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# arab health

THE OFFICIAL MAGAZINE OF THE ARAB HEALTH EXHIBITION

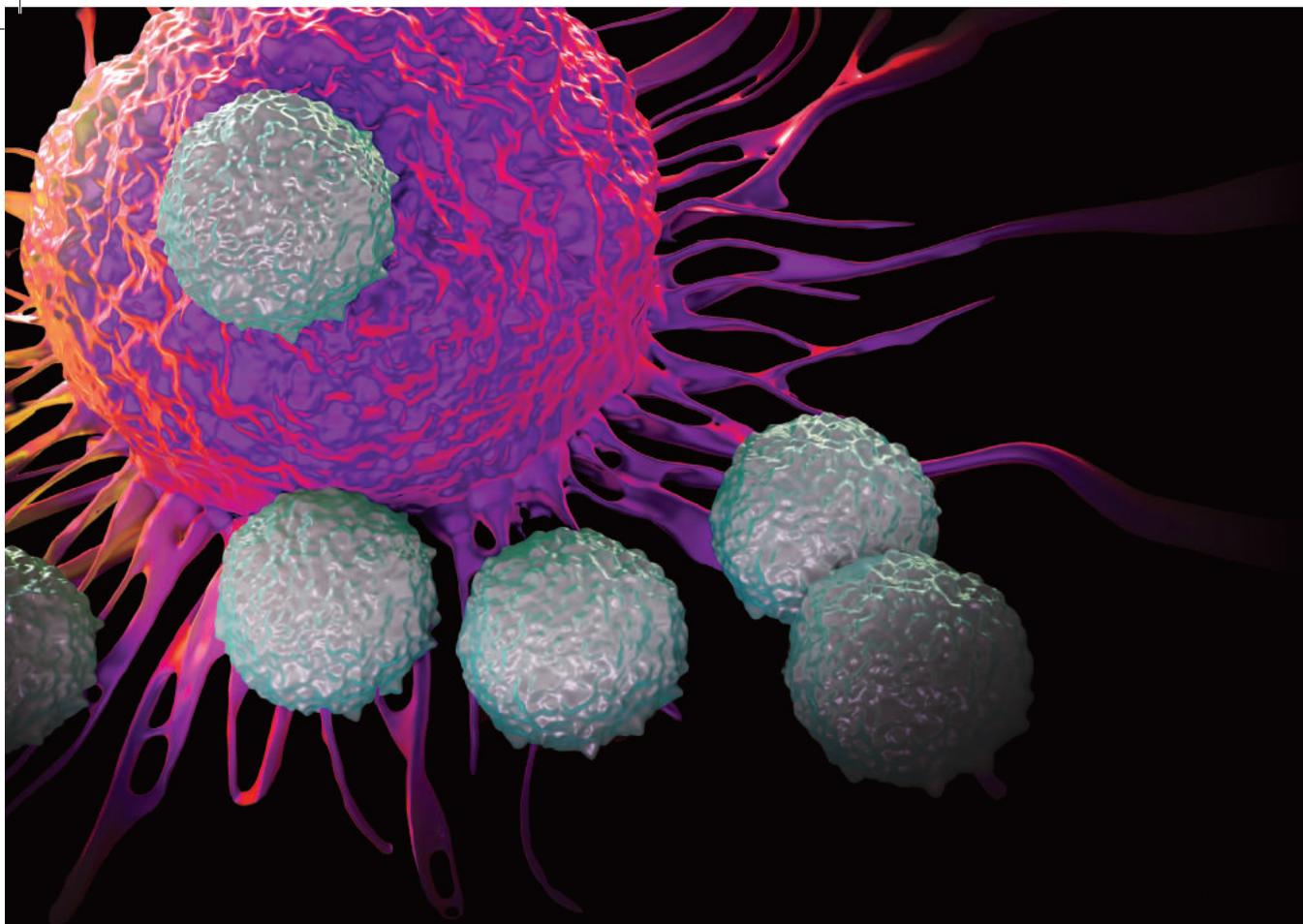
## GLOBAL HEALTH EXHIBITION 2018

Taps into Saudi Arabia's booming healthcare market



## SPECIAL REPORT: ONCOLOGY

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THE OFFICIAL MAGAZINE OF THE ARAB HEALTH EXHIBITION

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# Letter from the editor

## Ambitious healthcare vision

Saudi Arabia's Vision 2030 and the National Transformation Plan (NTP) have effectively transformed the healthcare landscape of the Kingdom. Increased private sector participation, effective regulatory frameworks, and stronger institutional set-up are driving expansion, opening new doors for investors.

The high growth opportunities in this sector will be presented at Informa Life Sciences' inaugural Global Health Exhibition, where 250+ exhibitors from more than 30 countries will provide a business platform for 10,000 attendees to make inroads into the Kingdom's healthcare market. As Saudi's premier healthcare trade platform, this event will showcase the latest advances in health services, pharmaceuticals, training and education, and medical device technologies.

Under the theme, Embracing the Future, the Global Health Congress will delve into the emerging disruptive and innovative trends in healthcare with the aim to serve as a catalyst to a common healthcare vision.

Our Special Report on Oncology addresses the emerging challenges in cancer care, particularly the explosion of the advanced data environment in oncology and its impact on clinical decisions and offers suggested solutions to transform patient outcomes.

We hope you have a pleasant summer and look forward to welcoming you to our next edition in September.



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# GLOBAL HEALTH EXHIBITION

## Taps into Saudi Arabia's booming healthcare market

In line with Saudi Arabia's Vision 2030, Global Health Exhibition, taking place from 10-12 September 2018 at the Riyadh International Convention and Exhibition Center in Riyadh, Saudi Arabia, will provide a business platform for 10,000 attendees to make inroads into the Kingdom's healthcare market

By Arab Health Magazine Staff

**H**igh growth opportunities abound in the healthcare market sector of the Kingdom of Saudi Arabia. The government will cumulatively spend \$180 billion on healthcare over the next 5 years in both the traditional and frontier subsectors to meet demand and tackle the Kingdom's public health challenges. As such, investors will find significant opportunities across the entire sector including hospital and healthcare services, pharmaceuticals, and medical devices. This is in line with the Saudi Vision 2030 that aims to achieve a world-class healthcare system and establish the Kingdom as a pioneering healthcare destination in the region, and the world.

To provide a business platform for investors looking to make inroads into this thriving healthcare market, Informa Life Sciences Exhibitions, the organisers of the annual Arab Health Exhibition, in collaboration with XS Conferences and Exhibitions and under the patronage of the Ministry of Health are launching Global Health Exhibition - Saudi Arabia's premier healthcare platform for the global market to meet and network with the pioneers and officials of the Saudi healthcare sector.

Taking place from 10-12 September 2018 at the Riyadh International Convention and Exhibition Center in Riyadh, Saudi Arabia, more than 10,000 industry professionals from the region are expected to explore +250 Saudi-based and international exhibiting companies showcasing the latest advances in health services, pharmaceuticals, training and education, and medical device technologies.



## ملتقى الصحة العالمي GLOBAL HEALTH EXHIBITION

According to Peter Hall, President, Informa Middle East: "Diminishing market access barriers for foreign investment, coupled with huge investment in healthcare infrastructure, has positioned Saudi Arabia as a top-tier market for medical device manufacturers, services providers, and dealers and distributors from across the globe. Through the launch of Global Health Exhibition, companies now have an opportunity to promote their products and services to a whole new audience of buyers and make significant inroads into the Saudi market."

Currently, 36 new hospitals with a total capacity of 8,950 beds are being established and developed in all regions of the Kingdom of Saudi Arabia, according to the Ministry of Finance. Two medical cities with a total capacity of 2,350 beds are also being constructed.

Commenting on the launch of Global Health Exhibition, Meshal Al Rubiaan,

Ministry of Health spokesman said: "The objectives set out by the 'National Transformation Program 2020', part of the Kingdom's Vision 2030, has enabled the Ministry to cultivate a favourable atmosphere to attract private healthcare providers and investors from abroad. We will continue to work closely with our strategic partners to support important economic trade platforms such as Global Health Exhibition that promote and facilitate the achievement of that vision. The exhibition will also attract world-class leaders and experts in the healthcare industry to support our objective to share knowledge and experience."

### **The Innovation Zone**

With Saudi Arabia having allocated \$1.5 billion towards a healthcare IT and digital transformation programme as part of Saudi National Transformation Project 2020, this pivotal area will be a main

feature at the Global Health Exhibition. The 'Innovation Zone' will give eHealth solution providers and digital health disruptors an opportunity to showcase their solutions and products to an audience of key decision makers, government authorities and trade and healthcare professionals from the KSA.

### **Global Healthcare Congress**

Under the theme, 'Embracing the Future', the exhibition will also offer a multi-disciplinary Congress that "aims to delve deeper into worldwide advancements and best practices in the healthcare industry with an emphasis on Vision 2030 to identify the immense opportunities represented for healthcare advancements in Saudi Arabia," commented Adel Abdel Shakor, CEO of XS Conferences and Exhibitions. "From emerging disruptive and innovative trends in healthcare to the impactful change at the public health and policy level, the congress will explore ways to transform and adopt the current healthcare landscape for better utilising the existing system's capacity and capabilities in hospitals and healthcare centres, and also to enhance the quality of preventive and therapeutic healthcare services."

The Congress is a high-level strategic dialogue and knowledge-sharing platform with an exclusive global speaker panel comprising of Ministers, CEOs and subject matter experts.

### *Embracing the Future Conference (September 10)*

Addressing key topics such as impact of policy on healthcare, Saudi Vision 2030 and the healthcare transformative plan, investment, value-based healthcare, and healthcare innovation, amongst others, this conference is of special relevance given the rising global interest in new ways of designing healthcare systems to address the mounting challenges that threaten the sustainability of these systems across the globe.

The conference will help build a global network of leaders and aims to become the source for emerging concepts and advancement in healthcare by facilitating opportunities for strategic, operational, and academic partnerships amongst interested parties while mobilising support for the Kingdom's vision and healthcare transformative plan.

### *Value-Based Healthcare Conference (September 10)*

This conference will review the framework for restructuring healthcare systems around the globe with a view to improve the quality of care and align patient outcomes with financial incentives to providers. Amongst the key focus areas that will be addressed at this conference include value-based care models across the globe, population health, outcome measurement, pay for value and value driven system improvements.

### *Healthcare Investment, Financing and Reimbursement Conference (September 11)*

How can you align investor and provider objectives and what does it take to create an attractive environment for financing healthcare innovation? This conference will provide insights into the changing investment ecosystem in the face of a changing care delivery model and will also provide solutions for investment, financing and reimbursement challenges and review perspectives from all stakeholders including hospitals, payers, pharmaceuticals, technology companies and policy makers.

The key topics under discussion will include role of healthcare incubators and accelerators, entry of sovereign wealth funds into the healthcare market, where to invest in healthcare, and creating an attractive environment for local and foreign investors in Saudi Arabia.

### *eHealth Conference (September 11)*

Digital and technological advances are transforming healthcare. The evolution of Information Technology has become increasingly more important in providing patient-centred and cost-effective care. This eHealth conference will identify technology trends, address key questions such as telemedicine, Artificial Intelligence in improving clinical outcomes, cybersecurity and patient data privacy, and provide solutions to implementing sustainable technology to deliver value-based healthcare.

Attendees at the conference will gain greater insights into what cyber security measures healthcare providers should implement in order to provide protection of data of their patients and their facilities; assess how disruptive technologies and

innovations can impact the healthcare ecosystem; and determine how connected health technologies can support delivery of new models of care, health and wellness.

### *Healthcare Innovation Conference (September 12)*

Focusing on emerging technologies and biomedical engineering advances to watch in the year ahead, this forum will be collocated with the Innovation Zone at the Global Health Exhibition that will feature a demo zone to review products and concepts that have been earmarked as the gamechangers of healthcare.

Personalised medicine, regenerative medicine and cell-based therapy, 3D printed medical devices, applied Artificial Intelligence, and population health analytics are some of the key topics that will be discussed at this conference.

### **CME Accredited Conferences**

#### *Medical Laboratory Conference (September 11)*

Themed 'Outsourcing lab services: Ideal vs. reality', this conference will review the developments and opportunities for clinical laboratories in the Kingdom. Amongst the key topics addressed here include overcoming the challenges of outsourcing lab services, driving value through lab automation, patient safety, evaluating best practices in Internal Proficiency Testing and Internal Quality Control, and improving diagnostic test utilisation, service efficiency, and "meaningful use".

#### *Total Radiology KSA Conference (September 12)*

Presenting the latest advances in medical imaging, accurate imaging diagnosis and improvement of care quality for radiology patients, these scientific sessions will touch upon the role of big data and AI in radiology, identify disease imaging and diagnostics for oncology, breast, abdominal, emergency and respiratory, gastrointestinal, cardiovascular, nervous systems and include a comprehensive discussion of the diagnostic imaging procedures utilised in demonstrating diseases and conditions. **AH**

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# ‘VISION 2030 REPRESENTS A STRUCTURAL SHIFT IN THE SAUDI HEALTHCARE SECTOR’

Healthcare is one of the main focus areas of the ambitious Saudi Vision 2030 and National Transformation Program 2020 (NTP) that seek to improve the quality of healthcare services and facilities across the Kingdom of Saudi Arabia.

By Arab Health Magazine Staff

**A** demographic shift where population above the age of 60 are expected to rise considerably in the next decade, increased private sector participation and increase in health insurance coverage are amongst some of the chief factors raising the stakes for high growth opportunities in the healthcare sector landscape of the Kingdom of Saudi Arabia. In addition, the country's ambitious Saudi Vision 2030 and National Transformation Program 2020 (NTP) seek to improve the quality of healthcare services and facilities while optimising available resources thereby boosting opportunities for increased private sector participation.

Alaa Adel, senior director and general manager in Cerner Middle East, who focuses on client satisfaction and organisational growth in Africa and Saudi Arabia, opines that despite the inherent challenges in the system, government initiatives are changing the dynamics of the healthcare sector in Saudi Arabia. Effective regulatory frameworks will help facilitate the flow of private investment, he says, and the encouragement of public-private partnerships will sustain growth even in the face of long-term challenges.

In an interview with Arab Health Magazine, Alaa Adel says that as the government switches over from its role as that of a service provider to a regulator, competitiveness and quality care services will be given a boost leading to increased efficiency and improved outcomes.

“A sweeping change is imminent and on the horizon,” he adds, “and this change needs to be embraced. Ultimately, a healthier population leads to enhanced productivity for the national economy.”

**What, according to you, are the major healthcare challenges in Saudi Arabia today? Can the existing model of healthcare delivery meet the future needs of a growing and ageing population in the country?**

I have seen over the last couple of years the advancement of healthcare services in Saudi Arabia and how that has influenced life in the Kingdom and the health map of the country in a very positive way. I believe the current 2030 healthcare vision will provide the Kingdom with efficient healthcare services. However, with every nationwide programme and new developments, there are a few challenges that need to be addressed. These include:

**Rapid increase in expenditure:** Healthcare services are free for all Saudis. In a rapidly growing and ageing population, this tends to be a costly model.

**Waiting time:** This is another challenge as we see waiting time of several months in certain cases for patients to get surgery or procedures done.

**Shortage of qualified healthcare resources:** This is true not only for Saudi Arabia, but other GCC countries too. Relying on expatriates to make up for this shortage may lead to other impediments like language barriers between care providers and patients.

**Digital transformation:** Adoption of modern technology in combination with healthcare best practices is required to enhance patient care and deliver the highest quality of service.

**Restructuring:** The public sector will need to undergo a transformational shift from its status as a cost centre to a revenue centre in alignment with Vision 2030, and this could

lead to several hurdles in the initial stages of implementation.

**Insurance sector:** The insurance market in Saudi Arabia is maturing fast in expectation that moving forward, healthcare organisations will do more to improve health with less resources and improve health outcomes. This is a double-edged sword as with the little resources they have, organisations are now in the position of having to decide where they get the most bang for their buck and also show the best outcomes. Insurance companies will have a big role here and need to keep up with this shift.

**Public health management:** Around 5 million pilgrims visit Saudi Arabia every year, which provides a major challenge in providing health services and containing infectious diseases arising from such a large mass gathering.

That said, I believe the competent and able teams in the Kingdom responsible for the delivery of the 2030 healthcare vision are hugely talented and have thoughtfully strategised innovative ways and measures to achieve this vision.

**What are the main drivers of new demand for quality healthcare in Saudi Arabia in the medium to long term? What is the outlook for the sector in the medium to long-term?**

The current leadership in Saudi Arabia has given a thrust to improve healthcare quality in the country for two main reasons: improving the welfare of the citizens and higher efficiency compared to the current model. These are in line with Saudi Vision 2030 and one of the main changes it ►

will bring about lies in the financing of healthcare. The government is encouraging private investments in the healthcare sector and is preparing to switch its role over the long term from that of a service provider to a regulator. This will create competitiveness in service quality amongst all service providers and stakeholders, including the current government-run hospitals, which will lead to service improvement and increased efficiency.

### **What are some of the operational challenges that Saudi Arabia has to contend with? How can a more effective integrated continuum of care be brought about to overcome these challenges?**

Several operational challenges including long waiting times, high appointment no show rates, underutilisation of resources, and tight controls may limit the agility of the leaders and block or delay some of the creative changes required to solve the current problems. Technology now offers many solutions to address some of these challenges. The direction should be to have better visibility to manage the available resources and better engage the patient for better results. If we can increase the percentage of care delivered outside the four walls of the hospital using the available technology and by relying more on primary healthcare centres, we should see natural improvement in the above-mentioned challenges.

We also need to keep in mind that lifelong learning and continuing education of healthcare professionals are critical to improving healthcare, patient outcomes and population health. This by itself will largely address the continuum of healthcare.

In addition, operational changes should also be reviewed regularly between both the public and private sectors to achieve the best synergy between the two entities.

### **Obesity is a growing concern in Saudi Arabia. What are the specific healthcare challenges that lifestyle habits and rising incidence of non-communicable diseases are causing in the region? How can these be addressed?**

Obesity is an increasing challenge in many countries especially with the onset of the modern life style. Several noteworthy campaigns have been launched in Saudi to

raise awareness on these issues. However, the impact has been minimal to lead to a big shift in results. The problem is that fast food is quick, unhealthy options are tasty, and hectic work schedules or sedentary lifestyles - even with entertainment - does not leave much time for exercising. While people know that these are bad choices and will have a negative effect on their health in the future, what is required is a direct and timely incentive for individuals to make the change.

At Cerner, our experience in addressing this issue with the introduction of a programme linking one's activity level and BMI with the discounts one can get from health insurance and a few other similar incentives has shown promising results. We need to look at new methods of enhancing obesity assessment and management programmes if we need to have a healthier and happier population.

I believe, we should maintain an attitude that more can be done from adopting a preventative approach rather than looking at it from a curative perspective. It is imperative to address this challenge and encourage people to make healthy lifestyle choices through raising awareness amongst the public and design efforts and strategies to combat obesity so that the consequences brought on by the rising incidence of non-communicable diseases such as cardiovascular diseases, diabetes, etc are greatly reduced.

### **How has the rapid pace of technological innovation and digital disruption affected the healthcare delivery system in Saudi Arabia?**

Technology is playing a big role in our lives across all industries and healthcare is no exception. In Saudi Arabia, healthcare stakeholders are welcoming digital disruption to transform the sector in the coming years. For example, in many cases where the need for physician opinion or consultation is urgent but does not require a personal meeting, physician e-visits can be done over the phone or through video conferencing. This will be much more efficient and convenient for both the patient and the physician and will lead to better results as opportunities for complications are reduced (if the patient waits or took wrong medication on his own). In addition, a virtual waiting room is better than the physical one to help prevent infection between patients.

The availability of multiple devices and solutions which can track our health (activity, vital signs, sleep, sugar levels) can provide a much more comprehensive picture about our condition to our healthcare providers and allow for early warnings and proactive engagement.

Also, the sharing of data across facilities and the possibility of having a single patient file across providers is a game changer as it negates the need for unnecessary examinations and conflict of treatments which arise from fragmented care.

### **In your opinion, what would be some of the ideas or solutions for a nationwide healthcare programme?**

- Use technology to aggregate patient data and have national registries; modernise primary care centres
- Increase collaboration between different facilities and organisations (including private sector) to efficiently utilise existing resources.
- Switch the focus from sick care (treating illness) to preventive care (avoid illness and staying healthy); create public awareness of adopting healthier lifestyle habits
- Attract qualified clinicians and offer continuous professional development to improve quality of care
- Implement best practices and innovative strategies to improve care coordination and manage multiple chronic conditions. AH



*Alaa Adel, senior director and general manager in Cerner Middle East, focuses on client satisfaction and organisational growth in Africa and Saudi Arabia*

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# A HEALTHY OUTLOOK FOR 2030

## Saudi Arabia reforms and restructures to drive investment and improvement in the healthcare market

By Inga Louisa Stevens, Contributing Writer

According to human data science company IQVIA, the compound annual growth rate (CAGR) for the total healthcare market in the Kingdom of Saudi Arabia (KSA) for 2018/2019 is expected to be 3%. So with the KSA market expected to continue growing in the coming years (Saudi Arabia represented 58.5% of the region's healthcare market with current healthcare expenditure of US\$ 37.7 billion in 2015), primarily driven by diversified investments towards healthcare, new private hospitals entering the market set up and chain pharmacies increasing in numbers, the many new facilities and healthcare initiatives provided by the government is encouraging investment and improvement in quality of healthcare system in the Kingdom.

The plans outlined in the country's Vision 2030 identify healthcare as one of its main focus areas and, as such, the target objective of the national transformation programme is to increase private healthcare expenditure from the current 25% to 35% of total expenditure by 2020 through alternative financing methods and service providers. In order to successfully meet this target, the Ministry of Health has embarked on reforms and restructuring of primary healthcare in the country, public-private partnerships through the privatisation of medical cities and localisation of the pharmaceutical industry, increasing the capacity and quality of healthcare education, health insurance & medical services purchase schemes, and increasing the number of trained health practitioners and improving their training, amongst other initiatives.

