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January - February 2018

Afternoon heart surgery

Study shows outcomes better in afternoon vs morning

Antimicrobial drugs

WHO warns resistance at dangerously high level

Making history

Surgeons perform UAE's first heart transplant at Cleveland Clinic Abu Dhabi

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- Malaria control at crossroads as funding plateaus
- Fake drugs problem on the rise
- Encouraging progress made in eliminating Neglected Tropical Diseases

Bahrain BD3, **Egypt** E£40, **Iran** IRR75, **Iraq** IQD9,400, **Jordan** JD5, **Kuwait** KD3, **Lebanon** LBP12,000, **Oman** RO3, **Qatar** QR30, **Saudi Arabia** SR30, **Syria** £S400, **UAE** Dh30, **Yemen** YR1,600

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MEDICINE
Aasim I. Padela, MD, MSc
Emergency Medicine

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When an international academic center approached the University of Chicago Medicine (UCM) for guidance, we sent a multidisciplinary team of experts to advise the hospital on how to improve its health care service delivery, operations and training programs. Katherine Pakieser-Reed, PhD, RN, executive director of the Center for Nursing Professional Practice and Research, reviewed the institution's nursing practices and provided a set of recommendations that included operational improvements as well as customized training programs in areas such as preventing pressure ulcers. Gary Lennon, UCM's director of Supply Chain Performance and Analytics, brought to the project his business savvy on how to contain costs and improve efficiency in the management of materials and supplies. And Dr. Aasim Padela, an Emergency Medicine faculty member, reviewed the hospital's Emergency Department operations and educational programs and suggested improvements in clinical care processes and residency and fellowship training.

These are just three of the many experts from the University of Chicago Medicine who are now supporting new and existing hospitals around the globe. They are the same men and woman who work every day in our "hospital of the future," the Center for Care and Discovery, a new 10-story facility at the heart of the University of Chicago medical campus. An architectural and technological tour de force, our new hospital provides a home for complex specialty care with a focus on cancer, gastrointestinal disease, neuroscience, advanced surgery and high-technology medical imaging.

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Welcome to the New Year. We wish you prosperity, happiness and good health.

This issue is filled with news of select research that has been published recently in peer-reviewed clinical journals. The abundance of life science research emanating from labs around the world and being published in clinical journals on a daily basis is quite astounding. Scientific endeavour is now truly prolific. This is great news for the future of health care as the frequency of ground-breaking and innovative discoveries accelerates.

In this issue we cover a broad spectrum of news of published research – ranging from cardiology to synthetic life forms. Highlights include:

– A study that shows outcomes are better if heart surgery is performed in the afternoon as opposed to the morning.

– Research that shows a naturally occurring molecule, Resolvin E1, helps prevent and treat atherosclerosis

– The development of a vaccine for leishmaniasis

– A new gene-therapy that cures haemophilia

Also in this issue we look at antimicrobial resistance which is now rising to dangerously high levels worldwide. The WHO states that it is a global crisis we cannot ignore and warns that "if we don't tackle this threat with strong, coordinated action, antimicrobial resistance will take us back to a time when people feared common infections and risked their lives from minor surgery".

We report on the historic first heart transplant in the UAE performed by surgeons at Cleveland Clinic Abu Dhabi. It is being hailed as a major milestone for the nation.

There have been several interesting developments in the region. Qatar has set up a national trauma registry, a first in the region; in the on-going effort to eradicate polio, the Islamic Advisory Group has issued a training manual on polio eradication for doctors; and a number of hospitals in the region have been recognised for their innovative use of information technology.

In world news, the International Diabetes Federation has released their latest Diabetes Atlas which shows the prevalence of diabetes continuing to increase worldwide; the World Hepatitis Alliance has issued a call for improved screening of expectant mothers and treatment of children; and a Dementia Discovery Fund has attracted a $50m investment from Bill Gates.

This is but a small selection of news and reviews in this issue. There are many more informative articles for you to peruse. Read on.

