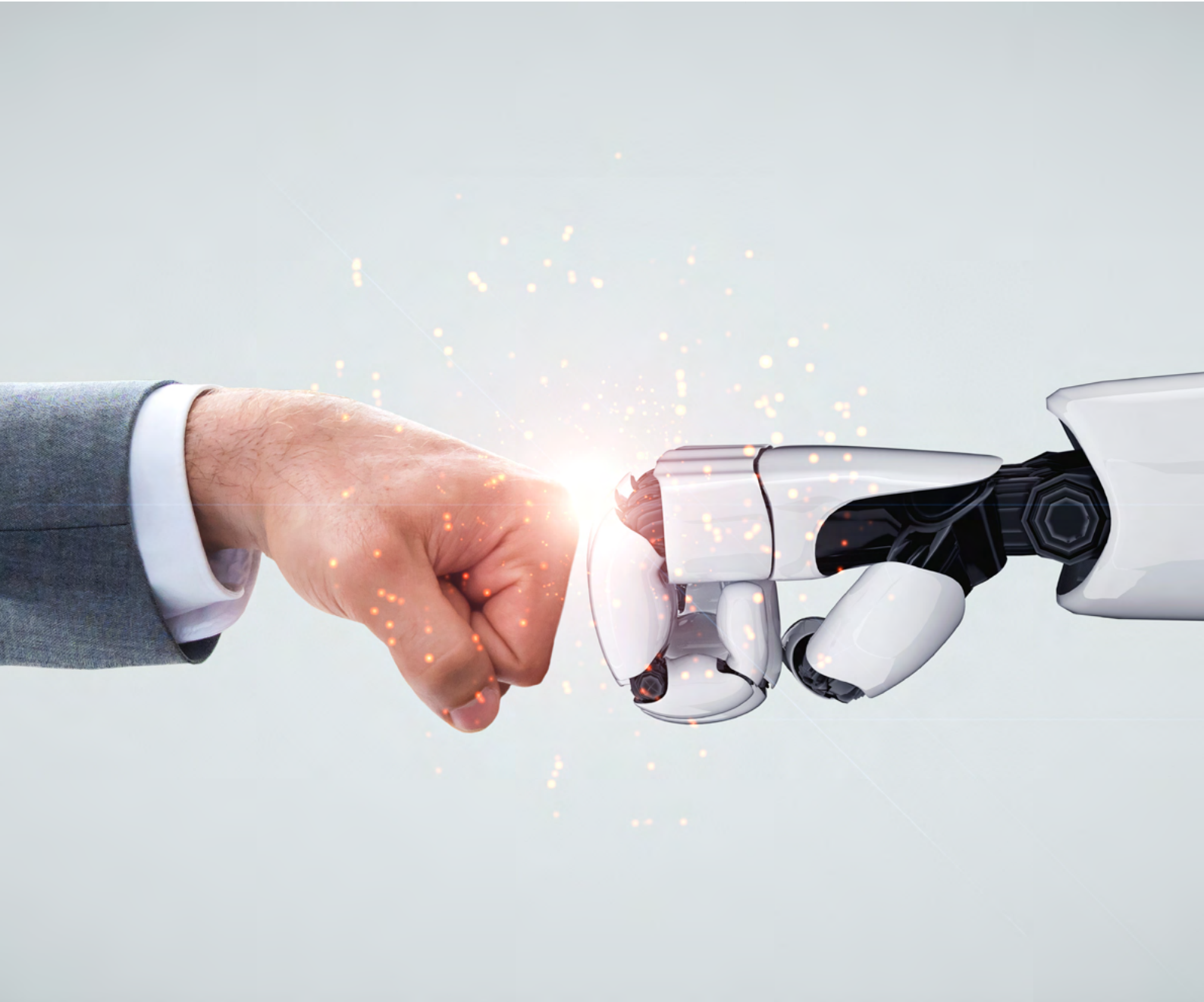


Together for a healthier world



## The Future of Medicine: **AI's Journey in Healthcare**

Industry updates brought to you by Omnia Health Insights

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# Introduction

For the field of healthcare, AI is bringing a paradigm shift, powered by the increasing availability of healthcare data and rapid progress of analytics techniques. In this exclusive eBook, Omnia Health Insights and its contributors share key insights into AI navigating its ground-breaking, seamless technology and presents educational presentations to redefine healthcare as we know it.