### Partnering for growth

Mohamed Mostafa, who is a senior director and general manager for Egypt and Upper Gulf at IQVIA explains that there is a lot of interest and traction in public-private partnerships in the Kingdom. "We have seen many big multinational companies signing memorandums of understanding with public universities to encourage training, for example. And we also see a trend of localisation in manufacturing where many private companies are partnering with local companies to produce locally."

As reducing the financial burden in KSA becomes a priority, private-public partnerships are increasingly being utilised for cost-savings and improving operational efficiencies. The recent announcement of the formation of a joint venture healthcare platform with Hassana Investment, a unit of pension fund General Organisation for Social Insurance (GOSI) in KSA, and UAE-based NMC Health, a large private healthcare operator, would see the creation one of the largest private healthcare platforms operating in KSA today.

According to a statement from NMC Health, the joint venture would have a strategically unique position in the country, with a strong foothold in Riyadh, the single largest healthcare market in Saudi Arabia, as well as in multiple smaller, underserved cities. The enlarged organisation is expected to benefit from economies of scale, allowing more efficient deployment of capital, increasing patient choice and optimising returns across multiple assets. Furthermore, in-line with NMC's existing strategy, the

proposed joint venture platform would continue to build a strong pan-Saudi Arabia presence, unlocking considerable synergies across its facilities in the process. These are expected to cover business segments such as revenue cycle management, procurement, HR and IT systems among others.

NMC CEO Prasanth Manghat said, "The Saudi government's forward-looking and investor-friendly policies make the Kingdom one of the most attractive destinations in the region for investment in the healthcare sector. Moreover, Hassana's strong commitment to the sector, particularly in the form of strategic investments, remains a vital means of attracting and developing healthcare expertise in the country.

"NMC has been the most progressive foreign entrant in the Saudi healthcare market, and the proposed partnership with Hassana would accelerate the process of bringing international best practices to Saudi Arabia," he added.

Commenting on the joint venture, Saad bin Abdulmohsen Al-Fadly, CEO of Hassana, said: "The proposed partnership between Hassana and NMC is driven by our view that healthcare in Saudi Arabia is one of the most attractive markets for strong long-term growth. The proposed joint venture has ambitious growth plans across different healthcare sub-sectors, with both partners committed to compounding returns over the long term, whilst providing best-of-class services to patients. Benefiting from Hassana's role as a strong long term financial and strategic investor and NMC's expertise as a sophisticated and successful healthcare ►

expert in the region, the joint venture platform would be well-positioned to become one of the most dominant healthcare players in Saudi Arabia and is ideally positioned to capitalise on the health care privatisation programme in Saudi Arabia in line with the country's Vision 2030 initiatives."

### Digitising the marketplace

As is the case in many healthcare systems around the world, and as it is in the GCC's hospitals, up to half of annual operating costs go to third parties. According to Federico Mariscotti, who is a vice president in A.T. Kearney's Procurement & Analytic Solutions Practice in the Middle East, although governments and private companies have spent billions of dollars to expand the region's healthcare facilities, increasing capacity and improving outcomes, healthcare systems in the Gulf have yet to tap into a powerful way to make hospitals more efficient: optimising the way goods and services are selected and sourced.

"An advanced approach can reduce a hospital's external costs by 20% and cut waste in half, whilst improving the quality of care," Mariscotti says. "By making sustainable cost reduction, reinvesting these sums into healthcare priorities creates huge possibility."

Indeed, Emdadat, a Saudi national company specialised in innovating the integrated services and solutions in KSA, has done just that with the launch of a new digital marketplace for healthcare on SAP Ariba. The procurement and business technology specialist has created a digital marketplace through which medical providers and suppliers can connect and collaborate across the entire procurement process to increase their efficiency and improve quality of care.

The platform is intended to create an online sourcing process through which buyers including hospitals, pharmacies and doctors, can connect with suppliers who can deliver the right goods and services at the right prices to meet their customers' needs. The platform will also ensure that goods are delivered to the right places at the right times under the right conditions and support healthcare entities to manage their capacity, demand, and medical equipment utilisation by integrating with supply chain and sourcing activities in real-time. Using the network, buyers can manage the entire purchasing process from end-to-end, while controlling

spending, finding new sources of savings and building a healthy supply chain.

Emdadat CEO Abdullah Alfifi said about the new platform: "At Emdadat, we have successfully integrated healthcare stakeholders into a sustainable ecosystem where they can communicate and trade with greater insight, transparency, efficiency and speed, and in doing so, we are transforming the health sector in the KSA into one of the finest systems globally and setting a new standard for the way healthcare is sourced and delivered around the world."

### Investing in Infrastructure

KSA has made significant investments to build hospitals, clinics, research centres and huge medical cities and complexes. According to an Alpen Capital GCC Healthcare Industry report for 2018, the Kingdom is likely to witness the largest bed requirement in the region at over 7,500 new beds to cater to its large and expanding base of population - the country's General Authority for Statistics (GaStat) recently reported that KSA's population registered an annual growth rate of 2.52% in 2017. In fact, Knight Frank has estimated that in order to keep pace with population growth, the Kingdom would require an additional 20,000 beds by 2035 (based on the current density of beds) and, based on the global average of bed density, KSA will face a gap of 40,000 beds by 2035.

There are a number of ongoing healthcare

infrastructure projects in the Kingdom including the King Abdullah Bin Abdulaziz project for the development of Security Forces Medical Complexes which the largest healthcare project in KSA, and also the largest medical project in the GCC. Two separate medical cities for security forces are being developed in Riyadh and Jeddah on behalf of the Kingdom's Interior Ministry adding an extra 2,000 beds to the country's bed capacity.

Meanwhile, the US\$1.27 billion King Khaled Medical City in Dammam is scheduled for completion in 2020. The 1500-bed hospital project, managed by the King Khaled Mega Project Management Office (PMO) on behalf of the Ministry of Health will include many centres of excellence, a research centre, staff accommodation, conference centre, mosque, administrative building, car parking structures and community centre.

Another mega project is the King Faisal Medical City in Asir. With an estimated project cost of US\$1.06 billion, the 262,836 sqm., 1,350-bed mega hospital complex will comprise of a 500-bed main hospital and another 850 beds distributed across five speciality hospitals: cardiology, oncology, ophthalmology, neurology and rehabilitation.

Also, the Mouwasat Hospital in Al Khobar has an expected capacity of 220 beds, 60 out-patient clinics, a substation building and staff accommodation, and will be established on a 53,000 square metre land plot. **AH**





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# BIOENCAPSULATION

## of living cells and the fight against diabetes

Biotechnology, tissue engineering, biomaterials and designing artificial healthy organs: Innovative new smart nano/micro encapsulated formulations can potentially function as new organs and treat diabetes

**By** Dr Hani Al-Salami, Senior Lecturer of Pharmaceutical Sciences and Biotechnology, Curtin Health Innovation Research Institute, Curtin University, Perth Western Australia, Australia; Laboratory Head, Biotechnology and Drug Development Research Laboratory

Over the last twenty years, major social and industrial growth unfolding in the Gulf region has had a significant impact on social norm, lifestyle commonalities and personal daily activities. The rapid expansion and urbanisation driven by economic prosperity and strengthening in technology, telecommunication and globalisation of services in the Gulf region have been associated with higher life expectancy and reduced infant mortality.

The United Arab Emirates in particular, has seen significant economic growth and prosperity and highly stable political arena, with strengthening global recognition, broadening of public services and empowered individual productivity. Unfavourable outcomes have been a dramatic increase in incidence of diabetes, with the International Diabetes Federation revealing that around 20 per cent of the population aged 20-80 have diabetes, mainly Type 2 diabetes, with many patients remain undiagnosed. This means that more than a million people in the UAE have diabetes, with many more being prediabetic. This has led to significant global increase in ranking in diabetes prevalence making the UAE in the top 20 countries worst affected by diabetes.

This has led to an astonishing increase in health expenditure for treating diabetes, which exceeds \$3 billion annually. Since 2015, general trends in diabetes prevalence in

the UAE have shown faster than expected increase, which has been directly linked to sedentary lifestyle and higher life expectancy. Subsequently, diabetes prevalence in the UAE is expected to increase 100 per cent by 2040, with diabetes treatment costs exceeding \$6 billion annually. This increase in prevalence and associated health costs are anticipated to have a major impact on the social fabric of the country and future prospective and economic growth.

Diabetes mellitus is a life-long chronic disorder which is divided into three types: Type 1 diabetes, gestational diabetes and Type 2 diabetes.

Type 1 diabetes affects 10 per cent of diabetics and is caused by the immune system destroying cells of the pancreas responsible for insulin secretion. This results in partial or complete cessation of insulin production and the need of diabetic patients to inject exogenous insulin.

Gestational diabetes affects less than 1 per cent of diabetics and develops in pregnant women. Gestational diabetes results in loss of tissue sensitivity to insulin and subsequent raise in blood glucose levels despite availability of endogenous insulin. Gestational diabetes is not chronic as the majority of pregnant women will not have the disease after giving birth. They are though more likely to develop diabetes at a later stage.

Type 2 diabetes is a chronic disease and the most dominant type of diabetes mellitus,

affecting 90 per cent of diabetics. It is caused by loss of tissues to insulin stimulation and glucose uptake, and results from insulin-resistance. Type 2 diabetes has been strongly associated with sedentary lifestyle, poor diet and obesity, and lack of physical activity.

All types of diabetes are believed to have genetic and hereditary components. They share main features such as loss of glycaemia control, chronic inflammation and disturbances of insulin release and effects. Prevalence of diabetes mellitus is around 7 per cent globally and this is rising by about 1 per cent every year. The health cost of diabetes is increasing every year, and this includes direct costs of treating diabetics and indirect costs of increased rate of hospitalisation, reduced work performance, increased time off work and low life expectancy as the result of diabetes and its complications.

In addition to making significant and better lifestyle changes, common treatments for diabetic patients include insulin injections, and antidiabetic drugs which stimulate insulin secretion and improve tissue sensitivity to insulin. Insulin was discovered in 1921 and since then has been a life saver and widely used by diabetics. All Type 1 diabetics, 30 per cent of Type 2 diabetics and the majority of gestational diabetes sufferers use insulin. However, current insulin therapy has many limitations including patient compliance, adverse effects such as hypoglycaemic episodes and the lack ▶

of appropriate glycaemic control, despite strict adherence to therapy.

Diabetes mellitus has been associated with pancreatic damage, and failure of pancreatic cells to produce sufficient insulin or body inability to utilise insulin efficiently. Recent research in the area of diabetes treatments have focused on the possibility of replacing injectable insulin, with a more permanent and consistent delivery system which ensures insulin-tailored release, based on body requirements.

One research area is using nano and micro bioencapsulation technology in order to produce capsules which can be loaded with healthy pancreatic cells, mimicking an artificial organ. The artificial organ will be implanted into the body, and the encapsulated healthy cells will produce insulin, based on body requirements and sugar concentrations. The aim of the research is to have a new artificial pancreas which will replace the body's damaged one, and thereby serve as a healthy new source of insulin capable of synthesising and producing enough insulin to cure the disease.

In order to design new capsules with healthy cells capable of producing a new organ and curing diabetes, there is a need to be able to produce the microcapsules and fill them up with viable living healthy cells. In order to produce capsules containing cells, there is a need to use the microencapsulation technology, which is responsible for fabrication and manufacturing of the new microcapsules.

The microencapsulation technology was pioneered by Professor Thomas Chang at McGill University (Canada) in the 1960s, and this technology has been used globally by many researchers, scientists, industrial partners, and translational entrepreneurs. Artificial cells are engineered capsules that mimic our own biological cells in terms of shape and ability to carry out biological entities. They are novel delivery systems for cells and biologically active compounds and have been used significantly in the delivery of various cells and therapeutics. When using the microencapsulation technology, the polymeric semi-permeable membrane encapsulates biotherapeutics (such as cells) and biologically active compounds (such as bile acids), and allows the diffusion of small molecules such as nutrients, oxygen and metabolic

biowastes, while preventing metabolising and degradation of enzymes, antibodies, complements factors and active biomarkers and cytokines, from entering the microcapsule.

There are several labs in the world that carry out artificial pancreas research, and as a leading researcher in the area of pharmaceutical science and biotechnology, I am using my research training in New Zealand, Canada and Australia, to apply the use of cutting-edge biotechnologies to design new breed of capsules, which can grow new and functional organs. As the founder of a highly productive research lab at Curtin University in Australia, the Biotechnology and Drug Development Research Laboratory, the focus of my research has been to design, develop, refine and establish new types of capable, robust, competent and industrious capsules for tissue engineering, biomaterials and production of matrices suitable for growing and implantation of healthy organs.

This new breed of capsules I have pioneered has special properties which address two major challenges of current tissue engineering and diabetes treatment. The first challenge is the lack of ability to control inflammation, with the need to administer anti-inflammatory treatments. The second challenge is the ability to design a capsule or implantable matrix which can house and promote survival, growth and functions of different types of cells.

With the continuous interests in the applications of microencapsulation biotechnology, many labs are aiming to produce more complex, sophisticated and multilayered systems that are capable of maintaining viable mammalian cells that can perform normal physiological functions once implanted in the body.

Such aim can have great future implications as the fields of artificial organs and stem cell continue to grow including undifferentiated and differentiated mammalian cells, and pluripotent and multipotent stem cells. Stem cells can be extracted from diabetic patients, and ideally be differentiated into new healthy pancreatic cells capable of producing insulin.

This is particularly interesting as this technology offers many advantages, compared with other formulation methods that have been used in the past. Such

advantages include forming new body-own functional cells, formulation process that is gentle and does not need heating or significant pressure and the use of biodegradable and biocompatible polymers that can accommodate the new cells and form a new healthy and functional organ. In addition, aiming for least immune-response associated with stem cell implantation is another area of great interest. Characterising of such microcapsules can be easily performed.

As prevalence of diabetes mellitus is increasing annually in the UAE, so do diabetes-associated complications such as bad blood circulation, rate of amputations, kidney failure, eye damage, and heart disorders. Current research in artificial organs is likely to have huge positive impact on wellbeing of diabetics in the UAE and the rest of the world.

Meanwhile, significant lifestyle changes can contribute significantly to reduction in diabetes-associated complications and improve long-term prognosis. Increase in daily physical activities, diet control and strict adherence to diabetes medicaments are all important in improving diabetes prevention, enhancing diabetes therapy and improving the long-term effects of the disease and its complications. <sup>AH</sup>

*References available on request.*



# 'A HEALTH PRESCRIPTION FOR THE GCC'

New white paper identifies six key focus areas to help improve the changing GCC healthcare industry

Examining the GCC's evolving multi-billion-dollar healthcare industry, Investcorp, a leading global provider and manager of alternative investments, has offered several recommendations in its recently launched white paper on improving the operating environment, reducing costs and increasing opportunities across the industry's value chain.

Titled, "A Health Prescription for the GCC", the white paper identifies four areas of weakness in the region's healthcare industry, namely, insufficient access and quality of care, the high cost of treatment of a relatively young population and the increasing burden of funding on GCC governments - the current primary spenders on healthcare in the region. These gaps must be bridged, and several weaknesses need to be addressed for the industry to reach global standards.

Based on tried and tested models, global best practices and deep knowledge of the GCC's healthcare industry, the paper offers six vital remedies and highlights key priorities to help improve it.

The paper recommends that the Gulf countries improve their wellness and prevention measures, for example, by promoting a healthy food and exercise regimen for their citizens and encouraging screening and health checks. It says that prevention and early diagnosis are widely recognised as effective levers to reduce healthcare costs and improve clinical outcomes.

Second, to help fill supply gaps with adequate care, there needs to be a focus on increasing the number of specialised facilities and improving the quality of services, by, for instance, partnering with experienced Western institutions.

Third, as the private sector remains somewhat fragmented in the GCC, healthcare providers, such as hospitals and clinics, need to consolidate to benefit from economies of scale.

The top five private hospital groups in the KSA, for example, account for just one-fourth of all private beds, and the top five in the UAE make up 40%, while similarly sized Western markets are much more consolidated.

Fourth, the paper stresses the importance of privatisation to improve the overall healthcare system and infrastructure. Private players, for instance, can help public providers and the overall system become more efficient, using techniques already proven in many parts of the world.

Fifth, it recommends that governments try value-based care systems to incentivise good behaviour and reduce costs. Finally, the paper emphasises the need for greater cooperation between GCC nations and pooling of purchasing power and infrastructure.

Commenting on the white paper, Tristan de Boysson, Co-Head of Corporate Investment for

MENA at Investcorp, said: "The GCC healthcare industry is undergoing a much-needed transformation, mainly driven by the pressure on governments to shift the burden of funding to the private sector and the rise of the patient as a 'consumer' of healthcare services. The change is creating plenty of opportunities, and the buildup of a more complete eco-system."

According to Rabih Khouri, Managing Director, Corporate Investment MENA at Investcorp, "Encouraging steps have already been taking place to help take the GCC healthcare industry to global standards. The magnitude of the transformation is highest in Saudi Arabia, where new regulations are being prepared as well as a substantial privatisation programme. I believe the transformation will considerably raise the standards of healthcare and better meet the population's expectations." **AH**



Tristan de Boysson, Co-Head of Corporate Investment for MENA at Investcorp



Rabih Khouri, Managing Director, Corporate Investment MENA at Investcorp

# FIME TO MOVE BACK TO MIAMI IN 2019

Refurbished Miami Beach Convention Center in Florida to welcome back FIME Exhibition & Congress for its 29th edition next year

By Arab Health Magazine Staff



Informa Life Sciences Exhibitions, the world's leading publishing and exhibitions company, has announced that the FIME Exhibition & Congress will be making a return to its original host location – the Miami Beach Convention Centre in Florida - in 2019. The show, which is the largest health expo in Americas, will be relocating back to its permanent home in Miami as the venue is expected to complete a \$620-million state-of-the-art renovation project by the end of 2018.

Due to the ongoing refurbishment project, FIME Show was temporarily held at the Orange County Convention Centre in Orlando in Florida in 2016, 2017, and for the final time from July 17-19, 2018. Attracting more than 1,200 medical device manufactures from 42 countries, FIME 2018 welcomed more than 24,200 healthcare trade professionals looking

to source products and medical services from across the continent.

According to Gil Alejo, Exhibition Manager, FIME: "Under Informa's stewardship and strategic direction, FIME has continued to witness a 25% year-on-year growth in visitor numbers, and, with exhibitors already looking to secure their booths for the 2019 edition, our move back to Miami is vital in order to accommodate the increasing scope of the show. It was always the intention to bring FIME back to Miami in 2019 and we look forward to fully utilising the 500,000 sq ft of exhibition space at the Miami Beach Convention Centre to the benefit of our strategic partners, exhibitors and visitors."

As the "gateway to the Americas", Miami continues to serve the world's healthcare business community due to its strategic

geographic location and its fast airway connections to Latin America. The city also benefits from a rich social makeup with more than 70% of its inhabitants from multicultural backgrounds. The network of professional contacts that Miami facilitates is geared towards a fruitful business relationship between the Americas. As the 18th largest economy in the world, and with an extensive transportation system and flourishing trade ecosystem, Florida is the ideal place to reach customers and suppliers anywhere, fast.

For FIME 2019, the primary focus of the show will remain across four industry sectors: medical technology, medical products & supplies, medical services, and medical equipment. Informa also remains committed to expanding the clinical education offering

proving industry workshops, conferences and seminars to attending healthcare trade professionals from across the continent.

Informa Life Sciences Exhibitions, in charge of the healthcare portfolio within Informa's Global Exhibitions division, organises 26 exhibitions yearly covering the Middle East, Africa, Asia, Europe and US market, connecting more than 150,000 healthcare professionals worldwide and offering a range of marketing solutions for companies involved with the healthcare sector. Over 100 congresses take place in parallel with the exhibitions.

### Affordable Healthcare Solutions Showcased at FIME 2018

The 28th edition of the FIME Exhibition & Congress, held from July 17 - 19, 2018, at the Orange County Convention Centre in Orlando, Florida, U.S., welcomed more than 1,200 medical device manufacturers from 42 countries showcasing new and refurbished medical and hospital equipment, technology, products and supplies. The show also attracted more than 24,000 healthcare trade professionals looking to source products and medical services from across Latin and North America.

According to estimates by the Centers for Medicare & Medicaid Services (CMS), U.S. healthcare spend is projected to reach nearly US\$5.5 trillion by 2025, and the Latin American medical device industry is expected to reach US\$ 18.4 billion by 2020. This market growth is expected to attract a huge amount of interest from overseas medical device manufacturers, suppliers, service providers looking to capitalise on the expanding market.

Gil Alejo, Exhibition Manager, FIME, says: "FIME continues to be one of the most important events to do business in the healthcare market in Latin and North America. It is truly the optimal platform to source cutting-edge medical equipment and technology on a global level, ensuring that attendees have access to the largest range of affordable new and refurbished medical devices, products and supplies, at the best possible prices."

Featuring 16 dedicated country pavilions as well as the popular Dealers & Distributors Wall offering dealers/distributors and agents the opportunity to post their business requirements live for exhibitors to review and connect directly to do business, FIME 2018 featured an array of national and international companies looking to promote

their affordable healthcare solutions.

Exhibiting for the 6th year at FIME was Florida-based Vertisa Medical Waste Technology who promoted and showcased their medical waste technology compact systems for clinics and hospitals - in particular, models AXL 150/100/150 L that are cooled with air generating 20-40-80 kl/per hour systems.

Axel Lopez, Business and Marketing Director, Vertisa, said: "We look to FIME each year to establish new distributorships and clients and to catch up with our clients and existing distributors. The show is very productive for our company as it generates great traffic and new business."

