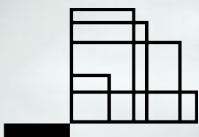




AI-powered

healthcare:

Shaping the future of
population health



pwc

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Executive summary

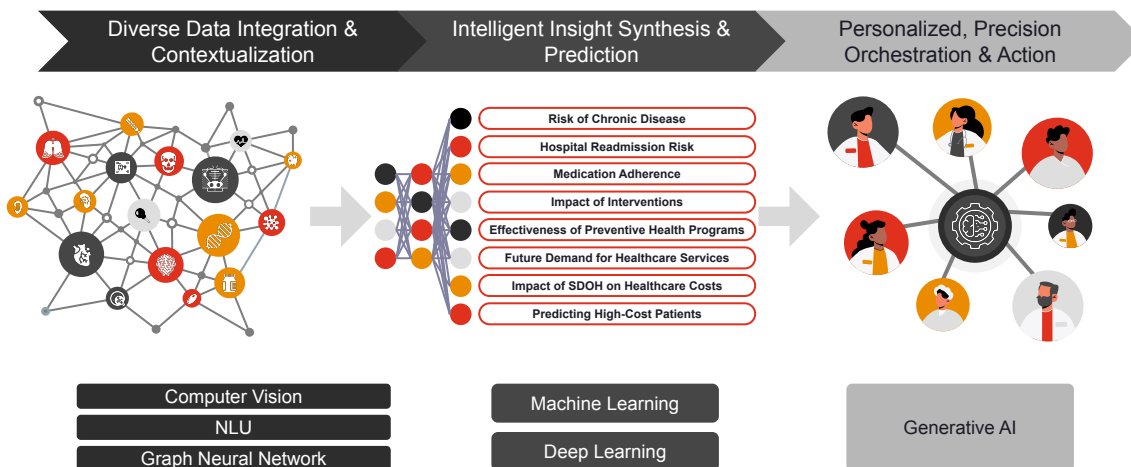
Artificial Intelligence has the potential to bring about transformative change in Population Health. This report explores three critical areas where AI will play a pivotal role in shaping the future of population health management.

Population health encompasses a broad spectrum of ecosystem inputs that influence health outcomes. It is an approach that seeks to improve the physical, mental, and social well-being of communities through the meticulous analysis of health determinants, including socioeconomic factors, environment, lifestyle choices, and genetic predispositions.

Traditionally, the practice of population health has focused on a narrow set of information, including health records and survey-based data. This produced limited clinical-focused insights, leading to broad care plans and interventions across patient segments with diverse care needs. The application of AI marks a shift in the science and execution of population health through three pivotal stages of understanding, insights, and action:

- 1** Diverse data integration and contextualisation, where AI algorithms assimilate a wide array of data types - from electronic health records to genomic data, environmental variables, and real-time monitoring - creating a holistic view of population health.
- 2** Intelligent insight synthesis and prediction, where AI harnesses this integrated data to uncover deep insights, forecast health trends, and identify risk factors with unprecedented accuracy.
- 3** Personalised, precision orchestration and action, where insights are translated into targeted, precise interventions and care plans, orchestrated between the population health leader, clinicians, case managers and individuals, thereby elevating the effectiveness and efficiency of population health initiatives.

Figure 1. Applications of AI elevating the science and execution of population health



The GCC region is leading the way in this population health revolution with AI. In recent years, the nations across the region have begun to evolve their care delivery models to more value-driven, community-centered care. Guided by the national transformation visions across the region, the GCC countries in particular are becoming leading pioneers in innovative population health strategies enabled by AI applications and emerging health technologies.

AI-driven unification of health data for a more holistic population view

The integration of multifaceted health data into a coherent, comprehensive view of individuals and the population represents a cornerstone of modern population health management, enabled by AI. This process is transformative compared to the traditional set of data elements used for population health, leveraging AI to harmonise data from electronic health records, genomic sequences, environmental factors, and behavioural insights - previously siloed and unstructured - into a cohesive health narrative.