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## Chapter 1

### Technology-driven convergence in the life sciences industry

**T**echnology-driven innovations are dramatically altering the way modern life sciences operate, enabling a paradigm shift from treating diseases and their symptoms to preventing and curing them.

The UK-based Galleri trial uses Artificial Intelligence (AI) based algorithms to analyse blood samples. This enables the early detection of 50 types of cancers. Examples like this are many, and they make it increasingly clear that it is time for biopharma and medtech to transition. In other words, embrace modern technologies such as artificial intelligence, machine learning, and advanced statistical analyses to remain competitive.

We explore five tangible ways the life sciences industry can move toward technology-driven convergence.

#### Use AI and ML to develop new drugs and treatments

In early 2020, Exscientia's AI-designed drug entered clinical trials for the first time. Since then, more than 160 AI-enabled drug discovery programmes have been under development. Fifteen of them have already reached the clinical development stage.

Such trials highlight the growing importance of *in silico* (an experiment conducted via computer simulation) drug development, which uses AI and machine learning (ML) models to discover new and effective medicines to treat conditions efficiently.

In the future, companies operating within life sciences can use these AI and ML technologies to identify structurally novel molecules and effectively develop new treatments and drugs.

#### Leverage technology-enabled mental healthcare

A recent article by the Cambridge University Press describes just how promising digital CBT is. In that vein, companies



operating in mental health can leverage gamification and digital simulation to deliver effective intervention programmes.

Digital therapeutics are becoming exceedingly popular in discovering new treatment paradigms in mental health, addictions, and neurological conditions. For instance, insomnia and other disorders have been successfully treated with the help of digitally administered cognitive behaviour therapy.

#### Adopt a customised approach toward treatments

Healthcare companies can also customise their treatments better with the help of genetic profile archetypes and genetic sequencing. Statistical models and predictive analysis can customise treatment approaches for everyone, enabling exact intervention techniques.

Life sciences companies can use these predictive and prescriptive technologies to make educated decisions regarding treatment options instead of relying on pharmaceutical treatments that have depended on extensive patient cohort studies.

## Use AI-enabled decision making

Making treatment-related decisions and triaging can become more accessible with AI-enabled decision-making. AI algorithms can predict the best treatment outcomes and aid in clinical decision-making. Possible outcomes include:

- Detecting how responsive a tumour will be to a specific treatment.
- Pre-emptively identify potential infections in at-risk populations.
- Reduce the cost of treatment by choosing the most effective and affordable approach.

## Focus on early detection and prevention

The COVID-19 pandemic has brought to light the importance of using technology to deliver telemedicine and remote monitoring of patients. By the end of June 2020, 41 per cent of adults had delayed medical care because of concerns related to COVID-19. The human cost could be staggering if one accounts for all the delays and treatment avoidance due to the pandemic over the last few years.

AI and ML-enabled devices can help with the monitoring and early detection of infections so that mortalities can be prevented by adequately monitoring patients remotely.

## AI and ML will breathe new life into life sciences

Life sciences and medical industries have primarily depended on extensive cohort studies involving diverse patients. However, this approach has its limits.

Treatments cannot be customised, and practitioners cannot give adequate medical attention remotely. Thus, the convergence and adaptation of technologies such as AI, ML, and genomic sequencing are necessary for the future.

Such an adaptation will help companies discover new drugs, treatments, and therapeutic approaches and remain competitive. In addition, these advanced technologies will play a crucial role in the early detection and prevention of diseases rather than treating them at a later stage. In the future, we expect them to enhance the remote delivery of interventions as well.



# Chapter 2

## Experience the next generation of healthcare

The Healthcare Transformation Zone at Arab Health evolves every year to bring forth the latest cutting-edge technology in healthcare. This year, it welcomed the Intelligent Health Pavilion, which is redefining the care continuum with revolutionary technology and equipment that enable seamless digital integration.