Medical solutions provider Strena Medical was also at FIME to announce the acquisition of a set of companies, including Medimar Corp., that support a stronger strategic initiative into the health technologies market. According to Strena Medical CEO Mario Labella: "FIME is one of the most important tradeshows in the U.S. for medical equipment and we attend every year to be able to reach our target market and customers that are looking for the solutions we offer. That's why we decided to announce the acquisition at this special event."

Los Angeles-Based Carley Lamps showcased their Carley Manufacture Line of products compatible with Riester, Hiene, Welch Allyn, Neitz, Rusch, as well as hard to find obsoleted examination lamps and batteries at FIME this year. Carley has also added a new to portable handheld LED light source ROVER IV to their endoscopic illumination line.

### Educational Agenda at FIME Show 2018

Visitors to FIME 2018 were also able to attend a series of insightful accredited conferences that focused on infection control, digital healthcare and healthcare supply chain and procurement, whilst the trade seminar discussed investment opportunities in North America, and provided market insights, trade prospects and regulatory affairs for market entry to the US, Latin America, China, Asia, APAC and Europe.

According to Gil Alejo, Exhibition Manager, FIME: "Informa's motto of 'Exhibition with Education' has been well received at the FIME show in previous years and this year too, thousands of delegates attended the multi-specialty three-day conference and seminar programme. We welcomed some

of the most respected and knowledgeable experts from various medical specialities who shared their insights on the challenges and opportunities the future of the industry."

One of the key themes discussed at this year's meeting was patient safety and quality control; in particular, the fresh perspectives on healthcare imperatives relating to infection prevention, infectious diseases, public health and healthcare epidemiology. Chairing the Patient Safety & Quality Congress for 2018 was Kelly Pyrek, Editor in Chief of Infection Control Today Magazine from Phoenix, Arizona, alongside activity director Anthony Warmuth, who is the Enterprise Quality Administrator at Cleveland Clinic in Cleveland, Ohio.

"Cyber security was another major conversation focus at FIME 2018," said Alejo. "Delegates at the Digital Healthcare Conference were offered practical advice on assessing how disruptive technologies and innovations can impact the healthcare ecosystem, and discussions were held on how connected health technologies can support delivery of new models of care, as well as the implementation of practical strategies to protect patient data and facilities from growing cyber security threats, among other topics."

Meanwhile, key topics at the Healthcare Supply Chain and Procurement Conference held under the theme 'New frontiers in supply chain management', included clinically integrated networks: challenges and opportunities, value chain transformation and patient engagement, investment protection, device tracking, contract compliance and quality control, as well as supply chain importance to patient care.

The free-to-attend Medical Devices International Trade Seminar took the approach of exploring opportunities in an evolving market.

Delegates got the chance to understand the trends in the US health devices market, capture new markets by understanding the global opportunities available and review trade regulations in emerging markets, among other new trends.

This year, FIME was co-located with MEDLAB Americas, a dedicated area for medical laboratories, which brought together leaders in the IVD, diagnostics and laboratory management industry to exchange ideas and discover the latest testing techniques and solutions available to the market. **AH**

# REVOLUTION IN MICROBIAL IDENTIFICATION AND MICROBIOLOGY EFFICIENCIES

Albarah El-khani, Director – Technical Operations, National Reference Laboratory, sheds light on the principles of MALDI-TOF Mass Spectrometry

Over the past few years, matrix assisted laser desorption ionisation-time of flight mass spectrometry (MALDI-TOF MS) has emerged as a tool for microbial identification and diagnosis. At MEDLAB 2018, Albarah El-khani, MSc (CSSBB), Director of Technical Operations at National Reference Laboratory (NRL), shed light on the principles of this revolutionary technology that is positioned to have a strong impact on improving clinical outcomes for patients.

El-khani said: “While it is true that with advancements in technology we have been able to meet the growing demand for faster turnaround times in every laboratory discipline, it has been quite challenging to achieve similar progress in the microbiology laboratory.”

Traditionally, microbiology testing is a labour intensive and lengthy testing process, requiring microbiologists to wait patiently while the microbial cultures grow enough to be identified. Once grown, the processes that follow - Kit for direct identification of bacteria and yeast specifically staining, microscopic examination and identification of the resulting growth - each add approximately 12-24 hours to the time needed to report the result growth - collectively reaching a total turnaround time of 48-72 hours.

El-khani highlighted: “Although the traditional process continues to be important today, we are fortunate to live in an era of development where technologies such as the MALDI-TOF MS allow us to significantly improve the turnaround time of microbial identification.”

## Evolving Identification Methods

There are various methods used to identify microbes, including: phenotypic, immunologic, genotypic, and proteomic.

- Traditional phenotypic methods are lengthy and labour intensive, and are dependent on the physiological and/or biochemical characteristics of the microbe.
- Immunological methods are based on the interaction between a microbial antigen

and a known antibody.

- Genotypic methods are molecular diagnostic techniques that require the examination of the genetic material of the microorganism. The genotypic methods include the use of nucleic acid probes; for example, Real Time Polymerase Chain Reaction (Real Time PCR) sequence analysis and Restriction Fragment Length Polymorphism (RFLP).

El-khani said: “The genotypic or molecular methodologies used for microbial identification today are increasingly becoming the preferred means of identifying microorganisms due to their speed and accuracy. Nevertheless, the disadvantage of the molecular methodologies is that you have to know the exact type of microorganism that you are looking for in the sample, in order to be able to identify it.”

- Proteomics is the study of proteins in an organism. This method offers an excellent complement to the aforementioned techniques, and includes the following: MALDI-TOF MS; Electro spray ionization mass spectrometry (ESI-MS); Surface enhanced laser desorption/ionization (SELDI), and Fourier-transform infrared spectroscopy (FT-IR).

## Insight into MALDI-TOF MS

Mass spectrometry (MS) is an analytical technique in which chemical compounds are ionized into charged molecules (ions), following which the components are separated by their mass-to-charge ratio. Although MS was developed in the early 1900s, its scope and application was limited to the chemical sciences. However, the development of electro spray ionization (ESI) and MALDI-TOF MS, as advanced types of MS methods in the 1980s, increased the applicability of MS to large biological molecules such as proteins.

El-khani explained: “The MALDI-TOF MS technology was developed in the 1960s; however, growth in the number of publications related to the use of MALDI-TOF MS for bacterial identification occurred only in the past 10 years.

The publications and the visibility they provided led to MALDI-TOF MS becoming a mainstream technology and a major breakthrough within the microbiology diagnostic laboratory.”

The MALDI-TOF MS method uses a laser to ionize the sample consisting of proteins and polymers, where the analyte is embedded in a crystal aromatic matrix. The presence of the matrix causes the large molecules to ionize, instead of decompose or fragment, when absorbing the laser energy. As a result, the analyte ionizes into a gas phase and a “cloud” of proteins is released into a flight-tube in the mass spectrometer. The proteins are accelerated by an electric charge, and after passing through the tube, their “Time of Flight” is recorded. The proteins are then detected with a sensor that creates a spectrum which represents the protein makeup of each sample.

Finally, the spectrum is compared to a known database of proteins, and according to the match, the microbial identification is completed.

Currently, many laboratories are using MALDI-TOF MS technology to replace selected steps from the conventional microbial identification process; for example, confirming the genotype samples for isolated cultures. Such process enhancements significantly reduce the turnaround time of bacterial identification by at least 12-24 hours. As a result, the time to report antibiotic susceptibility is also shortened.

## Improving Patient Outcomes and Healthcare Efficiencies

### *Septic Shock a Priority*

One of the most important applications of the MALDI-TOF MS technology is the identification of microbes from samples for blood cultures, which represent approximately 10% of the samples received by microbiology laboratories. Bloodstream infections are associated with high rates of morbidity and mortality among hospitalized patients. The risk of death from septic shock

increases by 7% with every hour that passes, and the mortality rate in severe sepsis is reported as high as 35%<sup>1</sup>. Therefore, the time required to complete the identification of microbes in sepsis, and to establish their antibiotic sensitivity in order to administer appropriate antibiotic treatment, is crucial for the clinical outcome of patients.

A study conducted on 501 patients<sup>2</sup> found that MALDI-TOF MS based identification in comparison to conventional identification, resulted in the following:

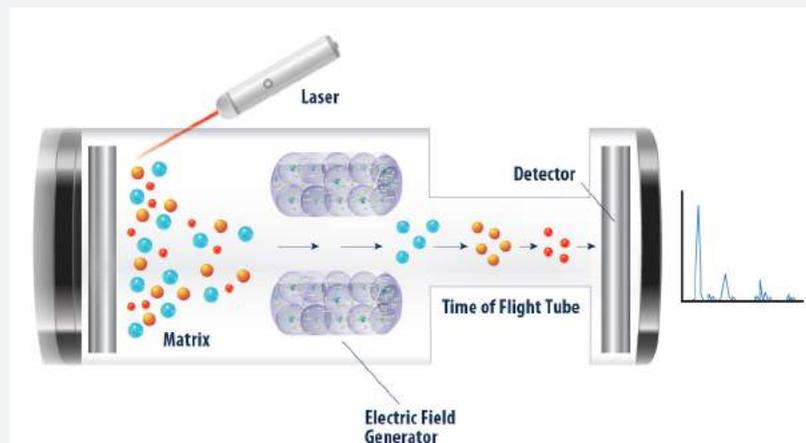
- Reduction in mortality by 5.8%
- Reduction in length of hospitalization (ICU) from 14.9 to 8.3 days (≈ 7 days or 44%)
- Reduction in time to effective therapy from 30.1 to 20.4 hours (≈10 hours or 32%)
- Reduction in hospital costs per patient from US\$45,709 to US\$26,126 (≈US\$20,000, or 43%)

El-khani continued: "The application of MALDI-TOF MS technology in the microbiology laboratory greatly improves clinical outcomes by reducing morbidity and mortality, guiding more appropriate antibiotic selection and initiating appropriate infection control measures. The positive impact of this technology becomes evident as it improves patient care and reduces financial costs for the patients, providers, payers and the healthcare system in general."

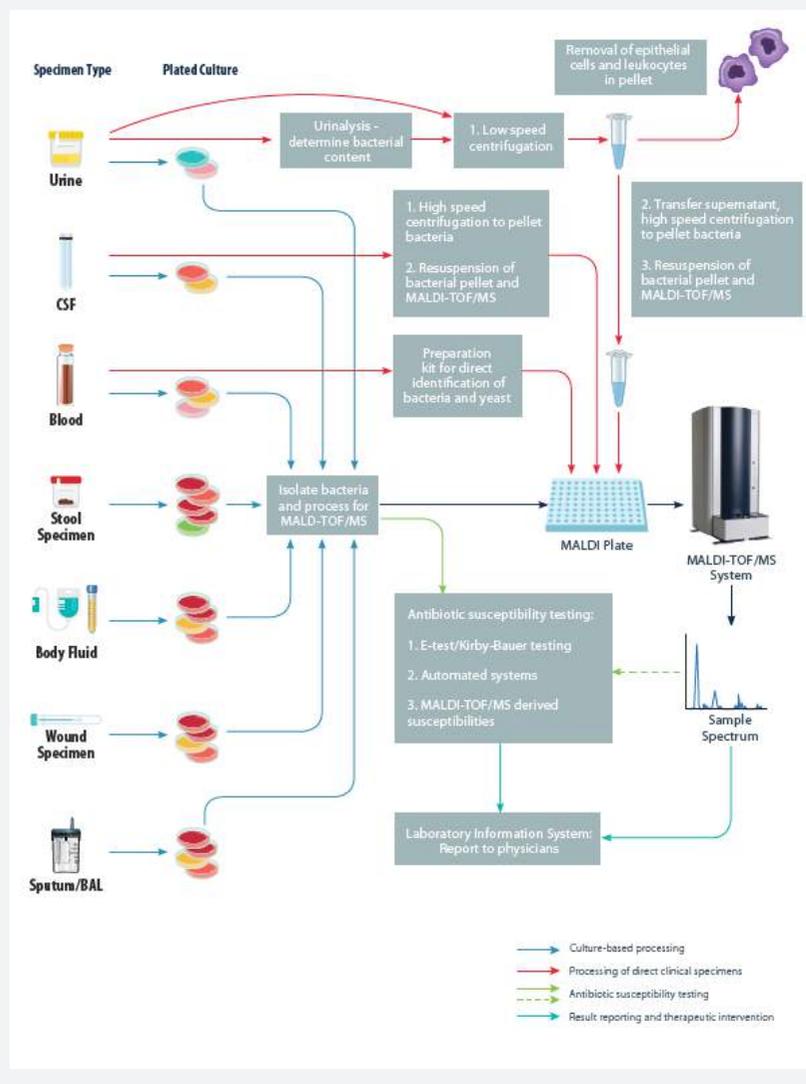
### The Future for MALDI-TOF MS and Automation in the Microbiology Laboratory

El-khani concluded: "Currently, we are able to use MALDI-TOF MS for bacterial identification of several types of primary samples including blood, urine and cerebrospinal fluid. It will not be long before MALDI-TOF MS will be used to directly analyse other samples, such as stool and sputum, and thus reduce the time to diagnosis for a wider variety of diseases. The next development that is expected to bring pivotal change to the microbiology laboratory is the full automation of the testing process. Full automation will further improve laboratory efficiencies and enhance the quality of the microbiology testing process through increased reproducibility and productivity which will reduce contamination and time to result. With the many advancements in technology in the microbiology laboratory, physicians will be able to provide appropriate therapy for their patients earlier than ever before." **AH**

#### ▼ Schematic representation of the MALDI-TOF MC methodology



#### ▼ MALDI-TOF workflow for multiple primary samples



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## HOSPITAL DESIGN TRENDS IN 2018

# Going greener and smarter

By Inga Louisa Stevens, Contributing Writer

**H**ealthcare design in the Middle East and North Africa (MENA) region is going through some dynamic changes. As technology evolves, regulations change and patients become more informed, healthcare providers are having to evolve the way that these facilities are designed and managed to adapt to changing patient needs.

According to Nicholas Burger, Healthcare Consulting Analyst at Frost & Sullivan, hospitals form an indispensable part of the healthcare value chain and provide sanctuary to

patients seeking organised medical attention.

"It is no surprise that the inherent structure and design of hospitals are evolving along with the rest of the healthcare industry as the fourth industrial revolution drives digital transformation across various sectors," he explains. "As a result, 'green' and 'smart' hospitals are stimulating positive debate regarding the future of hospital-based healthcare services and the manner in which medical professionals and patients (amongst other relevant stakeholders) interact with their clinical environment."

### Green Hospitals

Around the globe, hospitals are striving to reduce their carbon footprint while delivering effective healthcare services, Burger says. These establishments are renowned for consuming substantial amounts of water and electricity - energy use intensity (EUI) for hospitals ranks just behind the food service sector, inflating hospitalisation costs.

"There is an urgent need for hospitals that, amongst other eco-friendly practices, leverage onsite renewable energy sources and practice water recycling," Burger adds. "This is



particularly vital in developing economies and water-scarce regions such as MENA.”

The Keserwan Medical Center, situated north of Beirut in Lebanon, is the first green healthcare facility in the Levant region. Burger explains that the center offers automated window shading to shield patients during peak sunlight periods and the building’s walls are thicker than traditional structures with windows that are fitted with thermal break aluminum frames and low emissivity (low-e) coated glass creating an envelope that keeps rooms at a constant temperature and reduces the reliance on air conditioning systems. The hospital’s building management system (BMS) was designed by Siemens and measures the performance of an LED lighting system and an energy-efficient heating, ventilation, and air conditioning (HVAC) system. Furthermore, water usage is attenuated through low-flow plumbing devices and wastewater is processed through a local treatment plant.

### From Green to Wellness

HKS Architects have been planning and designing places of care for more than 40 years. As Dan Flower, Design Director at HKS, explains, “In our work globally, and especially in the MENA region, we are seeing a shift from green buildings, to a broader wellness-based approach which focuses far more on the quality of human experience in the built environment, of which building performance and green technology is one aspect.”

One such HKS project is CapMed Medical City, New Cairo, which is committed to producing renewable energy on site. With 11 buildings and eight specialist hospitals across the campus, around 70% of the roof area is covered with photovoltaic arrays. These solar PVs will be able to operate in almost optimal conditions, and so greatly offset the energy needs of the hospitals during their day-to-day operation.

“Our approach to wellness drove a pedestrian-friendly design that aims to cut car journeys between medical institutes by making walkable routes through shaded colonnades in the central gardens linking the buildings,” Flower adds. “The layout and proximity of the buildings help protect them from direct solar heat gain creating a cooler microclimate on the site.”

For Flower, energy efficiency, sustainability, and the resilience of a project’s materials and systems are design considerations from the earliest stage. Early goal setting around each of these aspects embeds considerations

right from the project’s inception to ensure an integrated and functional approach to resource management of a building or campus. These include the approach to daylighting, energy retention, passive cooling, water management.

For the CapMed Medical City in New Cairo, development of the orientation and massing of the campus was informed by solar impact studies. Solar modelling studies then played a key part in the expression and depth of the facades with the intention of maximising natural light in patient rooms while minimising unwanted glare and overheating.

In the design of Kuwait Children’s Hospital, another HKS project, an unhelpful site orientation made for a unique architectural expression. A scaled shading screen was designed to reduce energy consumption by balancing the need to shade from the extreme heat of the east and west sun. Access to natural daylight in in-patient rooms has proven effects on accelerating recovery times, and this was a principle that drove the design of the ward tower from the earliest stages of the project which led to the design solution integrating a parametrically tuned sun shading system that is at the heart of the building’s architectural expression.

“Hospitals are such large and complex buildings that their continued efficacy is dependent on the integration of environmentally conscious and responsible solutions from the outset – something that is embedded in our working process in the development of our projects,” Flower says. “For CapMed Medical City we ran energy models on in-patient rooms from the concept stage, and their results informed our designs to ensure that functional daylighting efficiency was part of our architecture, not a later addition. Ultimately, our approach is about good, responsible design that is appropriate to the client, the context, and the environment and its environment.”

### Smart Hospitals

Digital transformation in healthcare is spurring the development of connected hospitals that can efficiently provide relevant and critical information to healthcare providers and patients, thereby enhancing operational efficiency, reducing administrative load, and enhancing the overall clinical experience for all stakeholders, explains Frost & Sullivan’s Burger. He says that technological solutions - including electronic health records (EHRs),

healthcare applications, wearables and other connected point-of-care (POC) devices, and self-check-in patient kiosks - could alleviate the pressure on developing hospital systems with limited human resources.

One of the examples Burger gives is Dubai-based Latifa Hospital that recently launched Vocera, a smart communication system that alerts on-duty doctors and nurses with the touch of a button. This function eliminates the need to locate healthcare providers manually and can quickly assemble a team of anaesthetists, surgeons, and nurses for emergency procedures. “Making equally effective use of technology, the Dubai Hospital in Deira operates a smart pharmacy that is manned by a robotic system,” he adds. “The paperless pharmacy can dispense medications, via scanning barcodes, to hospital patients with great speed and precision allowing pharmacists to focus on providing key advice on prescribed regimens.”

Meanwhile, King’s College Hospital London in the UAE is adopting the use of smart technologies and digital solutions at their new Dubai hospital. “The worldwide healthcare industry is undergoing a radical transformation, with digital technologies playing a larger role in how hospitals improve efficiency and patient care,” says Augustine Amusu, Chief Information Officer at KCH Healthcare UAE. “Therefore, we continually seek and invest in this area and one example of such a solution we are excited to introduce is Roomlink, a smart room digital screen device.”

This device will be positioned outside each patient room and integrated to an electronic patient record system, to receive real-time information relating to the room or the patient’s condition, and proactively inform the clinical and operations team. This dynamic information capture device allows all members of the King’s team to receive the most up-to-date information to enhance the patient experience.

Another solution KCH Healthcare is excited about is Getwell, the Patient Engagement system. The solution transforms the interaction between patients and clinicians, by adapting to the patient’s demographical information, Getwell can change language settings as well as play videos to educate patients about their diagnosis. It also has the capability to provide the patient with a personalised list of activities of their day, such as time to theatre, time of MRI and meal times. “This helps facilitate enhance the patient-centred care delivery model,” Amusu adds. **AH**



# BOOSTING EFFICIENCIES IN HOSPITAL SUPPLY CHAIN

## Strategies for managing your supply chain and procurement costs

By Inga Louisa Stevens, Contributing Writer

**A** cost-effective and efficient supply chain is an integral part of a hospital or medical facility's functioning and is one of the main tools in maximising a provider's revenue. In fact, the cost of a hospital supply chain is only second to labour cost representing a huge burden on the efficacy of a healthcare facility. This is particularly important given the current economic environment with governments in the Gulf Cooperation Council (GCC) working hard to provide universal healthcare across the region.

Alpen Capital estimates that current healthcare expenditure (CHE) in the GCC is projected to reach US\$ 104.6 billion in 2022 from an estimated US\$ 76.1 billion in 2017, implying a CAGR of 6.6%. Expanding population, high prevalence of NCDs, rising cost of treatment and increasing penetration of health insurance are the factors auguring growth. Between 2017 and 2022, CHE on outpatient services is predicted to grow at an annualised average rate of 7.4% to US\$ 32.0 billion, faster than an anticipated CAGR of 6.9% on inpatient services to US\$ 45.4 billion. So with an expanding population, the rise in costs of managing the burden of chronic diseases such as Type 2 Diabetes and cardiovascular disease, poor infrastructure, increasing penetration of health insurance, and acute skills shortages, the entire hospital supply chain needs to be carefully streamlined and managed to reduce rising healthcare costs and improve quality. ▶

According to Takudzwa Musiyarira, who is a Transformational Health Research Analyst at Frost & Sullivan, healthcare financing is one of the major challenges for most organisations, particularly the private sector which has access to patients using both private and public health insurance.

“Public-private partnerships assist through cost-sharing among stakeholders, reducing the financial burden, and may include co-payments for health insurance claims. This enables both private and public sectors to save on costs while increasing efficiency,” he explains. “It is important for a healthcare facility to ensure its supply chain is managed effectively in order to cut costs and thus manage any revenue fluctuations.”