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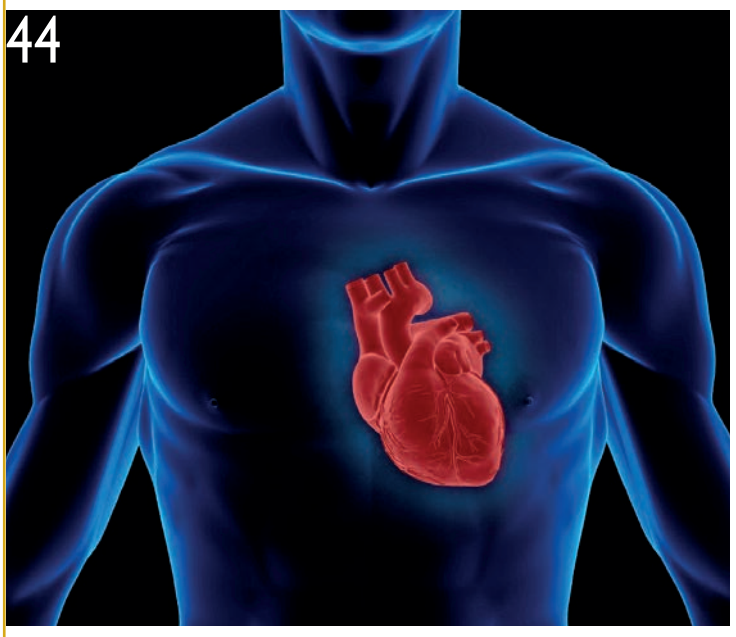

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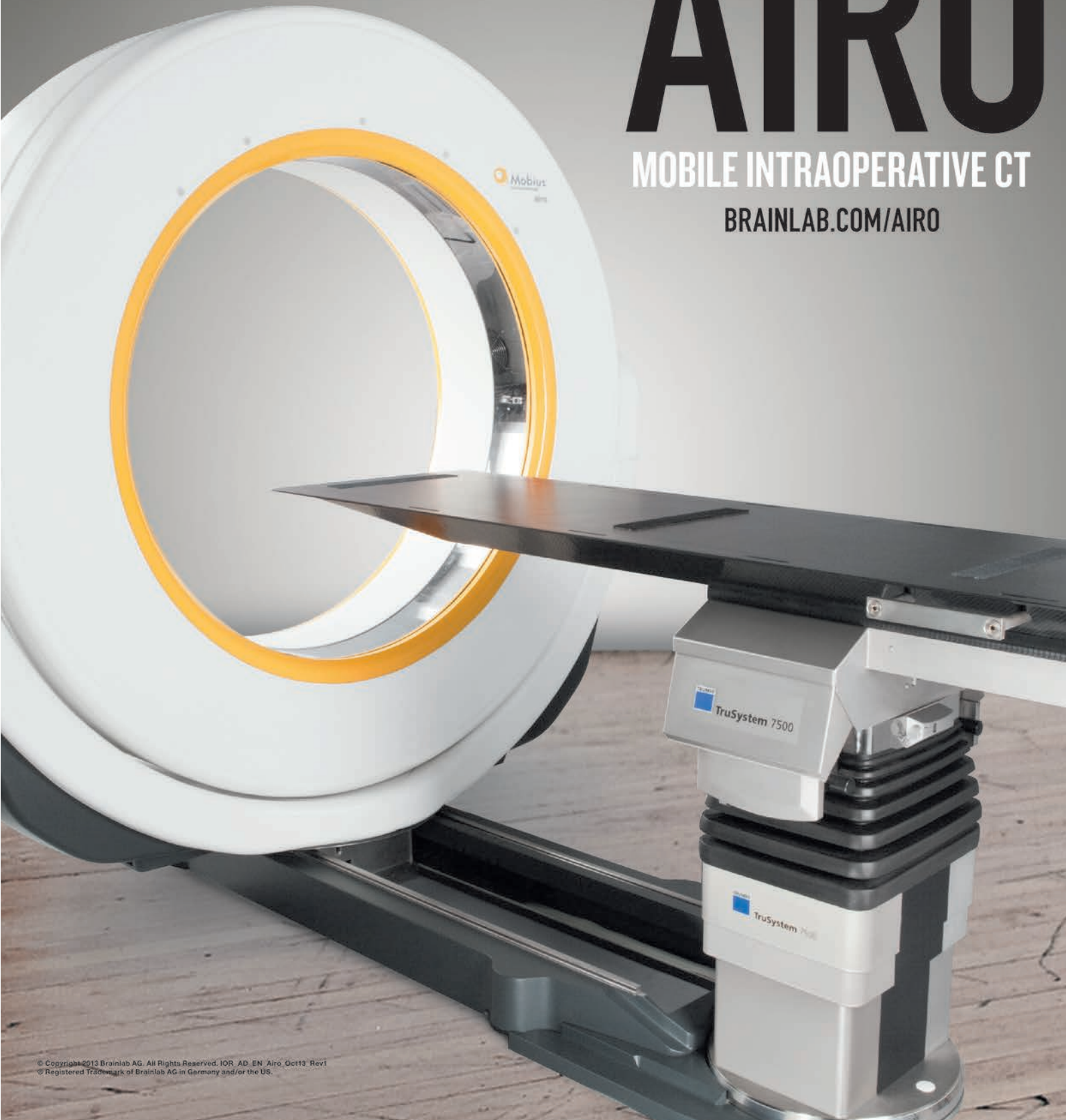