“There is a lot of technology in healthcare and the problem is that a lot of the executives in the hospital and clinicians simply do not have enough time to understand it. It is important that they are given opportunities to learn and adopt this technology so that we can save lives,” said Harry Pappas, Founder and CEO of the Intelligent Health Association.

The Association is armed with a mission to provide unbiased information to give healthcare professionals an all-inclusive, global platform of knowledge and inspiration to stay in tune with evolving trends. In addition, it aims to optimise processes — both from a clinical and business perspective — leading up to efficiency in workflows and enhanced patient outcomes.

Referring to the opportunities at the Intelligent Health Pavilion, Pappas added: “We must note the existence of technologies that could further reduce the cost of healthcare, improve the delivery of care and enhance patient safety. It also gives accountability and helps eliminate errors, so that we can reduce risks. With technology, we are further able to improve the patient experience, which includes reduced hospital stays and readmissions.”

The Intelligent Health Pavilion featured the latest digital innovations and future-ready solutions presented by organisations from various sectors of the healthcare industry across the globe, giving medical professionals and investors an interactive playground to network and discover new-age treatments. Dubbed a ‘show within a show’, the pavilion also introduced visitors to live simulations in an emergency department, intensive care unit and operating theatre, where each enclosed space offered attendees an intimate audio-visual representation of live cases.

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The leadership theatre, on the other hand, welcomed attendees to thought-provoking concepts led by seasoned experts in various fields. Each session also shone a light on the latest trends, addressed challenges, proposed solutions and demonstrated case studies of digihealth integration and solutions alongside success stories.

“We understand that different hospitals have different needs. We are very passionate about education and ensured that each session delivers real information and steer clear of brand and product promotions.



## Chapter 3

### Ejadah enhances healthcare management with AI

Dubai Health Authority highlighted during Arab Health 2023 that it will introduce a value-based healthcare model across 30 disease areas for the emirate by 2025.

The model known as EJADAH, which means proficiency in Arabic, was launched in June 2022 and it is a value-based model rather than a volume-based healthcare model. DHA's Dubai Health Insurance Corporation, which regulates the health insurance sector in Dubai, is overseeing the implementation of EJADAH.

The model uses AI technology for predictive healthcare analysis for early intervention, disease prevention and to prevent complications caused by the disease.

The AI technology will be initially used for two diseases: diabetes and asthma. The model will also include patient-reported outcome measures (PROMs) to assess the outcome of care from the patient's perspective.

Saleh Al Hashimi, CEO of Dubai Health Insurance Corporation said: "The model will create a transformational shift in the health sector as providers and payers move towards a value-based care model instead of the current volume-based care model. The value-based model will benefit patients, it will lead to the transformation towards preventive and outcome-based care, at the same time, it will benefit providers and payers

as it will optimise healthcare expenditure and lead to better population health."

The value-based healthcare model will pay for performance and outcomes that matter to patients, it will provide healthcare service providers with evidence-based guidelines, which will be a framework for all physicians to follow regarding treatment protocols for all ailments.

Insurance providers will have a strong foundation to refer to evidence-based data and all stakeholders will work together to enhance healthcare and reduce unnecessary medical expenditure.

Al Hashimi added: "The model is driven by quality outcomes and at its core lies the health of patients, it will help shift the focus on preventive care, which will benefit patients and lead to reduced healthcare expenditure thus leading to healthcare sustainability. It will also help improve government oversight of the health sector by overseeing clinical outcomes, economic and human-centric outcomes. The implementation of this model will lead to a transformation in the health sector wherein the focus lies entirely on performance and clinical outcomes."

Al Hashimi added that payers and providers have been undergoing training to understand the framework and KPI's which will lead to minimal waste of healthcare expenditure and enhanced focus on preventive care.