Two popular supply chain cost-saving methods that can be used are self-management and the Japanese-inspired just-in-time method. As Musiyarira explains, the self-management method essentially cuts out the middleman, who may be a distributor or other third-party suppliers. This method requires the healthcare facility to engage directly with the manufacturers of pharmaceuticals and medical suppliers, for example, and negotiate the best deals. However, this may require a proper inventory management system. “Additionally, for larger hospital groups, there is the additional advantage of collective purchasing through economies of scale. This results in further cost savings,” Musiyarira adds.

The just-in-time option focuses on keeping only important items in the inventory and sourcing the rest as and when needed. This however, requires an efficient distribution system to ensure lead times are short and not negatively affect patient care. This method also reduces overstocking which sometimes leads to the expiry of stock in storage, particularly for pharmaceuticals.

Ultimately costs are saved due to reduced wastage.

“Other methods of cost control involve the digital transformation of a healthcare facility,” says Musiyarira. “The use of digital tags placed on all forms of inventory can be useful in tracking movement of stock, thereby automatically notifying the supply chain manager if they are running low. This ensures effective stock and cash flow management, focusing spending mainly on necessary and current costs.

### **A much-needed transformation**

According to Federico Mariscotti, who is a vice president in A.T. Kearney’s Procurement & Analytic Solutions Practice in the Middle East, most GCC healthcare systems have put third-party spend into too small of a box tagged with a narrow definition of procurement: basic tendering and material handling. He says much bigger benefits can be achieved if hospital management gives procurement a more advanced role and that there are four regional challenges that tend to thwart attempts to reduce costs:

**Doctors’ diverse backgrounds.** GCC healthcare systems are staffed with doctors from around the world. This unique diversity of backgrounds brings with it an endless array of preferences for medical equipment, consumables and pharmaceuticals, making it difficult to standardise using basic methods.

**A skills shortage.** There is a lack of procurement professionals who specialise in healthcare, and local schools do not offer courses to train the workforce in healthcare supply chain management. Therefore recruiting category managers who are key to driving the advanced techniques is exceedingly difficult.

**Procurement’s low status.** Even when limited procurement skills do exist, suppliers’

functions are often seen and operate as a transactional entity that simply purchase goods and services under instruction from doctors and others. Few hospitals give procurement a genuine voice in which products are purchased.

**Competitiveness of the local supply market.** Local companies often have exclusive rights to international products and brands and distributor mark-ups can double costs. A nascent manufacturing sector means a limited local market for even basic products.

In response, Mariscotti outlines four sourcing strategies can deliver substantial and sustainable cost reductions:

**Change specifications: optimise what you buy.** Hospitals have an excessive number of products, primarily because of a lack of governance and control mechanisms. For example, in the GCC, doctors and nurses often have a choice in which gloves they buy. Because of variations in personal preferences, hospitals end up purchasing a wide variety of gloves. In more advanced hospital settings, purchasing departments have a strong influence over the final decision.

“One hospital system we worked with was buying three brands of infant formula with identical specifications but vastly different prices,” Mariscotti explains. “By standardising to the most affordable option, the company reduced its costs for formula by 70% with no negative impact on the standard of care.”

**Reduce demand: decrease waste and underuse.** GCC health organisations have expanded quickly to meet the population’s needs, often without setting up clear rules for spending. Because of this, many warehouses are full of an assortment of items, often in quantities which invariably leads to a lot of it becoming obsolete

**“It is important for a healthcare facility to ensure its supply chain is managed effectively in order to cut costs and thus manage any revenue fluctuations.”**

**“A complete improvement transformation can take 12 to 18 months, but we have found that by working collaboratively most of the savings can be delivered in the first six to eight months.”**

and being thrown away. According to Mariscotti, policies contribute to stockpiling because many hospitals have a use-it-or-lose-it budgeting practice that results in unnecessary purchases. “What’s lacking is rigorous planning with stock thresholds and governance mechanisms that define what is desirable and what is excessive.”

**Leverage competition: do things better.**

Despite the region’s healthcare market being relatively small, two factors give it a big bargaining power: the growing and ageing population and the fact that GCC countries tend to be cash rich and have demonstrated a willingness to invest in healthcare. This makes the region attractive for companies with an eye on growth. For example, the United Arab Emirates is among the world’s top improvers in terms of its business environment, and the government is committed to attracting foreign direct investment. Too often, however, negotiating power is lost because of poor planning. “For example, one company we worked with was buying blood-collection tubes from the same supplier every few months but at hugely variant price points, primarily because orders were being placed by different hospitals,” says Mariscotti. “Combining demand and establishing long-term contracts lowered the cost of the tubes by 74%.”

**Partner with the right vendors: choose your suppliers wisely.** Mariscotti says that identifying strategic vendors and forming meaningful partnerships can create the right conditions to benefit both the hospital and the supplier. For example, a hospital in the United Kingdom has a long-term partnership with a provider of cardiac devices. The partnership extends beyond product supply into patient lifestyle sessions and follow-up clinics. This encourages both the hospital and the vendor to take a long-term view of patient satisfaction and clinical outcomes as well as the commercial opportunity.

**Locking in Sustainable Results**

According to Rahul Anand, who is a director in A.T. Kearney’s Supply Management Practice, there are four practices that are proven to help keep costs down:

- 1.** Change the setup of your procurement team. A world-class procurement organisation is created by investing in talent, and infrastructure, to build serious capability, and consulting support to mobilise that capability quickly and with immediate results. The return on this investment is measured by the benefits that procurement delivers, including lower costs and better results. A.T. Kearney’s unique Return on Supply Management Assets study found that for every dollar invested in developing and running a health organisation’s procurement function, the company gets \$4.30 in return.
- 2.** Bring stakeholders together in a cross-functional clinical value team. Advanced healthcare organisations have clinical value teams that act as decision-making groups. “Comprised of doctors and nurses along with people from supply management and finance, these teams pinpoint the right specifications for the whole organisation, for example the ideal type of gloves,” Anand explains. “In addition, this level of transparency and information-sharing enhances compliance to the jointly agreed product selections.”
- 3.** Overhaul the engine with fit-for-purpose processes. According to Anand, many GCC health organisations struggle with the timely management of procurement requests and bottlenecks and delays tend to be the norm. Strategic sourcing requires a flexible approach to adapt to both the organisation’s needs and the market’s changing conditions. Category managers need the freedom to choose the most appropriate strategy, from making purchases on demand to setting up multi-

year agreements. Leading organisations standardise and automate the process, often by using dedicated software.

- 4.** Use enhanced analytical capabilities to uncover hidden opportunities. With the large variety of products that a healthcare system buys, and the countless unique item numbers, enhanced analytical capabilities are essential to uncovering the opportunities buried under all the data. Analytics can also prevent overstocking and reduce working capital by optimising inventory and defining reordering policies. In more advanced applications, statistical analysis of historical patient data from electronic medical records can be used to develop predictive models for low-cost interventions, reduce the number of readmissions, identify chronic illnesses, and evaluate the effectiveness of treatment.

**The way forward**

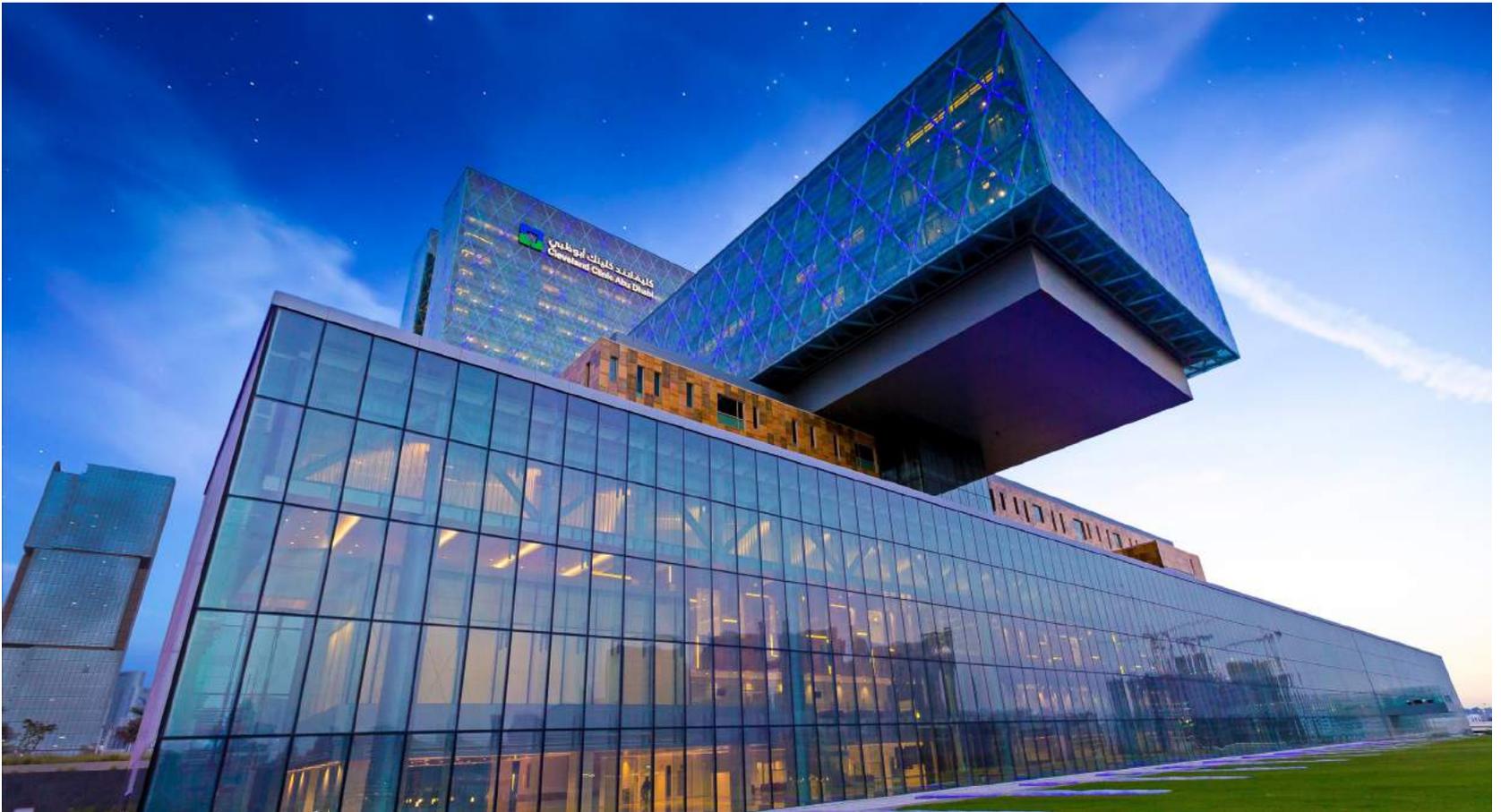
According to experts from A.T. Kearney, a forward-thinking approach to third-party spend can create significant economic gains, including reducing third party spend by 20%, which can, in turn, be used to support investments to sustain the region’s escalating demands for healthcare.

“Unlocking the full range of opportunities will require a proficiency in generating competition among suppliers to get the best prices, systematically managing demand to avoid unwarranted range complexity, creating clinical value teams to facilitate a healthier cost-benefit dialogue with clinicians, and, most challenging of all, developing differentiated supplier interaction models, including strategic partnerships, to get the most from your suppliers,” says Anand. “A complete improvement transformation can take 12 to 18 months, but we have found that by working collaboratively most of the savings can be delivered in the first six to eight months.” 

# BUILDING A GLOBAL HEALTHCARE PROVIDER:

Meeting the complex healthcare needs of the world's population

By Rakesh Suri, MD, D Phil, CEO, Cleveland Clinic Abu Dhabi



**T**he mission of Cleveland Clinic Abu Dhabi is to 'provide better care of the sick, investigation into their problems, and further education of those who serve'. The mission statement of Cleveland Clinic, drafted nearly 100 years ago, helped to guide the work of doctors at a four-storey outpatient building in Cleveland, Ohio, when it first opened its doors to patients in 1921. Today, it remains a touchstone for more than 50,000 caregivers in an international network that includes our coordinated, multidisciplinary hospital in Abu Dhabi. The statement's clarity and simplicity has proven to be an essential point of focus across our global footprint, even as our industry has

faced a growing level of complexity and range of challenges.

Keeping a clear central focus – reminding ourselves every day that we are here to serve our communities – has been one of the main success factors in establishing Cleveland Clinic Abu Dhabi as the first patient-centred complex care hospital to operate outside of the US. I would highlight four other key factors that have played a role in our development:

- The support of key stakeholders
- Recognising the potential impact of innovation
- Emphasising collaboration and information exchange
- Placing research at the heart of integrated healthcare

Understanding these success factors – and in particular how these align with today's population healthcare management challenges – provides an insight into how we can build a new model for global healthcare delivery.

## Healthcare management – serving the needs of the population

There are three key dynamics that made the development of Cleveland Clinic Abu Dhabi possible.

The first is the need within the region for complex care closer to home. With a growing population, the UAE was actively looking for ways to reduce the need for patients to travel overseas for treatment.

Second was the vision of the leadership of the UAE, who saw the importance of bringing a world-class institution to the UAE.

Finally, the strength of the partnership between Mubadala and Cleveland Clinic in the US provided the necessary foundation for us to grow our service offering sustainably.

As an organisation, we take our responsibilities very seriously, as we use all our tools – experience, expertise, technology, research, and innovation – to address the needs of our patients. The benefit of an integrated healthcare network is that patients can walk into any one of our facilities, anywhere in the world, secure in the knowledge that they will receive the highest possible quality of care from 57,000 of the most connected minds in medicine.

### Encouraging technological innovation in healthcare

Connected devices mean that preventative medicine will become an increasingly important tool in the fight against disease. People are more mobile than ever and, as technology develops, they will be able to access diagnostic and advisory services from leading medical professionals, wherever they are in the world.

These advances provide us with the opportunity to move toward a new model of healthcare, one that enables providers to use their resources and expertise to encourage the whole community to live healthier lives. We can detect problems earlier and encourage behaviours that reduce the risk of illness and infirmity in the long-term, thereby preventing disease. We can also intervene remotely at the very earliest stages of illness facilitated by sophisticated remote cardiac monitoring that we currently use at Cleveland Clinic Abu Dhabi and have deployed throughout the region.

In the UAE and wider Middle East and North Africa region, moving to this 'healthier lives' model will necessitate more focus on the primary care sector. Even healthy people need to see a general practitioner once a year. It is in this way that diseases are detected earlier, diagnosis is more complete, and patients are referred at the appropriate time for subspecialist care. Our regulatory partners are working toward introducing a referral system where patients are initially seen by a general practitioner before being referred on to a specialist if necessary.

### Prioritising collaboration and information exchange in patient care

The ability to collaborate effectively will be a fundamental predictor of success in improving outcomes. We must significantly improve strategic outreach, combining best practices, cutting-edge innovation, and global talent with the kind of expertise that will create a step change in the healthcare provision on a global scale.

Integrating care between medical facilities requires several key steps, including the shift to a single electronic medical record system, inter-facility consultations, and real-time patient monitoring.

All Cleveland Clinic facilities have a single, integrated medical records system, allowing care teams to gain a clear understanding of a patient's medical history across all our international locations, whether in Abu Dhabi, Florida, or Ohio. This seamless integration lets us offer carefully tailored, personalised care, regardless of where the patient is being treated. Future challenges include developing processes to include other healthcare partners in our best-in-class medical records system, while ensuring top-level data security. This will be supported by an innovative integrated healthcare network led by Mubadala.

Patients also benefit when multidisciplinary teams meet and consult with their colleagues through video-conferencing and collaborative technology. Such collaboration allows teams of physicians to discuss complex cases, adding another layer of expert evaluation when deciding on how to proceed with treatment. This can be a welcome extra layer for a patient, providing peace of mind that his or her case has had as thorough a review as possible.

### Placing research at the heart of an integrated healthcare system

Research and investigation, to build our knowledge of health issues within a population, are the foundations of good health and appropriate, effective care. By understanding the reasons behind a community's health challenges, and devising new ways to treat those problems, we can tailor treatments to meet their specific needs.

A great deal of advanced medical research is conducted in the United States and Europe, studying western populations. This approach has led to an imbalance in the quantity and quality of population data available for certain parts of the world,

including the Middle East.

Closing this gap must be a priority, and we need a coordinated, multi-agency approach to developing research programmes that consider the needs of this region. As a designated human subject research facility, Cleveland Clinic Abu Dhabi has partnered with several local institutions to conduct population health studies and support core research in the region.

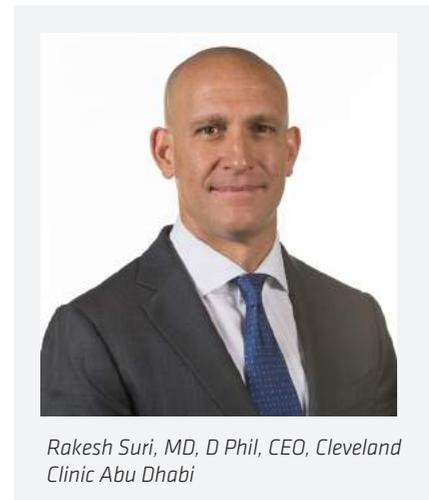
Last year, our clinician scientists published 137 peer-reviewed academic medical papers, reporting on innovative treatments administered at Cleveland Clinic Abu Dhabi along with the outcomes of those procedures. Many of our caregivers are also thought leaders in their fields and known globally for their work.

At Cleveland Clinic Abu Dhabi, we also continue to expand our educational facilities, which now include a full range of post-graduate opportunities from physician internships to residencies and fellowships. We welcomed our first cohort of physician interns in 2017, and our specialist residency training programmes will commence later in 2018.

### Sustaining the foundations of care

In conclusion, as the world becomes more closely connected, and the population ever more global, healthcare provision will continue to change dramatically. The formulation of strategic priorities that highlight future investment in innovation, research and the ethical use of healthcare data, will align around the shared goal of providing world-class care to an increasing number of lives globally.

Embracing these challenges will enable us to confidently ensure the highest global standard of healthcare is delivered in a culturally appropriate way at the local point of need. <sup>AH</sup>



*Rakesh Suri, MD, D Phil, CEO, Cleveland Clinic Abu Dhabi*

# SURGEONS PERFORM THE UAE'S FIRST DOUBLE-LUNG TRANSPLANT SURGERY

## Single deceased donor provides lungs, kidneys and liver for life-saving operations in the UAE

**M**ultidisciplinary teams of surgeons at Cleveland Clinic Abu Dhabi have performed three transplant surgeries from a deceased donor on the same day, including the UAE's first double-lung transplant. The surgeries – double-lung, liver and kidney – took place on June 10, and a kidney from the same donor was transported for a transplant operation at Sheikh Khalifa Medical City.

Double-lung transplants, also known as bilateral transplants, see both lungs removed and replaced with donor organs.

Earlier in 2018, Cleveland Clinic Abu Dhabi had performed successful lung and liver transplants, following on from the country's first full heart transplant in December 2017.

Dr Redha Souilamas, Chair of Thoracic Surgery at Cleveland Clinic Abu Dhabi, led the double-lung transplant, assisted by a multidisciplinary team of 10 specialists, including cardiothoracic surgeons, pulmonologists, anesthesiologists and critical care nurses.

The double-lung transplant patient, a 45-year-old expatriate female, had been suffering from idiopathic pulmonary fibrosis (IPF). A progressive disease that causes extensive scarring of the lungs, there is no cure for IPF and patients are typically given a three- to five-year survival rate after diagnosis without transplant surgery.

To complete the operation, the surgical team used an innovative, minimally invasive approach without the need for a cardiopulmonary bypass, making two small incisions on either side of the patient's chest. This ensures a faster recovery time; shorter hospital stay; and

little to no scarring compared with the standard approach, said Dr Souilamas, who has performed 150 double-lung transplants over the past 10 years.

Dr Antonio Pinna, Transplant Surgeon in the Digestive Diseases Institute, led the team for the liver transplant for a female patient from Ras Al Khaimah, who was suffering from severe cirrhosis. She is recovering well following the operation.

The kidney transplant operation was led by Dr Bashir Sankari, Chair of the Surgical Subspecialties Institute and head of Cleveland Clinic Abu Dhabi's transplant programme, providing vital surgery for another patient on the hospital's transplant list.

Cleveland Clinic Abu Dhabi's transplant programme works with a number of key organisations for multi-organ operations, including the Cleveland Clinic Transplant Center in the US, Mubadala, Abu Dhabi Police, the Department of Health, Ministry of Health, National Transplant

Committee and a number of other government entities.

"When we opened our doors in March 2015, we made a promise to bring advanced complex and critical care services to the UAE, removing the need to travel abroad for life-saving medical care. Cleveland Clinic Abu Dhabi's latest multi-organ transplants mark another significant moment in that journey," said Dr Rakesh Suri, CEO, Cleveland Clinic Abu Dhabi,

"It's worth reflecting on the incredible contribution that the donor and the donor's family have made by sharing their precious organs – four lives have been transformed by this selfless gift. We will continue to work with the relevant authorities to support the development of a nationwide transplant list and donor management network, so that more patients will be able to benefit from this life-saving opportunity," Dr Suri concluded.

All three patients are recovering well.



*Dr Redha Souilamas, Chair of Thoracic Surgery at Cleveland Clinic Abu Dhabi, leading the double-lung transplant*



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# King's: Enhancing the Patient Journey in the UAE

By Inga Louisa Stevens, Contributing Writer

A report by Alpen Capital has estimated that the hospital bed density in the region averages 17 beds per 10,000 people – much lower than the 54 per 1,000 seen in high-income countries. And as the United Arab Emirates continues to grapple with this shortage of hospital beds, a number of much-needed healthcare infrastructure projects are expected to enter the market in the next few years.