Through the utilisation of Computer Vision, AI interprets complex medical imaging, adding a layer of depth to our understanding of physiological conditions. Natural Language Understanding (NLU) extends this capability to textual data, parsing through clinical notes and patient reported outcomes to extract relevant health information, seamlessly integrating it into broader health profiles. Graph Neural Networks (GNNs) further enrich this data synthesis by modelling the intricate relationships between different health determinants, providing a dynamic framework that reflects the real-world interconnectedness of health factors.

This AI-enabled approach not only facilitates a comprehensive aggregation of health data but also ensures that various unstructured data types are now accessible and interpretable within the wider context of population health.

Deepening insights with machine and deep learning in population health

The progression from aggregating diverse health datasets to deriving actionable insights embodies the impact of AI in the field of population health. The synergy of machine learning and deep learning offers unprecedented analytical depth, combining ML's broad pattern recognition with DL's nuanced data interpretation. ML algorithms efficiently segment and analyse population data, identifying risk factors and health trends across diverse demographic and geographies. This facilitates targeted interventions and efficient mobilisation of resources.

Deep Learning, with its neural networks, excels in extracting insights from complex, high-dimensional data sources like genomic sequences and electronic health records. Its ability to process unstructured data, such as text from clinical notes and images from medical scans, enhances disease detection and patient outcome predictions. For example, Convolutional Neural Networks (CNNs) revolutionise medical imaging analysis, identifying subtle anomalies that inform early diagnostic efforts.

The integration of ML and DL not only elevates the accuracy of health predictions but also deepens our understanding of underlying health determinants, enabling a shift towards personalised, preventive healthcare strategies. This combined approach in AI analytics represents a sophisticated toolset for health data scientists, driving innovation in population health management by uncovering actionable insights that inform policy and practice.

Enhancing population health execution with Generative AI

Generative AI revolutionises population health management by translating insights into targeted, precise interventions and care plans across the spectrum of needs for an individual—from prevention and wellness initiatives to chronic care management. This technology harmonises the orchestration capabilities and simulation strengths of Generative Adversarial Networks (GANs) to tailor healthcare interventions and care models with unparalleled accuracy.

The simulation capabilities of Generative AI allow for the creation of detailed virtual models that predict how different population segments might respond to specific healthcare strategies. This predictive power extends beyond traditional analytics, enabling the design of personalised care plans that are validated through virtual testing. Such simulations are invaluable for understanding the potential impacts of wellness programs, managing chronic conditions, and optimising care for high-need patients.

Concurrently, Generative AI's orchestration capabilities ensure these insights are efficiently translated into action. It automates the coordination of care plans among population health leaders, clinicians, case managers, and patients themselves. This automation streamlines the delivery of care, ensuring that each intervention is not only precisely targeted but also seamlessly integrated across the care continuum.

By balancing the simulation and orchestration capabilities of Generative AI, healthcare providers can elevate the effectiveness and efficiency of population health initiatives. This approach ensures that interventions are data-driven and dynamically tailored to meet the evolving needs of all patient segments, marking a significant step forward in achieving personalised, precision healthcare.



Case study: Population health interventions and care plan orchestration with GenAI

One of the most promising advancements is the potential of Generative AI (GenAI) in supporting the new and enhanced role of the Population Health Chief Operating Officer (COO) – a critical role within Accountable Care Organizations (ACOs) across the region. ACOs will be pivotal in the move from a 'pay-per-service' to an 'outcome-based' care delivery model. A GenAI-enabled Population Health COO will make a significant impact on the health of a population and on the way in which the resources of a healthcare system are targeted and managed.

A Population Health COO within this new vision of healthcare has wide-ranging responsibilities that include:

- 01 Driving care strategy (including new services and care pathways)
- 02 Managing population health care from an initial assessment need through to outcomes
- 03 Making critical business decisions around budgeting, talent management, procurement, and communication

This level of decision-making requires robust and comprehensive data, drawn across a range of sources, as well as access to powerful analytical capabilities.