Since the launch of the model last year, DHA has identified and prioritised 30 key diseases until 2025 when this model will be applied:

- In 2022, Dubai's healthcare sector received training to use this model across diseases such as asthma, diabetes, Gastroesophageal reflux disease (GERD), lower back pain and respiratory infections. The sector was also provided in-depth training on maternity care guidelines in line with international best practices.
- In 2023, the focus will be on Chronic obstructive pulmonary disease (COPD), Inflammatory bowel disease (IBD), Osteoporosis, Hyper Hypothyroidism, Atopic dermatitis, Urinary Tract Infections, Migraine and Myocardial infarction (MI).
- In 2024, the focus will be on Peptic Ulcer Disease, Rheumatoid Arthritis, Obesity and Metabolic Syndrome, Polycystic Ovarian Syndrome, Acne, Benign Prostatic Hyperplasia and Arrhythmia.
- In 2025, the areas of focus will include Gallstones, Osteoporosis, Thyroid disease, Dermatitis, Psoriasis, CHD/Stroke, DVT and renal failure.

Dr. Mohamed Farghaly, Family Medicine Consultant, Diabetologist and Professor of Medicine at Dubai Medical College and Consultant at the Dubai Health Insurance Corporation highlighted that the model would lead to a sustainable healthcare system. Dr Farghaly is also the lead of the EJADAH project at the DHA.

Dr. Farghaly explained how a significant per cent of the cost of managing non-communicable diseases such as diabetes goes towards managing the complications of the disease rather than the disease itself. He said that by implementing an ecosystem that focuses on preventive care and patient-centered care,



this cost can be significantly reduced. The model will empower patients and lead to a sustainable health system.

Dr. Farghaly added: "It will increase efficiency, efficacy, and safety whilst utilising best practices and methodologies."



# Chapter 4

## Beyond the hype: generative AI and healthcare in the Middle East

The global AI in drug discovery market is expected to reach US\$24.7 billion by 2029, growing at a rate of 53.3 per cent annually. But AI is not a healthcare panacea. If AI is meant to be a cure-all, then advancing technology becomes a new and more complex challenge. For example, generative AI has flooded the public consciousness, with tools like ChatGPT and Midjourney dominating mainstream tech conversations, but is the technology ready for healthcare applications?

### The promise of generative AI

Generative AI techniques have the potential to significantly accelerate the drug discovery process by suggesting novel compounds, optimising molecular properties, and expanding chemical libraries. By leveraging the power of machine learning and advanced algorithms, researchers can explore infinite combinations of chemical molecules and uncover potential drug candidates that might have been missed using traditional methods.

Insilico Medicine, a clinical-stage AI-driven drug discovery company, launched the world's largest AI-powered biotechnology research centre in Abu Dhabi this year, specifically to further healthcare applications of generative AI. The company released several AI tools, including PandaOmics (generative AI for target discovery), Chemistry42 (generative AI for drug design), and InClinico (generative AI for clinical trial outcome prediction), collectively called Pharma.AI.

While the Middle East does not have a record of pharmaceutical drug discovery and development, Dr. Alex Aliper, President of Insilco, believes the region has the ingredients to leapfrog innovation, with its extensive scientific and technological expertise and opportunities for multi-stakeholder collaboration.

"Just like ChatGPT can take input parameters and produce generated output, our platform can turn scientists' directions for molecules with specific characteristics into brand new drug candidates that can then be synthesised and developed into new treatments for disease," says Aliper.

However, in AI for health, there's an added layer of urgency and accuracy, where bias could set research back instead of propelling it forward. "The trouble is that machine learning mainly focuses on prediction when what we need to recover is the truth," says Kun Zhang, Director of the Center for Integrative Artificial Intelligence and MBZUAI's Associate Professor of Machine Learning. "The system has to be infinitely more flexible and deliver the true relationships between genes to provide meaningful and accurate information."



### Privacy, accuracy and regulations

According to the US National Institute of Standards and Technology (NIST), bias manifests itself not only in AI algorithms and the data used to train them, but also in the societal context in which these tools are used.

"Context is everything," says Reva Schwartz, Principal Investigator for AI Bias and one of NIST's report authors. "AI systems do not operate in isolation. They help people make decisions that directly affect other people's lives. If we are to develop trustworthy AI systems, we need to consider all the factors that can chip away at the public's trust in AI. Many of these factors go beyond the technology itself to the impacts of the technology, and the comments we received from a wide range of people and organisations emphasised this point."