*Arab Health Magazine* sat down with King's College Hospital (KCH) UAE Chief Operating Officer Neil Buckley to get an update on the UK-based hospital group's plans for expansion into the UAE and his views on the increasing cost of medical care in the country.

## King's is expanding its footprint within the UAE. Can you give us a progress update?

We are delighted to be delivering on our promise of bringing the best of British evidence-based healthcare to the UAE and enhancing patient journeys across more than 10 specialties, including paediatrics, foetal medicine, diabetes, and endocrinology. We've been in Abu Dhabi since 2014, with our flagship medical and surgical centre based in the capital. We also launched our second

medical centre in September last year, this time in Dubai, specifically in Jumeirah. We are full steam ahead and on track to introduce two additional facilities in Dubai – another medical centre in Dubai Marina this year, plus our highly anticipated 100-bed hospital in Dubai Hills in Q1 2019.

All our facilities are directly connected to King's College Hospital in London and we are committed to delivering and transferring its 175 years of world-leading expertise to the UAE and enhancing patient journeys so people don't have to travel overseas, even for the most complex procedures.

Once all facilities are operational, come 2019, King's will be serving a catchment area of hundreds of thousands of patients every year. In addition, we will be creating jobs for UAE-based healthcare professionals as well as for international doctors wishing to come to the UAE and be part of King's expanding footprint.

We already have a stellar line up of world leading experts from King's in London and its partner hospitals, who will visit patients in the UAE every four to six weeks as part of our unique 'London Faculty Programme'. During the intervening period, their day-to-day involvement with our UAE-based doctors and patients is maintained through telemedicine and through our local clinicians.

## King's is really championing primary healthcare in the UAE and the role of the Family Medicine Consultant. Why is this?

We believe that primary healthcare is the answer to some central problems that affect the UAE healthcare industry. Family Medicine Consultants can significantly help improve patient care outcomes and reduce medical inflation.

Often, when UAE residents have common medical ailments, they prefer to visit a specialist, rather than first visit a Family Medicine Consultant, also known as a general practitioner (GP). The common misconception is that by going to a specialist first, people will save themselves the time and money of an extra visit paid to the Family Medicine Consultant, and will get to the treatment quicker. However, in order to determine which specialist to visit, people self diagnose themselves.

Research shows that 72% of people self-diagnose, yet the chances of getting the diagnosis right are fairly low. In the eventuality of a misdiagnosis, patients don't get the right treatment as early as possible, delaying recovery. Also, a patient's condition could worsen, and their recovery may be slower, making the patient experience complicated and unpleasant. ▶

An extra visit is, after all, not all that time-consuming; especially as the Family Medicine Consultant is the most qualified clinician within a clinical setting, fit to triage and refer the concerned patient to the right specialist, making a patient's journey to better health much quicker and smoother. People should think of their Family Medicine Consultant as their health champion. Not only will he or she be able to coordinate the care the patient needs across specialists and help them make the right decisions following specialist visits, but he or she will also help manage their condition from a holistic point of view.

A Family Medicine Consultant will also educate patients about prevention and remind them of important health screenings and vaccinations. He or she is also the clinician who will know a patient's full medical history (and his or her family's history if they also visit them), and will help them make better informed decisions when prescribing a treatment.

Last but not least, patients' medical choices affect the whole health ecosystem. Visiting multiple specialists for the same medical ailment leads to unnecessary costs for insurance companies, who find themselves having to increase medical premiums and decrease benefits. According to the Health Authority Abu Dhabi (HAAD), in Abu Dhabi people undertake - on average - 14 visits to solve a common health problem. We estimate that if this number was reduced by one visit, it could save insurance companies AED600 million.

### **What is driving up medical inflation?**

The UAE's medical inflation rate generally ranges between 13% - 20%. There are many contributing factors, such as science and innovation, as ground-breaking developments come at a high price due to the investment needed in research, development and training. You also have a soaring prevalence of lifestyle diseases - diabetes, cardiovascular diseases, obesity and so on - the burden of which add enormously to medical expenditures.

Then you have over-utilisation. There is a tendency for some UAE providers to over treat and over prescribe, with a massive impact on inflation. On the other side of the coin, there is often a patient mind-set that, unless you walk out of a doctor's appointment with a big bag of medication, then you have not been treated properly. Often, quite the contrary is true.



*Neil Buckley, Chief Operating Officer,  
King's College Hospital (KCH), UAE*

This is where evidence-based medicine can help. King's is a fantastic example of placing evidence-based medicine at the core of its business model. We follow strict governance guidelines working closely with King's in London, adhering to evidence based NICE (National Institute for Health and Care Excellence) treatment protocols that form the framework of our patient care. That means that we only treat patients using best practice for what is presented in front of us and nothing more. We refuse to over prescribe, which seems to be the fashion of the day. According to our research, 32% of UAE residents feel their doctors over prescribe. At King's, only one in four patients will be prescribed medication compared to the industry average of four in four, and what's more interesting is that over 50% of what we prescribe are generics.

We take all measures to maximise the chances of successful outcomes, fewer complications and fewer corrective procedures, and this practice is being extremely well received by insurers, brokers and most importantly, patients. What's best is that by the efficient use of healthcare providers that practice evidence-based healthcare, individuals, companies and the government can and are taking control of their medical costs.

Without this, we need to recognise that ultimately, there is only one loser in the end and unfortunately, that is the patient. Medical inflation comes at the price of higher renewal rates and often employers find themselves having to downgrade their employees'

health coverage, or even changing insurance providers, often resulting in stripped out health benefits for employees.

In order to stop this, we need change on many levels: regulator, provider, corporate and the patients themselves. By doing this, the end result is enhanced patient care and a more effective and efficient system with the flexibility to redirect funding towards other public health priorities, such as cancer treatment and research, awareness campaigns for obesity or diabetes, upskilling local talent or more medical infrastructure.

### **With rising medical inflation costs, how can providers, like yourselves, help control costs?**

Again, this is where evidence-based healthcare really comes to the fore. More importance needs to be placed on practicing evidence-based healthcare across the UAE. I'd like to give you a few examples of how evidence-based healthcare can help with cost containment and combating medical inflation.

Let's start with upper respiratory tract treatment protocols. King's estimates that if all uncomplicated upper respiratory tract infections are treated using the same protocol guidelines that we use, then the savings to the economy could be above AED1 billion given the prevalence of these conditions.

I'd like to give an example of how reducing elective procedures can help. King's encourages natural births. King's in London has a 17% elective C-section rate compared to the current industry average rate of 25% in the UAE; our target is 18-20%. The expectation is that there will be approximately 77,000 babies born in the UAE in the year 2020. If all providers took the same approach to reduce their percentage of C-sections to 18-20% while considering the wishes of the mother, this would represent an estimated cost saving to the economy of AED 305 million in 2020 alone.

Aside from evidence-based healthcare, there are many ways providers can help. Advocating for better use of primary care systems and educating patients on the importance of the Family Medicine Consultant as your 'health champion' are key changes I'd like to see across the industry. Ultimately, if we all do our part, when extrapolated out, these changes can make a big difference and add up to great wins for the UAE's health and economy. **AH**

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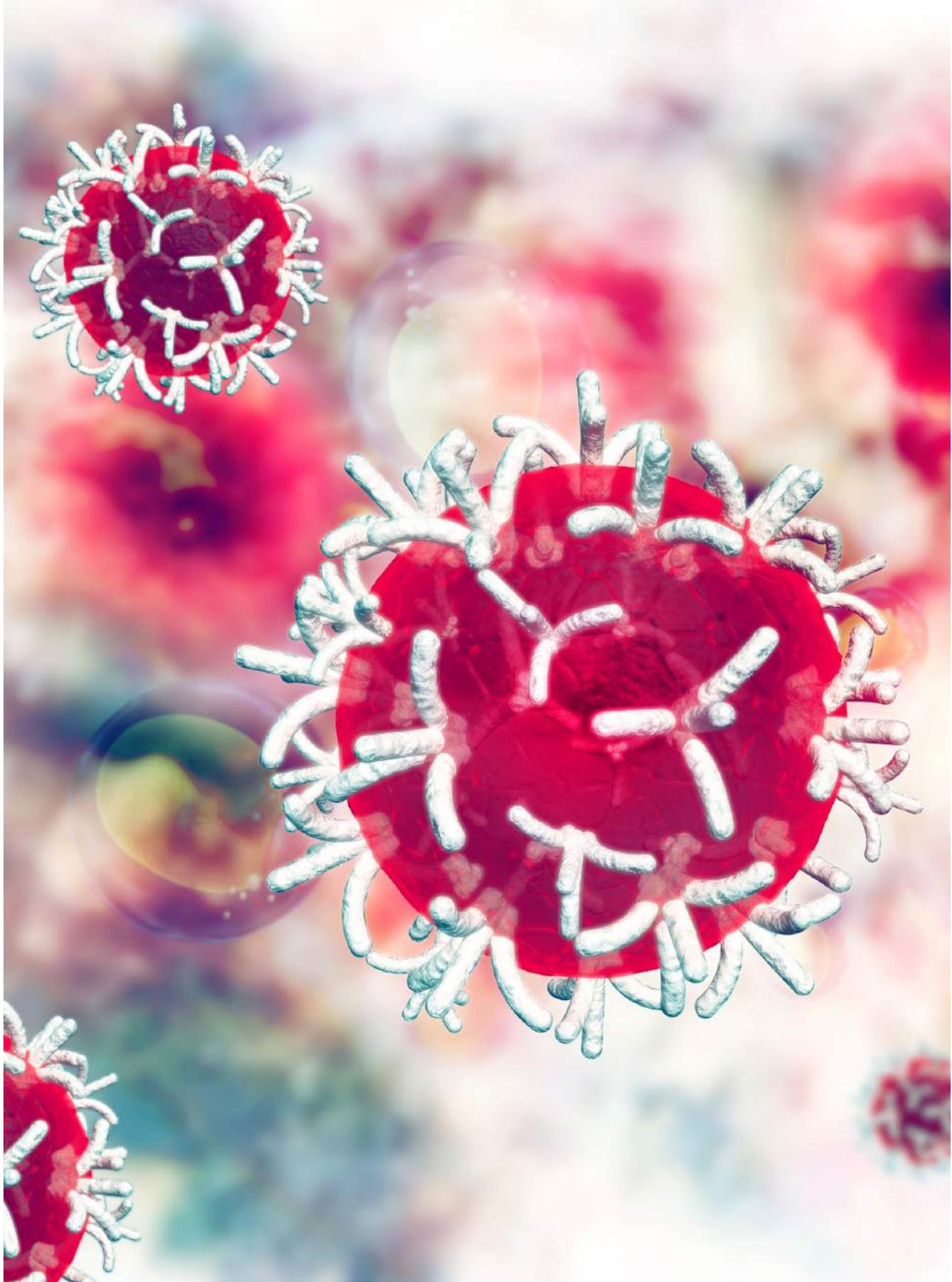
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# DATA DRIVEN DECISIONS IN CANCER CARE:

How using analytics on EMRs and biomarkers will improve patient outcomes

**By** David Ku, Associate, McKinsey & Company, Silicon Valley; Jonathan Usuka, Senior Expert, McKinsey & Company, Southern California; Arnaub Chatterjee, Senior Expert, McKinsey's North American Knowledge Center; Ziv Yaar, Partner, McKinsey & Company, Boston; and Björn Albrecht, Partner, McKinsey & Company, London and head of McKinsey's Cancer Center.

**EMR- and biomarker-based diagnostics are no longer novel in oncology, but ubiquitous. As this data environment is advancing, however, several factors hinder greater use of automation and analytics-driven decisions. This paper examines these limitations and suggests solutions. Addressing these challenges will unlock a new era in cancer patient outcomes, focusing the impact of the rapidly expanding arsenal of therapies available to an oncologist on mutation-based combinations derived from expanded diagnostics.**

**T**he development of oncology treatments has grown rapidly over the last two decades. The number of active compounds in clinical development quadrupled between 1998 and 2018, and nearly doubled in the last decade alone, with more than 1,600 compounds reported today in phase I-III clinical trends data.

At the same time, an unprecedented amount of data is being generated, stored, analysed, and consumed in healthcare. This data is coming from a variety of sources, including patients, providers, pharma companies, and payers. More than 13 million electronic medical records (EMRs) exist for cancer patients in the United States alone.

In addition, the global market for next generation sequencing is expected to grow by 21% annually from 2017 to 2022. In particular, the cancer biomarker market is projected to reach about USD20 billion in 2022 from about USD11 billion in 2017, driven by lower sequencing costs, increasing diagnostic applications of biomarkers in oncology, and a paradigm shift to one-test-one-patient.

In this environment, data use in oncology is exploding across all dimensions. Half of all drug submissions for Health Technology

Assessments (HTAs) now use Real World Evidence (RWE), payer spend on data and analytics has grown 20% annually in recent years, and several new oncology data aggregators have emerged with backing from major venture capitalists and partnered with large pharma companies. In one example, large healthcare technology companies have developed cloud-based platforms in oncology informatics to assist with treatment decisions and promote guideline adherence. Also, select in-vivo diagnostics companies have established partnerships with top biopharmaceutical companies to develop decision-support systems, including a dashboard for oncology care teams with combined in-vivo and in-vitro diagnostics to align on treatment decisions.

In addition, rising technologies like liquid biopsy allow minimally invasive, repeated testing along the treatment cycle that complement tissue biopsy. Ultimately, these technologies may allow for screening and early detection for high-risk patients with established biomarkers. Recent approvals of biomarker-based, indication-agnostic treatment and liquid biopsy companion diagnostics in oncology – for example, the US Food and Drug Administration (FDA)

has approved the Epidermal Growth Factor Receptor (EGFR) detection test – are milestones of precision medicine. Further, detection of measurable residual disease (MRD) enables greater sensitivity to assess response to treatment, detects relapse, and can accelerate decisions.

Finally, there is a large ongoing effort to aggregate data and generate insights by creating bigger and more comprehensive and longitudinal data sets of oncology patients. Several oncology analytics partnerships are already demonstrating how individual efforts around genomic data or clinical data can combine to generate valuable insights. Also, large provider systems and academic institutions have been developing aggregated data positions with patient consent.

Amid all of this activity in oncology – from clinical development to data aggregation – a dizzying array of treatment options and pathways is emerging. Compounded by the rising costs of these technologies, a compelling opportunity arises for systems and machines that are robust and sophisticated and can help medical professionals untangle the growing complexities of oncology care.

Emerging challenges in cancer care

The increasing complexity of immuno-oncology (IO), greater stratification of cancers, and a proliferation of biomarkers will make it impossible for physicians to keep pace, making optimal clinical decisions more and more difficult. IO is an experiment of unprecedented diversity, scale, and complexity. For example, the number of companies sponsoring trials for PD-(L)1 or CTLA-4 grew 70% a year between 2011 and ►

2018 and the monthly diversity of major tumour indications remains high, with about 43% of major tumour types having new cohorts launched each month.

Two factors are pushing the increased complexity of patient-specific biomarker information: the switch to multigene panels and the gradual lessening of reimbursement challenges. While companion diagnostics that guide therapeutic decisions directly remain the most frequent use of biomarker generation, new emphasis is being placed on multigene panels rather than single biomarker characterisations, with 83% of oncologists using multigene panels. Payer coverage of companion diagnostics is expected to expand and drive biomarker growth, as well, yielding greater opportunities for quantifying patient response in a multiple-mutation context. Indeed, already companion diagnostics are relatively common, despite a difficult reimbursement environment: only 38% of managed care organisations (MCOs) cover FDA-approved companion diagnostics.

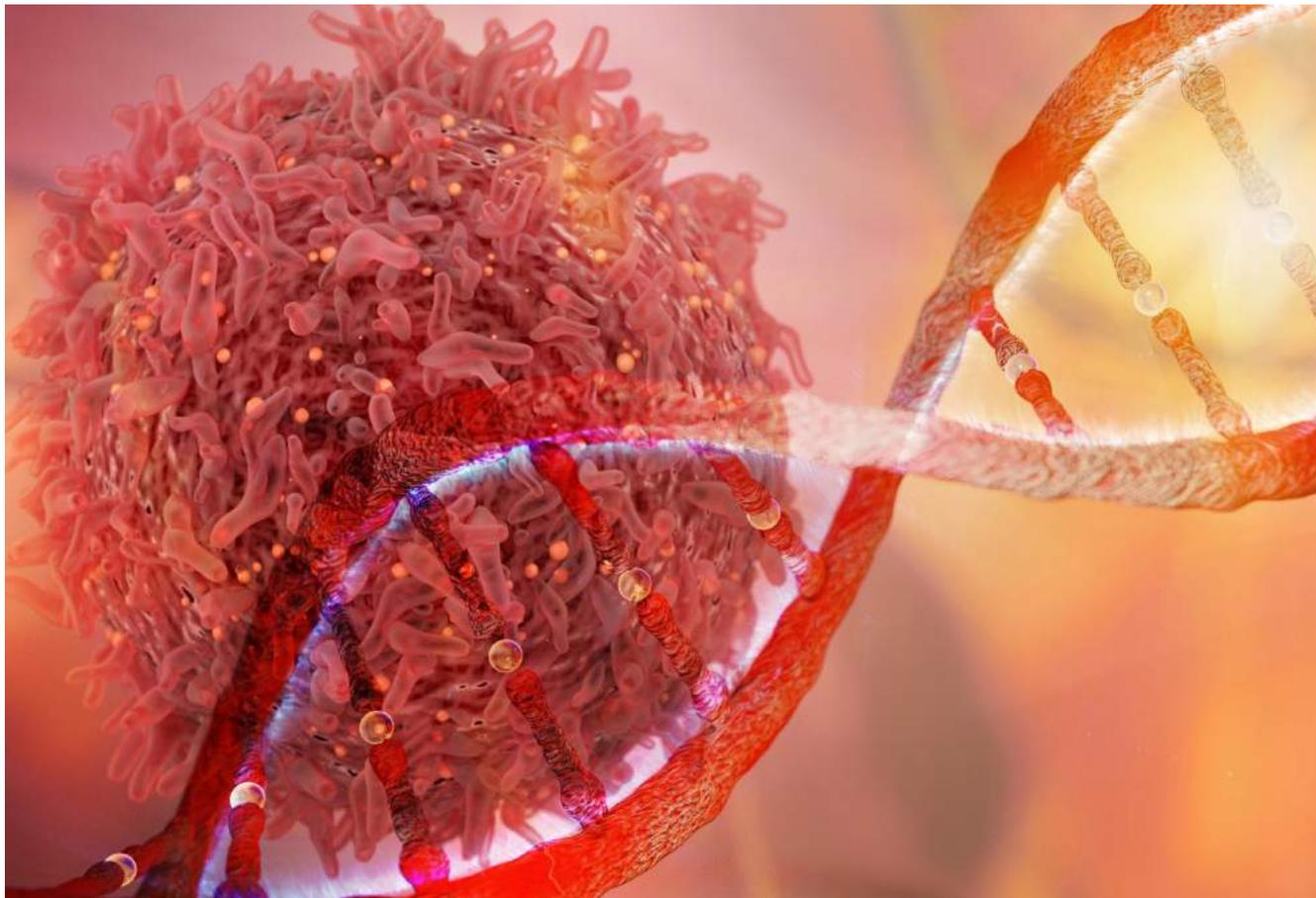
Taken together, these factors will

provoke a data avalanche for physicians. But even as the complexity of biomarkers becomes overwhelming for physicians, oncologists are still actively seeking novel treatment opportunities. For instance, in a recent survey, 50% of oncologists said they would pursue beyond the label usage of a therapeutic that matched the patient's biomarker results, for instance EGFR mutation.

Data illiquidity adds to the difficulties in making optimal decisions. Although 97 percent of oncology practices use EMRs, only 10% of practices had EMR interoperability with hospitals in 2018, down from about a third in 2016. The gap creates challenges for implementing learning algorithms for the best care. Additionally, oncologists are increasingly open to automated analytics, with about a third using physician-decision support (PDS) tools. Still the report showed oncologists remained isolated from the clinical flow of information, with fewer than one in four oncologists that use PDS tools reporting access to a PDS system integrated with their EMRs.

Without EMR integration, oncologists face challenges that limit further adoption of PDS tools. Integration allows PDS tools to detect novel clinical signals and improve predictions using machine learning, a benefit greatly desired by oncologists. Integration also enables PDS applications to help oncologists visualise expected outcomes. In isolation, analytics can only deliver static results that are limited primarily to data from clinical trials with long periods needed to incorporate RWE. And finally, integration can help resolve data quality issues that plague PDS tools. Without it, patient data must often be entered repeatedly, adding to the burdens on the practice and increasing the chances for data-entry and clinical errors and the risks of liability.

Practices also face a shift in patient channels, with younger oncologists opting for online patient portals and older ones relying on email. As portal use becomes more common, these online channels will become a rich source of patient response data, complementing EMRs. Portals are particularly well-suited for data analysis and



learning algorithms at scale.

This growing wealth of information provides new opportunities to create evidence-based treatment options. For example, panels that produce additional data over genotyping assays would be useful for exploratory understanding of disease mechanisms. Integration with EMR and communication portals would define machine learning approaches to predict patient response. And patient-provider communications would enrich the biological and clinical data needed to understand real-time patient outcomes.

Of course, automated decision-support analytics tools bring challenges as well as opportunities. PDS tools cannot be interpreted as recommending a therapeutic course that has not received FDA support. On the other hand, clearly linking available therapeutic options and biomarker results expands the options for life-saving therapeutic usage as clinical science and regulatory submissions catch up.

### Teaching machines to learn from oncologists

Data-driven decisions can improve the outcomes for oncology patients, and to deliver these benefits quickly the broad oncology community should work together. Four measures in particular could prove very powerful.

### Use biomarker data appropriately and transparently

Biomarkers have been at the forefront of oncology research and development and are expected to become requisites for the field. Combining biomarker data with clinical information in EMRs would identify complex genetic signatures linked to patient responses. Ultimately, larger sample sizes will produce phase IV-quality data and enable algorithms to be trained in a patient-care setting, with results that can be submitted to regulatory agencies and payers.