Case study: Population health interventions and care plan orchestration with GenAI

Let's look more closely at how a GenAI-enabled Population Health COO will work -

Kholoud, a Population Health COO based in Al-Qassim, wants to understand the health needs of women between the ages of 50 and 70 who have recently been diagnosed with Coronary Heart Disease. Using a GenAI-enabled population health tool, she identifies the target segment of the population and explores the current prevalence of disease, risk factors, and current care need patterns. She assesses the current services and care programmes that are available within the health network and interrogates the data to see how current programs can be optimised.

The GenAI-enabled systems provide detailed insights including:

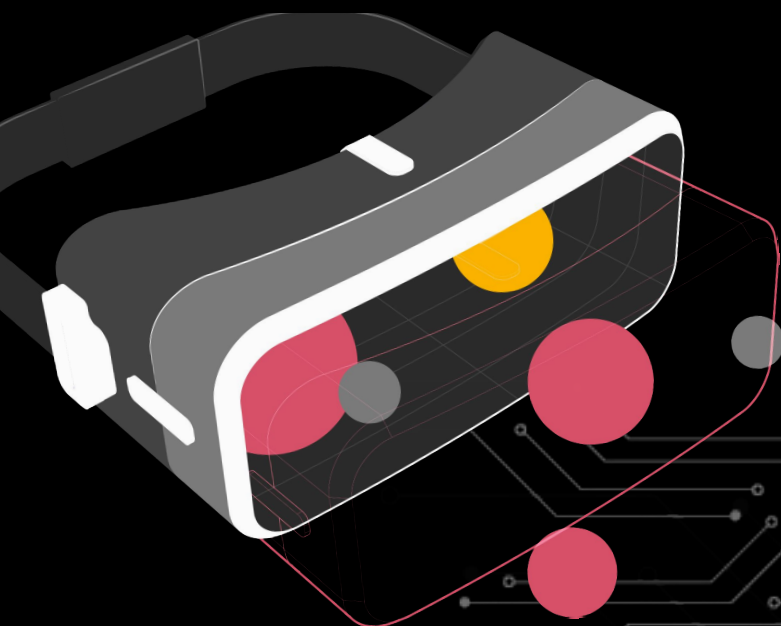
Comorbidities and secondary conditions present within the population segment

Patterns of adherence to treatment and medications by patients

Key factors that could contribute to deterioration of patients within the next 12 months

A summary of available services locally, and identification of care gaps for patients within the segment

A plan for identifying and engaging women who are seen as high risk



Case study: Population health interventions and care plan orchestration with GenAI



Using these insights, Kholoud creates a targeted action plan leveraging community, primary and secondary care services for the custom care model for this segment, including:



A defined clinical pathway for women already diagnosed with Coronary Heart Disease and at risk of additional complications from the disease



A set of defined treatments and interventions with specified owners across the case management and clinical team with targeted notifications for each owner, enabling automated orchestration



An education and outreach plan customized for the unique requirements for sub-segments focusing on proactive care and engagement

The result is better use of time and resources, more effective and comprehensive care for communities, and preventative measures that reduce the cost of healthcare over the longer term while simultaneously improving the wellbeing of the population.

Challenges to overcome

As we highlighted in our recent report, **Longevity and Ageing Populations in GCC Countries**, there is still more to do as Middle East nations develop precision health strategies, but AI provides the opportunity for rapid advancement, particularly for the role of Population Health COOs and orchestrating across stakeholders within Accountable Care Organisations.

There are still many challenges to overcome – including secure information exchange across population health stakeholders and the need for greater collaboration between care providers, case managers and coordinators, and stakeholders across health insurance, regulatory entities, and the public and private sector – but AI holds the key to better, more efficient and effective healthcare across the Middle East, and will become an essential tool for the population health manager of the future.



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