The report is sector and industry agnostic but warns that organisations should engage in high-quality data curation, make sure that data sources are diverse, and cross-validate using a variety of overlapping datasets to reduce that risk. To reduce biases and increase the accuracy of the model, organisations should also work together to create standardised methods for data collection and sharing. They should also embrace transparent documentation of data processing.

Because generative AI depends on enormous volumes of data, privacy concerns can arise concerning the potential misuse of sensitive data. Companies considering the use of generative AI should establish explicit policies, interact with authorities, and create moral frameworks to guide its use.





To complicate matters even more, generative AI models such as LLMs can sometimes “hallucinate” facts and research papers, which can be catastrophic in healthcare. Last year, Meta unveiled its scientific LLM Galactica in a public demonstration, only to take it offline three days later. Using ALMs with improved dependability and reasoning systems might be able to solve this issue. Drug firms can use expert knowledge and validation procedures, including iterative feedback from subject-matter experts or reinforcement learning with real-world data, to increase the accuracy of generative AI models.

### Challenges in scaling generative AI

Generative AI in its current iteration does not take causal relationships between data sets into account. “Only then can we begin to entertain the notion that AI can be used to inform new areas of research, the development of new pharmaceuticals, or the treatment of an individual patient,” says MBUZAI’s Zhang. “If you assume, as many researchers do, that there are linear relationships between your variables, this might skew all your results on real problems. On the other hand, if you use flexible models, the learning process will be less efficient. Therefore, we often say that causal analysis does not scale.”

To address this issue, Zhang’s team is exploring how causal analysis can be scaled to analyse millions of complex relationships. This, in the context of personalised medicine, has the potential to revolutionise drug discovery while avoiding the technology hype cycle.

While using generative AI, researchers must assume fairly basic and frequently linear relationships between variables, where a change in one variable results in a direct and predictable change in another variable. With complex health issues, however, variables are intertwined and linked in ways that are hard to predict. As a result, Zhang says, scaling up understanding of causal relationships is a long-standing challenge in various disciplines of science and machine learning.

### Generative AI in drug repurposing

Causal links are a challenge for generative AI in identifying new therapeutic applications for existing drugs as well. Machine learning models can analyse large databases of molecular structures, biological interactions, and pharmacological properties to predict the efficacy and safety of potential drug candidates. By analysing diverse datasets, including clinical trials, electronic health records, and scientific literature, AI algorithms can identify connections between known drugs and previously unexplored diseases. However, this is still mostly theoretical.

In 2021, Ohio State University (OSU) released research exploring a machine-learning method to determine whether certain drugs can be repurposed for new uses. “This work shows how AI can be used to ‘test’ a drug on a patient, speed up hypothesis generation, and potentially speed up a clinical trial,” senior study author Ping Zhang, PhD, an Assistant Professor of Computer Science and Engineering

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and Biomedical Informatics at OSU, said in a news release. “But we will never replace the physician — drug decisions will always be made by clinicians.”

Like MBZUAI’s Zhang’s research, the OSU researchers applied “causal inference theory” to group active drug and placebo patient groups that would be found in a clinical trial. “With causal inference, we can address the problem of having multiple treatments. We do not answer whether drug A or drug B works for this disease or not, but we figure out which treatment will have the better performance,” OSU’s Zhang says.

“My motivation is applying this, along with other experts, to find drugs for diseases without any current treatment. This is very flexible, and we can adjust it case by case. The general model could be applied to any disease if you can define the disease outcome.”

So far, this approach has not taken root in the Middle East, but its potential could be limitless.

While the industry is currently in its infancy, the region’s investment in AI infrastructure, research collaborations, and partnerships between academia, industry, and government bodies can further accelerate the adoption and development of generative AI-based solutions for pharmaceutical R&D.



## Conclusion

This eBook has highlighted the transformative impact of AI in the Middle East’s healthcare industry. From generative AI and healthcare management to next-generation healthtech and AI-driven insights, these articles demonstrate the potential of AI to revolutionise patient care, improve operational

efficiency, and enhance decision-making. By embracing AI ethically and collaboratively, healthcare professionals and policymakers can leverage its power to drive innovation, improve outcomes, and ultimately enhance the well-being of individuals in the region and beyond.



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