Rigorous, yet practical methods and practices are needed to define and standardise the collection, analysis, and reporting of real-world biomarker data. Today, many RWE analytics are strictly retrospective and observational, both of which are problematic. Further, any recommended decisions must be susceptible to robust analytics to confirm that data

methods eliminated biases, controlled for quality, and allowed for the appropriate incorporation of disparate data sources. In addition, patient data collection, storage, and use must comply with increasingly stringent data privacy laws, such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States and the General Data Protection Regulation (GDPR) in the European Union.

### Integrate oncology decision support with the EMR

A range of capabilities will be needed to build a broader analytics platform that integrates oncology decision support with EMRs, crucially real-time data ingestion. Clinical data must be scrutinised through Health Level Seven International (HL7)-compliant interfaces and EMR-specific applications. Integration would reduce or eliminate redundant data entry and provide up-to-date information and knowledge for decisions.

At present, several burgeoning Fast Healthcare Interoperability Resources (FHIR)-enabled tools link to EMRs. Researchers at the University of Washington and Vanderbilt University, among others, are designing applications to visualise genomic information in real-time, using the FHIR standard to interface with data in EMRs. Early tools can already compare a patient's genome against a distribution of thousands of other patients with links to external databases.

Oncologists will also demand that insights are displayed intuitively through effective visualisation in the EMR. The ability to visualise a patient's expected clinical outcome for a certain therapy based on clinical trial RWE data is of great interest, with 74% and 73%, respectively, of oncologists rating the two features as very important. Not only will this enable clearer interpretation of results, it also minimises disruption to workflow, avoiding "click fatigue" as oncologists deal with a wealth of information on their screens.

### Extract meaningful data from patient-provider communications

Portals can be powerful data tools when linked to physician-decision support algorithms. Yet similar to EMR data, data from portals would require interface between communications and the PDS. Additionally, well-designed natural language processing

(NLP) tools would be needed to extract meaningful data from conversations. Once successful, a range of rich data would be available, including changes in regimen, medication adherence, patient engagement, adverse effects, and qualitative therapeutic benefit.

### Link data-driven systems to post-approval monitoring and payer reimbursement

Decision-support systems tied to the EMR should not only support medical decisions, but also track the efficacy and safety of mass-produced therapeutics in the real world. New product introductions are increasingly complicated, featuring everything from more diverse usage patterns for patients and providers through drug-device combinations to advanced coating materials. Over the past two years, multiple studies have questioned the long-term impact of therapeutics on real-world quality-of-life and survival outcomes. Drugs passed by the FDA and European Medicines Agency were shown to have little follow-up once approved. These studies had clear limitations but highlighted the need for continued monitoring of approved medicines.

In addition, MCOs can link reimbursement processes to metrics tracked by a data-driven system in oncology. This would allow MCOs to manage costs amid a proliferation of treatment options for many indications with no clear leader. For instance, about 60% of projected haematology-oncology growth will come from classes with a high or medium degree of interchangeability. Decision-support solutions could also be linked to quality improvement programmes, documenting response to therapeutics – including patient compliance, appropriate drug utilisation, and support for the Healthcare Effectiveness Data and Information Set (HEDIS) of the US National Committee for Quality Assurance (NCQA) – with enhanced sensitivity and accuracy.

Embracing these measures will unlock a new era in patient outcomes, enabling oncologists to effectively analyse and deploy the rising abundance of therapeutics, technology, and data in breakthrough cancer treatment. <sup>AH</sup>

*References available on request.*

# THE PROMISE OF PERSONALISED MEDICINE

A key performance indicator of the UAE National Agenda is to reduce cancer fatalities by almost 18 per cent by 2021 and precision medicine is all set to play a key role in facilitating this goal

By Deepa Narwani, Contributing Writer

According to the latest statistics released by the Health Department of Abu Dhabi, the UAE government has indicated that every year, an alarming 4,500 new cases of cancer are reported in the country. In 2016, cancer was the prominent cause of death in Abu Dhabi and Dubai at 12.8 per cent and 17.9 per cent respectively, which highlights the increasing demand for oncology services in the UAE.

World Health Organisation (WHO) reports state that cancer incidence in the Middle East region including the UAE is on the rise with the number of cases expected to double by 2030.

Dr Gireesh Kumar, Senior Manager, Healthcare and Education, Knight Frank consultancy told Arab Health: "Breakdown of healthcare expenditure by disease type is not available in the public domain in the UAE, which is why it is not possible to comment on the current and forecasted government spend on oncology. However, we know that that healthcare expenditure is forecasted to increase from Dh59.2 billion in 2016 to Dh78.1 billion by 2021."

Recently, the Dubai Health Authority (DHA) announced the launch of the Basmah

initiative, making Dubai one of the first government entities in the world to provide a complete spectrum of care from screening to treatment for three types of cancer. "It is an initiative of the DHA's Health Funding department and under this, the basic benefit plan of the Dubai Mandatory Health Insurance Scheme now covers screening as well as treatment of breast, colorectal and cervical cancer," he added.

However, due to the increase in demand, the UAE government has also started encouraging the private sector to increase their participation in primary care and preventive medicine, which could result in early detection and reduced incidence, mortality and survival of oncology cases for residents.

Dr Kumar commented: "In addition, the private sector should consider increasing their presence in the oncology sector, especially now as oncology cover is part of the mandatory insurance package. This would aid in reducing the burden on public sector and capture a significant portion of the patients travelling abroad for care.

"The national population are usually treated for cancer at public sector hospitals

at the government's expense. Historically, non-nationals would look to relocate to their home countries or alternate jurisdictions for this treatment. The mandatory health insurance law of Dubai requires a minimum cover of Dh150,000 for oncology services and presents a case for the private sector to increase its presence in this sphere. As a result, we may see private sector participants gradually entering the oncology sector."

A key performance indicator of the UAE National Agenda is to reduce cancer fatalities by almost 18 per cent by 2021.

Some of the private sector initiatives seen in this regard include the third edition of Zulekha Healthcare Group's 'Screen and Survive' campaign. From March 12 to till April 30 this year, the campaign offered free screenings that were open to the public. Furthermore, a recent report highlighted that to boost the local pharmaceutical industry, the UAE has started manufacturing 24 different types of drugs for cardiovascular diseases, cancer cases and antibiotics that were low in demand in the world or discontinued 25 years ago but could lead to a shortage in the UAE.

## Breakthrough in treatment

A surge in global incidences of cancer has shifted the priority of researchers worldwide to understand its underlying cause. Globally, nearly 1 in 6 deaths is due to cancer and according to the World Health Organisation (WHO), 8.8 million people died from cancer globally in 2015. These disturbing trends have led to numerous studies, clinical trials and tests being undertaken to identify methods of early detection and prevention.

Generally, when a person is diagnosed with cancer, they usually receive the same treatment as others who have the same type and stage of cancer. These include a combination of treatments including surgery, chemotherapy and radiation therapy. Several studies have found that different people may respond differently to these treatments because a patient's tumours undergo genetic changes that cause cancer to grow and spread, debunking the 'one-size-fits-all' model.

These studies have led to the development of precision or personalised medicine, which is an approach to patient care that allows doctors to select treatments that are most likely to help patients based on the genetic understanding of their disease. The aim of personalised medicine is that treatments should be tailored to the genetic changes in each person.

Dr Kumar explained, "The latest advancements in oncology, such as personalised medicine and immunotherapy, are very exciting and will aid in reducing the incidence and improve the prognosis of cancer. Personalised medicine may be considered as the first deterrent to cancer as it helps in prevention of the disease and its recurrence. On the other hand, treatments such as immunotherapy, boosts the body's natural immunity to fight cancer."

Aided by advancements in technology, personalised medicine has seen a rapid growth. In a 2017 report, Allied Market Research valued the market at \$3.5 trillion in 2016 and estimated that it will reach \$7.7 trillion by 2023, with a CAGR of 11.9 per cent from 2017-2023.

The landscape of cancer care is evolving quickly as a result of the technological advances in next generation sequencing and bioinformatics. According to Minetta

## HIGH INCIDENCE RATES

In the UAE, some of the highest incidences of cancers among men were observed to be the following:

- Leukaemia
- Colorectal carcinoma
- Rectal carcinoma
- Non-Hodgkin's lymphoma
- Brain carcinoma

In females in the UAE, the top five cancers were observed to be the following:

- Breast (occurs 10 years earlier than the world average as highlighted by the Arab Genomic Centre)
- Leukaemia
- Colorectal
- Thyroid
- Uterus



*Dr Gireesh Kumar, Senior Manager, Healthcare and Education, Knight Frank consultancy*

Liu, Medical Oncologist and Translational Researcher at Mayo Clinic Rochester, the expanding knowledge of tumour biology is fuelling parallel advances in drug and biomarker development. In this regard, coordinated multidisciplinary efforts are needed in order to translate these advances into routine clinical care.

She said: "Mayo Clinic and its Center for Individualized Medicine are supporting large scale efforts toward that end. For example, the Immunotherapy with Precision Biomarkers (IMPRESS) study is designed to discover and verify new biomarkers to determine who will truly benefit – or experience significant toxicity – from any of the growing number of

immune-oncologic agents approved in the US to treat such malignancies as melanoma, nonsmall cell lung cancer, colon cancer, breast cancer, lymphoma, and bladder cancer. In addition, a protocol has been launched at the Mayo Clinic that allows for the analysis of tumor specific DNA, RNA, and protein from an individual patient's tissue and blood; the selection of targeted agents based on the genomic and proteomic findings; the "treatment" of ex vivo microcancer models derived from that patient's tumour with the selected agents; and then the administration of the agent(s) with the most prominent activity to the patient him/herself. These and other activities will help us to fulfil the promise of personalised medicine in the near term."

Factors such as Big Data will also impact personalised medicine, which makes use of variations in consumers' genes and lifestyle to guide the treatment of diseases and enables health systems to process large amounts of data to tailor personalised treatments that deliver better outcomes. For instance, Philips is using the US-based cancer research institute Dana-Farber Clinical Pathways to develop a cloud-based precision medicine platform that will help oncologists identify appropriate treatments.

Even though the future of personalised cancer treatments looks promising, not all types of cancers might have this option. However, despite certain challenges in its implementation, personalised medicine has the power to potentially revolutionise healthcare.

"These treatments will definitely change the state of cancer treatment in the country," stated Dr Kumar. "The UAE is in the process of introducing such services, which can currently be classified as being in the nascent stage, which is why information is limited.

"In my opinion, tech advancement and telehealth will improve the availability of oncology services. Healthcare service providers may choose to engage with international oncology specialists to introduce the service line in the country (for both screening and diagnosis). In addition, patients will be able to obtain a second opinion from foreign experts rather than travelling to the doctor's domicile in this state." **AH**

# UAE's nanomedicine and ultrasound cancer therapy project wins healthcare award

By Arab Health Magazine Staff

Prof Ghaleb Hussein, a research grant recipient of the UAE-based Al Jalila Foundation, has been recently honoured with the Technology and Innovation Pioneers (TIP) Healthcare Award instituted by the UAE Ministry of Economy and the Department of Economic Development in Abu Dhabi to accelerate the development of technology and innovation in the UAE.

Speaking about his winning research project, Prof Hussein, Principal investigator in nanomedicine and ultrasound cancer therapy project at American University of Sharjah, and associate dean of graduate affairs and research, says: "Under conventional chemotherapy, drugs spread

throughout the body, acting upon and killing all kinds of fast-growing cells. This means that hair follicle cells, cells in the stomach linings, and white blood cells also get affected in addition to cancer cells. Our multimodal treatment encapsulates the drugs in a lipid capsule with a target that specifically identifies biomarkers on cancer cells. Once the drugs are injected, they look for the biomarkers and gather around the cancer cells. We then apply an ultrasound to open up the lipid capsule and release the drug only at the targeted site. Our project is still in the pre-clinical stage but should be market-ready in five to seven years."

Current practice in chemotherapy requires

the use of high drug doses to increase its effectiveness on tumors, which also results in detrimental side effects on healthy cells. These side-effects significantly decrease the quality of life of the patient and result in life-threatening conditions.

Since the inception of its research grant programme in 2014, Al Jalila Foundation has awarded 76 research grants and 9 fellowships investing AED 20 million to advance medical research in the UAE.

In 2017, it awarded 21 seed grants and 6 fellowships to UAE-based medical researchers for projects in 5 research priorities: cancer, cardiovascular disease, diabetes, obesity and mental health. **AH**

## Cancer Care: Clinical and Research Is Rapidly Transforming Our Ability To Benefit Patients

Article provided by Professor James O. Armitage, MD, Nebraska Medicine

One poignant thing about being an oncologist for many years is remembering patients you saw in past years whose outcome might have been much different if only they had been diagnosed a few years later. Clinical and basic research is rapidly transforming our ability to benefit patients.

When I began practicing medicine, patients with Hodgkin lymphoma or the aggressive non-Hodgkin lymphomas who did not respond to standard therapy were doomed to die of their disease in almost every case. However, one of the exciting part of my career was being involved in developing autologous bone marrow transplantation as a treatment for these patients. Instead of palliative care, patients had a chance for a curative option that was successful in many of them. Had these patients we cured been diagnosed earlier, they would have missed the chance for this new treatment approach and would have died of their lymphoma.

Years ago, I regularly cared for patients with multiple myeloma. This was one of the most difficult of all the hematologic malignancies.

The standard treatment was a combination of *mephalan* and *prednisone*. Most patients did not have striking benefit and the median survival was approximately 2-3 years. The patients suffered greatly from fatigue and bone pain. I felt it was one of the most frustrating illnesses to see. However, if those patients would be diagnosed in this decade they would benefit from numerous new agents that have turned multiple myeloma for many patients into a chronic disease. The median survival is now on the order of 10 years and most patients are well and functioning normally during most of that time.

Clinical research, such as that being done at the University of Nebraska Medical Center/Nebraska Medicine (UNMC) and other similar institutions around the world, really matters. Not every new idea works, and sometimes doing these studies is slow and frustrating. However, if one stands back and looks at the impact this has had upon our world, the results are heartwarming. There are many people alive today because of the results of clinical studies in treating malignancies, and some of the diseases that are today almost always fatal will

not be as a result of work that is being done right now. To have advantage of "cutting-edge" knowledge and research, it is important to receive care or be seen for a consultation at an institution involved in clinical research in cancer.

Nizar Mamdani, executive director of UNMC's International Healthcare says, "Dr Armitage and his expert team are remarkable examples of the caliber of specialists and researchers working tirelessly to help provide better treatment options. Through collaborative strategic partnerships with 133 institutions in 45 countries, we continue to provide innovative treatment options, as well as specialized tele-pathology and second opinion services."

"The relationships Nizar describes are having a strong impact," according to Dr Armitage. "The ability to interact with colleagues around the world anytime to the betterment of patients is excellent."

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# Nebraska Medicine is one of the first to offer the newly FDA-approved CAR T-cell Therapy

Article provided by Nebraska Medicine

**T**houghtful, respected and consistent are words used to describe the nearly four decades of research within the lymphoma study group at the University of Nebraska Medical Center (UNMC), and its clinical partner Nebraska Medicine. These qualities are a result of leadership and teamwork that are unparalleled in the pursuit of excellence for lymphoma care.

"For the next four decades and beyond, we have a goal of maintaining the excellence and international recognition brought forth by my colleagues," says Matthew Lunning, DO, hematologist and medical oncologist at Nebraska Medicine and assistant professor in the division of hematology/oncology at UNMC. "I have championed as a clinical investigator, the continuation of cutting-edge medical research at the new Fred & Pamela Buffett Cancer Center at UNMC."

Significant advances have been made in cancer care, including the exciting change in patient care involving a technology called chimeric antigen receptor (CAR) T-cell therapy. While initially only available on clinical trials for people with refractory or relapsed diffuse large B-cell lymphoma, it is now approved by the Food and Drug Administration (FDA) for commercial use.

CAR T-cell therapies continue to be a rapidly evolving field with the goal to continue to improve on the paradigm shifting results that led to a major unmet medical need for effective therapies. Nationwide, patients with diffuse large B-cell lymphoma who have received this therapy have had continued complete remission rates of nearly 40 percent. Patients who relapse after a stem cell transplant or are not candidates for a transplant may be potential candidates for CAR T-cell therapy.

Nizar Mamdani, Executive Director

# IN THE KNOW

of Nebraska Medicine's International Healthcare says: "Our CAR T-cell expert team is a remarkable example of the caliber of specialists and researchers working tirelessly to help provide better treatment options. Through collaborative strategic partnerships with 133 institutions in 45 countries, we continue to offer innovative treatment options, as well as tele-pathology and second opinion consultation services to patients around the world."

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## Nebraska Medicine is one of the first to offer the newly, FDA-approved Chimeric Antigen Receptor (CAR T-cell) therapy.

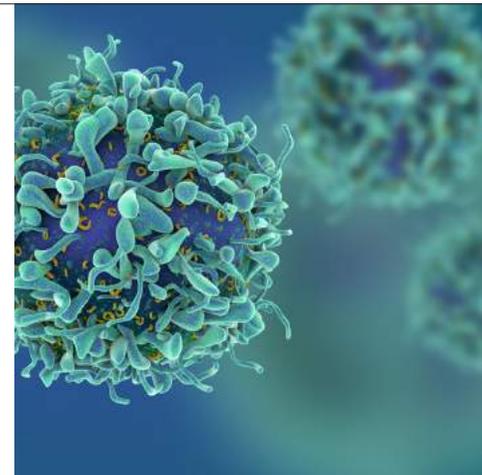


"This type of treatment can't be done at just any hospital or center in the United States. It's limited with respect to what's needed to process the cells and the specialized patient care," explains Julie Vose, MD, hematologist and medical oncologist at Nebraska Medicine and chief of hematology/oncology at the University of Nebraska Medical Center (UNMC).



### Contact the International Healthcare Services

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Phone: +1 402.559.3090  
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## Refer a patient for CAR T-cell

The CAR T-cell therapy is open to adult patients (19 years and older) with relapsed b-cell lymphomas, which is a subtype of non-Hodgkin lymphoma.

Fahad Ali, a double amputee for more than 15 years now, compares conventional wooden prosthetic legs with his new 3D printed prosthetics with Sebastian Giede, a certified orthopaedic prosthetist with Mediclinic



## 3D PRINTED LEGS OFFER NEW LEASE OF LIFE FOR EMIRATI DOUBLE AMPUTEE

Emirati Paralympic champion Fahad Mohammed Ali who had been wearing wooden prosthetic legs for over 15 years receives 3D printed transtibial prosthetics.

Article provided by Dubai Health Authority (DHA)

**T**he Dubai Health Authority (DHA) has announced that an Emirati double amputee has become the first in the region to receive 3D printed transtibial prosthetics.

25-year-old Fahad Mohammed Ali, a Paralympic champion from Dubai, who had been wearing wooden prosthetic legs for over 15 years will now walk in his customised orange 3D prosthetics.

The initiative to provide Ali with 3D prosthetics was undertaken by the Dubai Health Authority (DHA) in partnership with Mediclinic, Mercuris, a German company specialised in enabling digital prosthetics and orthotics, and Immensa Technology Labs, a Dubai-based privately-owned company specialising in the development and advancement of 3D printing.

The department of humanitarian services at the DHA fully supported and funded the initiative.

Fahad Mohammed Ali, a champion wheelchair racer and an engineer with Dubai Electricity and Water Authority (DEWA),

can now walk with the maximum feeling of anatomical function due to his 3D prosthetics. "My life has been transformed," he said.

3D printing has brought a new level of personalised patient care to the healthcare sector in the UAE. According to His Excellency Humaid Al Qutami, Director-General of the Dubai Health Authority, said, "In line with the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, the DHA has prioritised fostering the development of future technologies such as 3D printing in healthcare to provide high-quality patient-centric care."

He added, "We are keen to use this technology in the health sector to improve efficiencies, enhance healthcare management, improve overall workflows and most importantly further improve patient care. This is truly heartening as it is an example of how healthcare technology directly improves the patient's quality of life. We aim to continue harnessing manpower,

collaborating and investing in future health technologies to serve our community."

Dr Mohammad Al Redha, the Director of the Executive Office for Organisational Transformation at DHA, said, "This is a unique collaboration that allows us to see the most modern technology develop and become a reality. Our aim at the DHA is to provide patients with the best possible care and thus we are happy to bring together international and local stakeholders to work jointly on future technologies. The work we have done so far is part of the foundation of future 3D printing research and development work in the UAE."

Ali, who received the 3D prosthetics, said, "For the past 15 years I have been using regular prosthetics until I received the 3D prosthetics. My life has been transformed for the better. The 3D prosthetics make me feel like I got my legs back and it is simply incredible. I am very thankful to the leaders of the UAE and the DHA."

With more than 25 years of experience in the field, Sebastian Giede, Certified Orthopaedic

Prosthetist with Mediclinic, said, "The potential of 3D printing in the field of prosthetic devices is huge. It allows for faster turnaround times; we can get a foot customised within two to three weeks. It also provides more personalisation in terms of both design and functionality as these are designed using lightweight and strong materials. It also provides greater flexibility when it comes to replacement. The functionality of 3D printed prosthetics is superior as it allows us to design completely individualised models as compared to mass manufactured prosthetics."

Giede added that every aspect including the colour can be individualised.

Ali said, "I chose orange prosthetics as it is an attractive and positive colour. I even wear shorts now as I am confident and can show off my prosthetics."

In terms of the process of designing the 3D prosthetics, Giede, said, "We conducted several 3D scans of the patient's amputated legs. After that, we used a CAD software programme to design and modify the inner shape of the prosthesis. Then the test socket was 3D printed so that we could use it on the patient to control the size and make changes that will help provide the patient with maximum comfort and functional alignment."

Dubai-based Immensa Technology Labs, the UAE's leading Additive Manufacturing (AM or 3D printing) company, provided the test socket and final socket, which is about 40 per cent of the 3D prosthetics.

Fahmi Al Shawwa, CEO of Immensa Technology Labs, said, "3D printing technology provides a massive opportunity for Dubai to become competitive across various sectors including medical and we are proud to be working with the DHA and Sebastian Giede to realise this potential. Immensa is investing heavily in developing 3D printing capabilities and knowledge in line with the 'Dubai 3D Printing Strategy' and we believe that we need to see more private sector participation and involvement to fully capitalise on this technology on a wider UAE scale."

The rest of the 3D prosthetics were provided by Mecuris, a German company that combines existing industrial 3D technologies like 3D scanning, 3D data processing and 3D printing into an innovative process of digital tailoring for orthopaedics.

Manuel Opitz, CEO of Mecuris GmbH Germany said he is delighted about the professional and visionary collaboration between Mecuris, Mediclinic and DHA. "We team up

with medical professionals to co-create - with users and wearers - customised O&P products. This now is the second time we have worked together. With partners like this, boundaries are non-existent and the patient's needs and preferences are at the centre of a truly individual care, enabling us to enrich the wearer's life."

Giede constructed the prosthetics in Dubai. He said, "We are proud that we were able to provide Fahad with 100 per cent customised 3D printed prosthetics that provides a natural feeling of anatomical movement to the maximum extent possible."

This is the second time the DHA has collaborated with Mediclinic and Mecuris for 3D prosthetics. In 2017, the Authority and Informa Life Sciences collaborated with them and with Prosfitt to provide a Dubai resident

with a 3D prosthesis.

The 3D printed prosthetic leg was donated to Belinda Gatland, a British expat who had been an amputee for more than 10 years - following a life-changing event after a horse riding accident at the age of 22. With subsequent necrosis (premature death of tissue or bone cells) leaving her in immense pain, she ultimately had to have her left leg amputated. Belinda became the first amputee in the region to wear a completely 3D printed prosthetic leg as part of the Dubai Health Authority's Year of Giving initiative in 2017.

Salim Bin Lahej, Director of Humanitarian Services Department at the DHA said that the department was proud that they were able to provide Fahad Ali with prosthetics using the most modern technology. **AH**



*Fahad Mohammed Ali, a Paralympic champion from Dubai, chose orange prosthetics "as it is an attractive and positive colour"*



## GETTING A GOOD NIGHT'S SLEEP

Sleep deprivation should not be taken lightly as it can affect everything from your memory to your immune system, heart and metabolism, warns Dr Hassan Al Hariri, Head of Sleep Medicine at Rashid Hospital.

**By** Kamakshi Gupta, Communications Analyst at Dubai Health Authority

**D**id you know we spend one third of our lives sleeping, or trying to sleep? So maybe we should dig a little deeper and look at how we can sleep better.

“Sleep hygiene is a term used to include just about anything related to your sleep habits,” says Dr Hassan Al Hariri, Head of Sleep Medicine at Rashid Hospital. “It includes

practices and habits that influence good sleep quality at night and full daytime alertness.”

Light is the most powerful influencer of the body’s circadian clock, he says. “Bright lights in the evening hours can confuse your brain into thinking it is still daytime. Artificial blue light [the type that laptops, tablets and mobile phones emit] is the worst culprit, so

get rid of these devices at least two hours before bedtime.”

He adds: “Consistency is also key for sound and regular sleep. Try sleeping and waking up at the same time on most days including weekends if possible.”

Experts estimate almost 30 per cent of the UAE population experiences insomnia for

a certain period in their life. While in most cases, insomnia fades away on its own once the person's stress levels reduce, there are cases where medical intervention is needed.

The trouble with prolonged sleeping problems is that it is a risk factor for chronic health problems such as high blood pressure, heart disease, diabetes and stroke.

Sleep deprivation should not be taken lightly as it can affect everything from your memory to your immune system, heart and metabolism, says Dr Al Hariri.

"Sleep deprivation due to medical conditions such as obesity and arthritic pain needs immediate medical intervention," adds Dr Al Hariri. "The patient should visit a primary healthcare physician who may recommend specialised treatment.

"If the person is unable to sleep for three weeks in a row and continues, it becomes chronic insomnia and treatment can be very challenging."

A study by the University of Surrey in England revealed that the quality of sleep can even have an impact on a genetic level. It found that getting less than six hours a night affected the activity of more than 700 genes associated with controlling responses to stress, immunity and inflammation.

At Rashid Hospital's sleep clinic, doctors see more than 500 new patients a year.

Given the high obesity rates in the country, about 70 per cent of the patients are affected by obstructive sleep apnea due to obesity. About 20 per cent are cases of sleep deprivation due to stress and other medical-related issues and the remaining 10 per cent are due to insomnia.

"These figures do not reflect overall emirate-wide statistics," says Dr Al Hariri. "At Rashid Hospital, we pay particular emphasis to obesity-related sleep problems and work with doctors from other departments to ensure obese patients receive early and comprehensive intervention to prevent further complications.

"Snoring is one of the first signs of sleep apnea and should not be taken lightly. The problem is usually first noticed by the patient's spouse who is disturbed by the patient's loud snoring."

He said that sleep apnea is a disorder in which one's airway becomes obstructed while asleep, causing loud snoring to a complete cessation of breathing, cardiac arrhythmias and low blood oxygen levels at its worst.

"The airway of the obese individual becomes

obstructed by large tonsils, enlarged tongue and increased fat in the neck, all pressing on the airway when the throat muscles are relaxed during sleep. Sleep apnea is a major risk factor for heart disease and stroke. It can be dangerous for the person and those around him as patients with sleep apnea can fall asleep anywhere, even while driving."

Earlier people didn't seek medical intervention for sleep problems, but with greater awareness they are slowly realising the importance of early intervention.

"It is important to discuss your sleep patterns with your primary healthcare physician as sleep is one of the fundamental pillars of good health," says Dr Al Hariri.

"Early intervention is always advisable."

In today's world, where we try to squeeze time for everything, maybe we need to wake up to the importance of sleep.

### Ways to get a restful sleep

How much sleep do you need? This could vary depending on your age and is also impacted by your lifestyle and health. In general, some of the good sleep hygiene practices to incorporate in your daily life include:

**Establish a regular routine:** Maintain a regular sleep and wake-up schedule, and try to stick to it even during weekends.

**Create a sleep-inducing environment:** Light is the most powerful influencer of the body's circadian clock and it will negatively affect your body's ability to sleep. So, keep the bedroom dark, opt for heavy or blackout curtains and wear an eye mask if needed.

**Keep digital devices away:** Do not bring papers or a laptop to bed, keep your phones away and avoid watching TV. Screen time disrupts your sleep routine.

**Avoid stimulants:** Avoid smoking close to bedtime because nicotine is a stimulant and can keep you awake.

**Restrict heavy food at dinnertime:** Steer clear of heavy, fatty or fried dishes at night as these can cause indigestion and affect your sleep quality.

**Avoid excessive sleep:** Although obtaining healthy sleep is important for both physical and mental health, it is best to avoid sleeping more than 8 hours a day.

**Limit daytime naps:** It is best to do away with afternoon naps. If you need a nap, it should be early afternoon and not more than 30 minutes.

**Restrict consumption of caffeine:** Avoid

caffeine-containing beverages and foods such as teas, sodas and chocolate six to eight hours before bedtime.

Source: Rashid Hospital Sleep Clinic

### Restful sleep for kids:

- Children need much more sleep than adults; number of hours of sleep depends on the age of the child.
- Keep external stimulants such as TV and all tech devices at bay two hours prior to bed time
- Avoid installing a TV in your children's bedroom
- If your child has regular trouble sleeping, keep a sleep chart and jot down your observations, present the details to a doctor if the problem is persistent
- Do not let weekends mess up your child's biological clock. Try to keep the bedtime and wake-up time as close to the weekdays as possible for consistency.
- During holidays, ensure that children go back to their regular sleep schedule at least one week prior to the school commencing date.
- Exercise, particularly in the day helps induce sleep
- Provide the right nutrition support: No sugar four to six hours before bedtime is ideal
- A warm bath before bedtime relaxes the muscles and helps provide a restful sleep
- Do not give chocolate/sugars to children who have restless leg syndrome, especially few hours prior to bedtime
- If your child sleepwalks, put your child back in his/her bed. <sup>AH</sup>



Dr Hassan Al Hariri, Head of Sleep Medicine at Rashid Hospital, Dubai, UAE

# Impact of Insurance on Healthcare Economics

By Vivek Shukla, Director, Healthcare & Lifesciences, Frost & Sullivan



**T**he economics of healthcare delivery in the region is undergoing a transition owing to many factors, the most significant being the increase in the number of people with health insurance. Players who are inclined to embrace change and have an insight into what underpins the healthcare costs and revenues, stand to benefit more than their counterparts who are either resistant to change or oblivious of the intricate dynamics.

**The user is not the payer:** Financing healthcare for citizens and expats has been a priority for most governments in the region. Insurance penetration has increased over the years. Steps towards mandatory insurance are being taken in Oman, the KSA and remaining emirates of the UAE [Sharjah, Ras Al Khaimah and Ajman]. The impact on the economics of healthcare is being felt in the region already. With higher propensity to consume services, patients are visiting doctors and hospitals more often. Demand for higher end diagnostic and curative services has also seen a surge in recent years and the trend will continue.

Market forces are mandating the infusion of the latest technology and higher end procedures and this will also continue. Expats who used to go back to home countries and citizens who travelled westwards for treatment earlier are now choosing to stay back and demand treatment in the country of their residence, as insurance covers it.

Overall, volumes in terms of patients, prescriptions and procedures have gone up in the areas that have witnessed higher infusion of health insurance. With increase in volume, the marginal cost of providing a service has come down, thereby impacting the overall average cost of each procedure. However, there is a likelihood of increased costs in the short run as more infrastructure and manpower will be required to serve the increased number of patients.

When healthcare costs for a person are paid by a third party, the dynamics change rapidly. The user of the service is not the payer of the service anymore. Further, the payer has incentives to save or defer the payment and be more profitable. On the

other hand, the service provider does not face much resistance from the user for payments of diagnostics, tests and treatment. This in turn, can sometimes entice the provider to overtreat and overprescribe. The interesting interplay when three parties are involved results in attempts by each of them to shift the burden of costs to another.

Hence, overall margins will stay under pressure as payers will incessantly bargain for better discounts as they grow in stature with more policies being sold. This will increase price pressures and hence providers will have to turn towards cost optimisation to maintain healthier margins.

**Cost of providing care is a game changer:** We have witnessed pressure on pricing of services by payers in the markets for the reasons stated above. Service providers are now being driven to take a hard look at their costing and cost structures to maintain margins. We reckon that providers that manage to continuously maintain lower relative costs in comparison to their closest competitors will create a deeper advantage for

### ▼ An Analysis of the Number of Physicians and Nurses Across Regions in the GCC

Physicians	2010	2011	2012	2013	2014	2015	2016	CAGR
UAE	12,632	12,708	13,987	16,087	16,669	NA	NA	
KSA	66,014	69,559	71,518	80,475	81,532	86,756	75,740	2.3%
Dubai	4,766	4,867	5,618	6,559	6,781	7,783	8,614	10.4%
Abu Dhabi	4,757	4,900	NA	6,864	7,516	8,460	8,983	11.2%

Nurses	2010	2011	2012	2013	2014	2015	2016	CAGR
UAE	24,188	25,503	27,942	31,119	33,429	NA	NA	
KSA	129,792	134,632	139,701	154,568	165,324	172,483	180,821	5.7%
Dubai	9,302	10,449	11,238	13,096	13,541	16,515	18,493	12.1%
Abu Dhabi	8,221	10,504	NA	14,235	16,577	21,733	24,915	20.3%

Source: Frost & Sullivan Analysis

themselves, provided they do not compromise on clinical outcomes and quality. This will require innovative and possibly disruptive cost structures that are difficult to replicate.

There are various models that are being tried by the early innovators in the region. Activity Based Costing to determine costs of top procedures and diagnostics has been done by a few leading players. Some are looking at reducing the capital expenditure (CAPEX) by pay per service arrangements with equipment suppliers. Outsourcing of services is on the rise. In some cases, even the core services are being outsourced.

The time and money taken to hire a skilled doctor or a paramedic and pay for their license, visa, insurance, etc. adds to the cost burden of providers in the GCC. Organisations that hire these people are beginning to look at various ways in which resources can be retained or in some instances, even outsourced. We have come across examples where a group of visiting physicians takes over the onus of setting up and running a department in a hospital on a revenue sharing basis.

**Manpower cost is a crucial component in any healthcare system:** Nearly 50% of the costs in a healthcare delivery system are attributed to manpower. The requirement is diverse; from various kinds of doctors to nurses to technicians, healthcare has always been challenged by cost and availability of manpower. The economic viability of healthcare entities hinges on how manpower allocation is planned and its costs are structured. Recently, physician engagement models in some Middle Eastern countries have undergone a change. We are also witnessing more visiting doctors and part-time physicians being hired by various hospitals. The coming years will see further

interesting changes in how healthcare organises its manpower to deliver services.

As depicted in the table below, the number of physicians and nurses in two of the largest markets in GCC has been steadily increasing over the years. We reckon this trend will continue for the foreseeable future.

**Management of working capital is critical in modern times:** Payment cycles are more relevant than ever before. Healthcare providers must keep a tight leash on the money required to run daily business, because they get paid for their services later. This also has an impact on how the vendors are paid and inventory that can be stocked. Urgent payments are gaining priority over the ones that can be deferred.

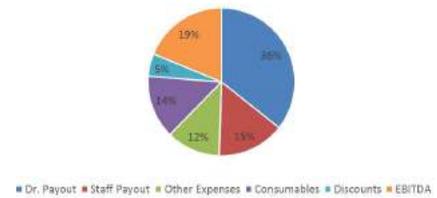
**Governments are not insulated from the change in the overall economic forces at work:** Public facilities are looking to share the burden with private ones and arrive at a balance between private and public sector participation in healthcare. For instance, there have been a series of announcements in the KSA, which indicate a shift towards the Public Private Partnership model in healthcare delivery.

Oman has also indicated its openness to private participation in some of the initiatives. Other countries will follow suit as the market evolves further.

We have also witnessed the interest of government hospitals to participate in the insurance eco-system. Governments have either started or shown interest in many instances in participating in the health insurance system and have their hospitals raise claims to payers for treating patients. This will add to the payouts of insurance companies, thus impacting the overall premium being paid to them.

### ▼ The graphic below depicts a typical structure of cost bifurcation of a hospital in the region:

Costs as a Percentage of Revenue

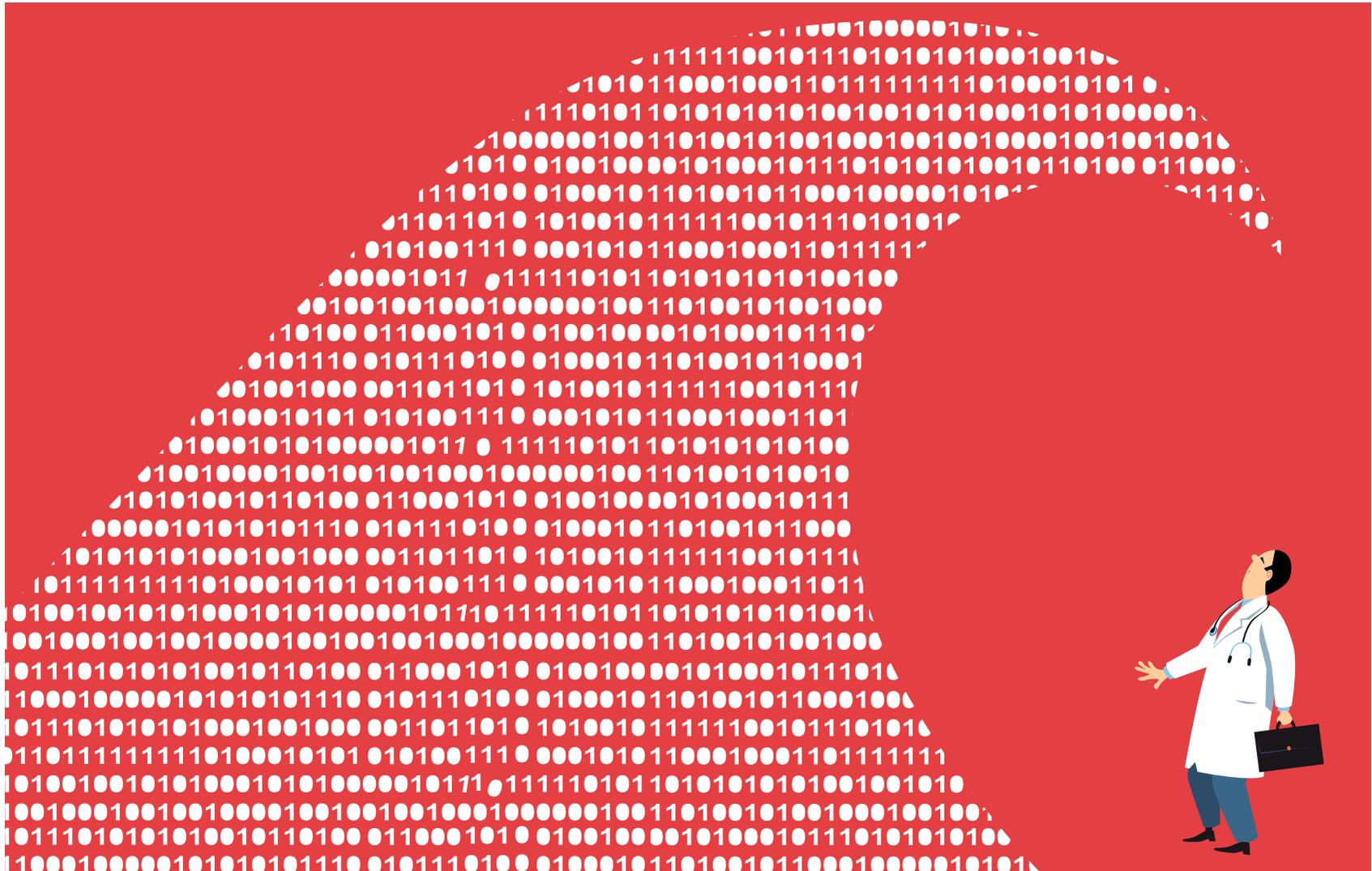


**Pharma industry is undergoing a metamorphosis as well:** Expensive branded medicines are now less preferred by payers than the cost-effective generic ones, especially in markets where insurance is playing a dominant role. With more people from the middle and lower income strata coming under insurance, this trend will amplify further. This will compel pharma companies to either focus more on generic production and distribution or innovatively engage industry stakeholders to promote branded medicines.

In short, the economics of healthcare is largely driven by the shift in the financing of care. As the transition from self-pay to third party payment continues, the eco-system will see many interesting changes in the future. Healthcare providers, payers, pharma companies and governments will need to continuously re-invent systems that they have relied upon in the past. **AH**



Vivek Shukla, Director, Healthcare & Lifesciences, Frost & Sullivan



# IMPROVING HEALTHCARE DATA MANAGEMENT

Lessons from WannaCry Ransomware – Why the Middle East Healthcare Industry Needs to Invest in Intelligent Data Management Solutions

By Gregg Petersen, Regional Vice President, Middle East & Africa at Veeam Software

The rising global threat of ransomware has become a grim reality. “WannaCry” virus, over a year ago, unleashed one of the worst and most widespread cybersecurity attacks ever seen that crippled business operations across the world including hospitals, government

offices, telecommunications, banks and other industries critical to national infrastructure. One of the most seriously impacted victims of the WannaCry ransomware attack was the National Health Service (NHS) in the UK where some hospitals were forced to cancel outpatient appointments.

If any positives can be said to have come out of the situation, it is that WannaCry has served as a wake-up call for IT departments supporting the healthcare sector globally, as the devastating impact of an advanced and sustained cyber security attack has been made crystal clear to all concerned. It cannot be allowed to be repeated.

### Cyber security and healthcare

At a time when other industries have become more sophisticated in detecting and blocking cyberattacks, criminals have begun actively hunting for new sources of valuable data and have realised there are potentially rich pickings to be found in the healthcare sector. Healthcare institutions collectively hold huge amounts of highly sensitive information on the vast majority of the population and, in some cases, their IT systems will also have links to financial services data.

When it comes to IT security, healthcare organisations have been slow to adopt the kind of preventative practices that have worked for other industries. Many medical personnel are unaware of the risks to data security (notwithstanding the traditionally strong emphasis on patient privacy in the sector). Healthcare organisations also tend to have smaller security budgets and teams than organisations operating in other sectors which brings obvious additional challenges.

As organisations in the Middle East embrace new technology to drive flexibility, cost-efficiencies and growth, it is important for Chief Information Officers (CIOs) to build secure IT infrastructures that not only withhold attack, but have backup processes in place to ensure data remains available for all who need it.

### The need for prevention

The axiom “prevention is better than cure” is as true for the field of IT security as it is for healthcare and the effectiveness that preventive action has against cyber security threats cannot be overstated. Offsite and offline backups not only mitigate the effects of ransomware, but when combined with the right security suite and employee awareness training, can help prevent the problem altogether. When it comes to security and data backups, however, the reality between what should be done, and what is happening is startling.

Veeam research suggests that only just under half of IT decision-makers test their backups on a monthly basis. Long gaps between testing can increase the chances of issues being found when data needs to be recovered. For those that do test their backups, a mere 26% test more than 5% of their backups.

There are a number of ways to externally backup data, from system disks and removable hard drives, to offline tape devices and cloud backups. Whichever option an organisation chooses, the backup repository itself must be protected against attack.

### Mitigating the impact of ransomware

There are some obvious steps that all organisations need to take to avoid ransomware attacks. Keeping all software up to date and performing a threat analysis with the security team (including penetrating testing to find any vulnerabilities) is vital.

With ransomware threats becoming more frequent and complex, organisations also need to ensure that they mitigate the impact of ransomware by adopting common best practices for intelligent data management. Once attacked, there are two courses of action; pay the ransom (with no guarantee of the recovery of the encrypted files or that a reinfection won't occur) or restore data as quickly and reliably as possible.

One of the best tried-and-trusted data protection rules that can effectively mitigate a ransomware attack is called the 3-2-1 rule which prescribes organisations should:

Have at least three copies of their data—the primary data and two copies—to avoid losing data to a faulty backup.

Store the copies on two different types of media—such as tape, disk, secondary storage, or cloud.

Keep one backup copy offsite—either on tape or in the cloud—in the event of local hazards or ransomware infections within the network.

Following the 3-2-1 rule will mean organisations always have an available and useable backup of your data and systems, and in a world where ransomware can instantly take you offline, that is a vital precaution.

### Raising awareness

Human error is the leading cause of major security breaches today. All organisations must prioritise compulsory training for all their staff and this is particularly true of the healthcare sector, where staff sometimes faced with life or death decisions may, understandably, not focus on cyber security best practices.

With the impact of high profile cyber

security breaches and attacks still being keenly felt, now is the time to seize the opportunity and ensure staff are equipped with the best levels of knowledge of the most effective preventative processes and practices.

### A holistic approach

Protecting patients' health information in the wake of attacks like WannaCry will take a highly coordinated effort among global healthcare organisations, as well as significant investments in new tools and process implementation. But the basics I have outlined above can help make a big difference in a short space of time.

Furthermore, for intelligent data management to be realised in the healthcare sector, CIOs within it will need to address the cyber risks across their organisation, not simply in one niche area (e.g., access to patient records), and be prepared to share these learnings with peers.

Today, hospitals must approach the risk of IT infections with the same level of seriousness as medical ones. Through intelligent data management, healthcare organisations can ensure the necessary processes are in place to ensure malware-based IT data infections can be surgically removed, before ever affecting a patient's life. **AH**



*Gregg Petersen, Regional Vice President, Middle East & Africa at Veeam Software*

## CPhI Middle East & Africa – Your partner for innovation & networking in pharma

Article provided by CPhI

**C**PhI Middle East & Africa is the region's most comprehensive pharma gathering. Together with its co-located events ICSE, P-MEC, InnoPack and FDF, it will host over 4,000 key visiting pharma suppliers and buyers. With a wide range of exhibitors from all across the entire pharma supply chain, don't miss out on your chance to participate at this unrivalled meeting point in Abu Dhabi.

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**When:** 03-05 September 2018

**Where:** ADNEC Centre, Abu Dhabi, United Arab Emirates (UAE)

### Who will attend?

Pharma professionals representing companies from across the full spectrum of the supply chain, both regionally and internationally. Over 60% of attendees hold key decision-making roles within their company, allowing your company to grow potential new business with the right people.

### Why attend?

*A recent CPhI report has predicted a new manufacturing hub in the Middle East*

A new report by CPhI forecasts sizeable changes ahead for the pharma markets in the Middle East and Africa over the next few years. It highlights recent regulatory changes, coupled with increased geopolitical stability and rising generics consumption as key drivers in transforming the prospects of pharma manufacturers in the region.



The CPhI Middle East and Africa report – released ahead of the inaugural edition of CPhI MEA – has identified significant opportunities for a region that is often overlooked by much of international pharma. The event will attract leaders and key decision makers of the pharma industry from the Middle East and Africa, bringing the expertise and reach of the CPhI brand to the heart of this new pharma hub. Running alongside the exhibition, there will be content sessions on the latest trends, keynote addresses, and numerous networking opportunities.

According to Cara Turner, Brand Director – CPhI Middle East & Africa at UBM, “Our report shows that there two types of market in the region, and both are likely to grow extremely quickly in the near term. The high-income economies offer excellent opportunities for innovative and branded medicines, whilst the free trade agreement between the GCC (Gulf Cooperation Council) nations will undoubtedly increase generics consumption. Additionally, high growth economies in Africa (notably Nigeria, Ghana and South Africa) also look a good bet for rapid generics growth over the next 5-years [with compound annual growth rates of around 10% each].”

Manufacturers in India look very well placed to capitalise thanks to the recent free trade deal with the GCC – a multinational partnership consisting of Bahrain, Oman, Saudi Arabia, Kuwait, the UAE and Qatar – which has significantly reduced trade barriers. Additionally, the GCC has also set in place a

drug price harmonisation strategy in order to standardise drug prices within the region.

However, due to the purchasing power and a cultural preference for domestic products, in the short term, it is more likely that Indian and other API manufacturers will be the largest beneficiary, with local companies providing the final product manufacturing.

CPhI Middle East & Africa 2018 comes with the backing of regional government and pharma associations, and is expected to attract over 250 local, regional and international exhibitors from 30 countries.

One final trend is that in light of the new opportunities, foreign direct investment by large pharma and generics companies is increasing with the goal of acquiring local manufacturing facilities.

Cara added: “International companies looking at the opportunities that abound in this region must appreciate cultural business norms. Our feedback from the market says that no matter how large a company or positive its international repute, there is a great deal of importance placed in building personal relationships with potential business partners. It’s also one of the reasons we have introduced Live Pharma Connect, a Match & Meet service, as well as a new Hosted Buyer Programme at the event to help build these new networks.”

*To register for event and to get the full report, please sign up via: [gotocphi.com/mea39](http://gotocphi.com/mea39) For more information, please visit [www.cphi.com/mea](http://www.cphi.com/mea)*

# United Arab Emirates Ministry of Health & Prevention Adopts National CCHD Newborn Screening Program Using Masimo Rad-97™ Pulse CO-Oximeters® with Eve™

Article provided by Masimo

IN  
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The United Arab Emirates (UAE) Ministry of Health & Prevention (MOHAP) is adopting a national screening protocol for critical congenital heart disease (CCHD) for all newborns. As part of the program launch, the MOHAP is equipping 9 hospitals across 5 emirates, serving 50% of the UAE population, with Masimo Rad-97™ Pulse CO-Oximeters® with Eve™ CCHD Newborn Screening Application. Newborns delivered at these hospitals will now be screened for CCHD using Eve – the first large-scale installation of Eve on Rad-97, which received CE marking earlier this year.

CCHD affects approximately 2.5 to 3 newborns per 1000 live births<sup>1</sup> and requires intervention soon after birth to prevent significant morbidity or mortality; later detection in infants also increases the risk of brain damage.<sup>2</sup> In a study of 39,821 infants, CCHD screening sensitivity increased from 63% with physical exam alone to 83% with physical exam and Masimo SET® pulse oximetry.<sup>3</sup> In a study of 122,738 infants – the largest CCHD screening study to date – CCHD screening sensitivity increased from 77% to 93% with the combined use of Masimo SET® and clinical assessment.<sup>4</sup>

Eve, also available on the Radical-7® Pulse CO-Oximeter, combines the power of Masimo SET® Measure-through Motion and Low Perfusion™ pulse oximetry with an automated pre- to post-ductal synchronization algorithm designed to reduce calculation errors. In addition, Eve simplifies the CCHD screening process by providing visual instructions, animations, and a detailed, easy-to-interpret display of screening results. The ability to label results with unique patient identifiers for both mother and newborn facilitates intuitive session management and seamless electronic charting. Eve also allows clinicians to incorporate perfusion index into screening, which has been shown to increase sensitivity to the detection of CCHD in infants with pathologically low perfusion.<sup>5</sup>

Masimo worked closely with the UAE to implement the MOHAP program, including onsite training for doctors, nurses, and midwives at each hospital. H.E. Dr. Yousif Al Serkal, Assistant Undersecretary for the Hospitals

Sector, emphasized the Ministry's strategy of "providing comprehensive and innovative health services in accordance with the highest standards of excellence, professionalism, and leadership in the health sector. The goal of the 'Newborn Critical Congenital Heart Screening Program' is to ensure that all UAE newborns are screened, and all affected infants receive appropriate confirmatory testing, counseling, and treatment to prevent complications and reduce mortality." He noted that the program has a comprehensive database and e-system for the registration of all screening test results, as well as helping to control quality and track performance through periodic reporting. Dr. Kalthoom Al Balooshi, Director of the Hospitals Department, explained that "the screening initiative will be implemented in nine main hospitals, which includes screening with pulse oximetry, a CCHD screening database, integrated EMR solutions, and awareness programs for physicians, nurses, and parents."

Jon Coleman, President of Worldwide Sales, Professional Services, and Medical Affairs for Masimo, said, "We are honored that the UAE chose Masimo to help implement this vital newborn screening process for their citizens. Masimo SET® performance and accuracy have helped to usher in reliable and cost-effective CCHD screening, as shown in the multiple studies concluding that SET® pulse oximetry, combined with clinical assessment, significantly improved CCHD screening sensitivity. We believe that Masimo SET® pulse oximetry and the Eve CCHD Screening App make for a compelling combination, and hope that more institutions and governments around the world

will recognize the importance of helping their youngest patients get a great start in life."

Rad-97 offers Masimo noninvasive and continuous monitoring, through Measure-through Motion and Low Perfusion SET® pulse oximetry and upgradeable rainbow® technology, in a compact, standalone monitor that incorporates advanced customizability, connectivity, and device integration capabilities. In addition to Eve, Rad-97 is also available in configurations with integrated noninvasive blood pressure measurement and integrated NomoLine™ capnography.

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# The future of care

At Ospedale San Raffaele, we bring together pioneering scientific research and first-class care for patients



Ospedale San Raffaele is a clinical-research-university hospital part of Gruppo ospedaliero San Donato, the leading hospital group in Italy. It has **more than 50 clinical specialties** and over 1,300 beds, and its emergency department counts 67,000 annual accesses. Research at Ospedale San Raffaele focuses on integrating basic, translational and clinical activities to provide the most advanced treatments to patients. The hospital counts on over 1,800 medical doctors, scientists and technicians and on state-of-the-art facilities and technology platforms. Ospedale San Raffaele is recognized as a **global authority in molecular medicine and gene therapy**, and is at the forefront of research in many other fields, standing out for the **deep interaction between clinical and scientific area** – this makes the transfer of scientific results from the laboratories to the patient's bed easier. Its mission is to improve knowledge of diseases, identify new therapies and encourage young scientists and doctors to grow professionally.

Ospedale San Raffaele is among the few centers in the world which **perform pancreatic islet transplantation** (i.e. the cells in the pancreas that produce insulin) to treat type 1 diabetes patients who do not respond to conventional therapies. The transplant aims at recreating the function of insulin-producing cells in a host organ (e.g. the liver). This technique has made huge progress along the years, but it still has some limits, involving immunosuppressive regimens and rejection risks like all transplants. Our researchers at **San Raffaele Diabetes**

**Research Institute (DRI) are currently studying new treatment perspectives using stem cells**, differentiating insulin-producing from pluripotent stem cells. In the future, this may allow to rely on an endless source of cells that produce insulin and to modify such cells so that the immune system does not recognize and attack them.

Our research stands out to find **treatments for genetic blood diseases**, too. Our Hematology and bone marrow transplantation unit works side by side with the San Raffaele Telethon Institute for Gene Therapy (SR-Tiget) to **find a cure to thalassemia major**, the most serious form of the disease, causing chronic anemia and provoked by a defect in the production of hemoglobin. At the time being, conventional treatment consists in regular transfusions of red blood cells associated to iron chelation therapy. Patients who can rely on a bone marrow donor and are in good condition can undergo transplantation – that is currently the unique curative therapy. Our doctors and researchers are trying to **set up a treatment to correct the defective gene causing the disease** – first, stem cells are extracted from the blood of the patient, then they are provided with the corrected gene and infused back into the patient's bone marrow. The healthy gene is carried into the cells by a genetically engineered virus which is modified so it becomes harmless. Once corrected stem cells are in the bone marrow, they start producing healthy and functional red blood cells. The treatment is currently an experimental protocol involving ten patients which showed encouraging preliminary results.

# IN THE KNOW

## Brian Bolwell, MD, on Challenges Leaders Face in Academic Medicine Cleveland Clinic Cancer Center Chairman discusses his leadership style

Article provided by Cleveland Clinic

### Q: What is serving leadership and why do you believe it is important?

**Dr Bolwell:** Serving leadership is more of a viewpoint. It's a belief that the team is more important than the leader as an individual. And that core belief leads to what I think are the central tasks of a good leader. First, you have to set and communicate a clear vision. That is harder than it sounds, especially since that vision tends to evolve over time as mine has for Cleveland Clinic Cancer Center.

Your next job is to be very involved in the process of recruitment. You want good people who understand or who are willing to understand the vision. Then, give them what they need to succeed, and remove barriers. Addressing challenges, which frequently are political, is a huge part of being a serving leader.

And if you do these things, your team will succeed. And that success needs recognition, and as a leader, you should be enabling but not participating in that recognition. It's not about you.

### Q: What's unique to leading an academic medical center?

**Dr Bolwell:** Academic medicine rewards people who celebrate their own work. That's how you get grants, that's how you get promoted. Success is defined by individual accomplishment. But if you are a serving leader, success is defined by the team. Those are two very different things.

I think that often in academic medicine, people who excel individually are elevated into leadership roles that require very different skills, skills that aren't practiced or rewarded in individual careers. Frequently, leaders in our field don't do as well as they otherwise could because they've historically been rewarded for individualistic work. And that in my mind is exactly the wrong thing to do as a leader of a big organization.



Image credit: Russell Lee Photography

Leadership is not about your own personal success. I've frequently said that I don't think a leader should be first author on any paper once they have a leadership position, and I really believe that to be true. But that's very hard for a lot of people to do. But if you're going to lead successfully, you've got to let other people do that.

You've got to be okay recruiting really good people, even if it means that your own personal recognition will diminish.

### Q: How do you go about setting a vision for an organization?

**Dr Bolwell:** You've got to demonstrate to everyone what your own personal priorities are. Our focus is the delivery of great clinical care in a compassionate and empathetic way, and it's my job to keep that front and center. It's our single most important priority, and that's why we care so much about access.

You also need to build a culture around those priorities. One of the things we do is circulate patient stories to everyone who works in the Cancer Center, from the front desk staff to researchers. It reminds people that there is a gravity to what we do, a seriousness, and it's

very important that our staff stay focused on the patient's perspective. For patients, their cancer journey is the most important thing in their lives. This isn't like coming in to check up on a cold. This is life changing. So I think one of the crucial aspects of leading a cancer center is to continually elevate a culture that centers on empathy and excellence.

### Q: What's your best advice to existing or aspiring physician leaders?

**Dr Bolwell:** Study the subject. I mean, if you are a leukemia doctor, you have to study and know everything there is to know about leukemia. It's the same with leadership. Some people make the mistake of not studying leadership and just assuming they know everything. I made that mistake myself in the beginning.

But the more you can learn about a topic, the better you can get. You can teach an old dog new tricks as long as the old dog wants to learn; if you want to be a better leader, you can if you work at it. That's my best advice.

To learn more about Cleveland Clinic's Healthcare Administration & Leadership Programs please visit, [clevelandclinic.org/execed](http://clevelandclinic.org/execed)



## NEXOR.Suite® Planning Guide for Critical Areas in Hospitals

Article provided by NEXOR Medical Germany

**N**EXOR Medical Germany, a specialist in hospital engineering and medical devices has launched its Planning Guide as a tool to support all stakeholders involved in hospital projects.

The Guide offers guidance, highlighting critical aspects in architectural design, hospital engineering and pre-fabricated/modular solutions mainly for OR-Blocks, ICUs and other clean-rooms in a healthcare set-up. Besides basic planning concepts, existing standards are explained, and the most frequently asked questions are addressed.

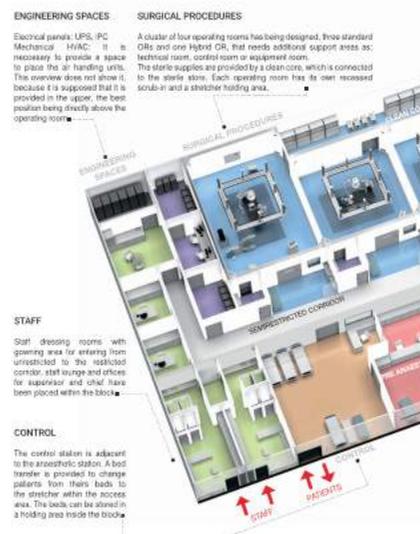
NEXOR.suite is a highly effective modular construction system especially designed to achieve the best performance where environmental conditions and customer needs are highly elaborate and complex, for example in critical healthcare areas (ORs, ICUs, NICUs, LABs).

The use of modular partitions makes it possible to achieve excellent results in a

very short time, without any aesthetic or architectural compromise.

NEXOR.suite is designed to evolve and

### GENERAL SURGICAL BLOCK EXAMPLE OVERVIEW



adapt in accordance with the continuous development of surgical and medical care technology, facilitating implementation and updating of the integrated medical devices and systems.

NEXOR Medical is convinced that successful hospital projects require an integrated view of all relevant areas of expertise involved, from design to execution.

Currently, NEXOR Medical is executing, among several others, 6 projects/132 OR's for All India Institute of Medical Sciences in Bhopal, Raipur, Patna, Jodhpur, Rohtak and Jabalpur in cooperation with its local partner in India.

*For more information on the company and its services, please visit [www.nexormedical.com](http://www.nexormedical.com). Apply for your personal copy of the NEXOR Planning Guide or contact us for any other question you might have at [info@nexormedical.com](mailto:info@nexormedical.com)*

# A Gentle Hand on the Heart

Article provided by RAK Hospital

A recent study on life expectancy and causes of mortality in the UAE has found that cardiovascular diseases still retains the slot of number one killer in the UAE with around 36 percent of deaths caused by heart issues. While the number itself is quite worrisome, the bigger cause of concern is the reasons behind such escalating cases. In a country where obesity is a rising problem – where even young children are overweight – and one in five residents is a diabetic, cardiovascular diseases is but a natural outcome. The entire Middle East is no exception with similar statistics driven by similar causes.

Another groundbreaking study conducted last year reveals that ‘wealthy’ UAE residents are more at risk of heart diseases, co-relating it with a more luxurious, unhealthy and sedentary lifestyle found among upper strata of society.

Typically, the most common cause of cardiovascular disease is atherosclerosis, a condition where fatty materials deposit themselves in the inner walls of the arteries, limiting the passage of oxygen- and nutrient-rich blood to the heart. Over the years, as the passage gets narrower, the heart has lesser ‘fuel’ to function, which puts immense pressure on it. The result manifests itself in chest pain, heart attack, stroke, and even death. A slow-progressive disease, atherosclerosis begins its destruction much earlier, often driven by high blood pressure, unhealthy diet high on cholesterol and bad fats, diabetes and smoking. Unfortunately, by the time the outward symptoms begin to appear, the disease has already caused much havoc within the coronary arteries and the heart.

Among the more common symptoms of coronary issues is angina attack or chest pain, often described as a crushing or squeezing feeling in the chest that may travel to arm, shoulders, back and jaw. The three types of angina – stable, unstable and variant – are red flags for an impending heart attack, and therefore should be taken seriously, with a reassessment of the

existing lifestyle. This is the time to change the dietary habits and include more activity in one’s life to reduce the chances of a more severe heart disease.

By and large, critical coronary artery issues are managed through medication, angioplasty and bypass surgery. In cases of bypass surgery, surgeons create a new route for the blood flow, interposing a healthy piece of blood vessel (either a saphenous vein on the internal mammary gland) from the aorta to the healthy part of the coronary artery.

At RAK Hospital, the most common procedure used is the bypass graft surgery, also known as Off-pump coronary artery bypass (OPCAB) technique. Less invasive and with fewer cognitive and neurological consequences, the technique eradicates the need for heart-lung machine, while using certain stabilisers on the heart beat to enable surgeons to carry out the procedure on a beating heart. The technique offers long-term coronary benefits, reduces the risk of neurological complications, heart attack and sudden cardiac deaths, requires less

blood transfusion, has fewer heart rhythm problems and a much quicker recovery time, cutting short the hospital stay significantly.

Positioned to deal with any cardiac emergency situation, the skilled surgeons and medical staff at RAK Hospital offers the latest innovations in cardiac care and clinical therapies to patients of all ages. The hospital provides state-of-the-art tests and procedures to assist in accurate diagnosis and planning of treatment. Moreover, a cutting-edge fully equipped cardiac catheter lab and full electrophysiology set-up are available round the clock. The hospital also holds the distinction of having successfully conducted a non-surgical balloon dilation procedure on a patient’s heart to remove an unnatural overgrowth of tissue known as subaortic membrane. Regular pediatric cardiology services are also offered by qualified pediatric cardiologists to cater to the care of children.

*For more information, please visit [www.rakhospital.com](http://www.rakhospital.com)*



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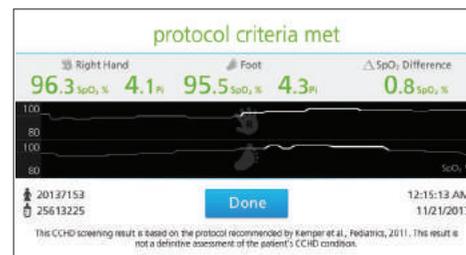


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<sup>1</sup> de-Wahl Granelli A et al. *BMJ*. 2009 Jan 8;338:a3037. <sup>2</sup> de-Wahl Granelli A et al. *Acta Paediatr*. 2007 Oct;96(10):1455-9. <sup>3</sup> Ewer AK et al. *Lancet*. 2011 Aug 27;378(9793):785-94. <sup>4</sup> Zhao QM et al. *Lancet*. 2014 Aug 30;384(9945):747-54. <sup>5</sup> Meberg A et al. *Acta Paediatr*. 2009 Apr;98(4):682-6. <sup>6</sup> Kemper AR et al. *Pediatrics*. 2011 Nov;128(5):e1259-67. \*Referred to as "CCHD Mode" in Rad-97 and Radical-7 Operator's Manual.

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