middle east monitor

Update from around the region

Dr Ossama Osman, Associate Professor in the Department of Psychiatry and Behavioral Sciences at UAEU's College of Medicine and Health Sciences

Better treatment needed for trauma sufferers in Arab world

Groundbreaking research conducted by United Arab Emirates University (UAEU) and a public health science program at one of the world's leading universities has identified the need to provide psychological trauma sufferers in the Arab world with better treatment through awareness and training programs.

A research team from UAEU's College of Medicine and Health Sciences (CMHS) and the Harvard Program on Refugee Trauma (HPRT) has completed a collaborative study focusing on the extent of trauma awareness and its impact on health in the Middle East, with 90 psychiatrists and primary care doctors from 17 Arab countries among those providing input and insight.

Led by Dr Ossama Osman, Associate Professor in the Department of Psychiatry and Behavioral Sciences at CMHS, and Professor Richard Mollica, Director of HPRT, the project studied the magnitude of the problems resulting from psychological trauma, the dynamics of the condition and its different types, and the resources available in the Middle East to address its impact on people's physical and mental health in "a scientifically and culturally sensitive manner".

The team – which also included Professor Taoufik Zoubeidi, Professor of Statistics at UAEU's College of Business, and was supported by the Zayed Bin Sultan Center for Health Sciences, directed by Professor Fatima Al-Maskari – found:

- There is a need for increased focus on psychological and psychiatric morbidity in the region, due to its links to trauma.
- Many patients are at risk of mental illness, or struggle to access care, due to "social problems" such as divorce and separation, with psychiatrists reportedly seeing divorced patients more frequently than primary care physicians.
- Respondents indicated they were "not highly confident" in managing patients with various psychosocial problems, suggesting a lack of training and "culturally-relevant research" in this area.
- "Strong social conventions" mean physicians may avoid discussing topics that have the potential for embarrassment.
- It is "very likely" that most people with post-traumatic stress disorder are only seen by primary care physicians, reducing the prospects of their condition being identified.
- There is a need for "local practices, data, and research" – such as traditional and religious healers, community volunteers, and other lay groups – to be integrated into the modern mainstream care network.

The study also found that many clinicians surveyed during the project said continuing medical education to update their knowledge was not a requirement of their role, and this needed "serious attention"; and that, in many areas, medication for psychiatric illness was not available in a primary care setting.

A research paper produced by the UAEU/HPRT team outlined that between 100 million-140 million people in the Arab world are estimated to suffer from at least one psychiatric disorder, with the level of psychiatric resources at regional level beginning to receive "increased attention".

Through the survey, the team discovered that the most commonly-reported traumas related to divorce or separation, the recent death of a close relative or friend, serious traffic accidents, and domestic violence. However, the types of problems reported differed from country to country depending on the number of practicing psychiatrists per person.

"The findings in this study indicated a need to continue efforts toward developing global mental health alliances," said the team in their project conclusions. "Clearly, improvements in awareness, education, planning, and resource allocation are necessary.

"In addition, the development and implementation of culturally-appropriate models of understanding and addressing psychiatric issues related to trauma will be important to maximize the cost-effectiveness and sustainability of these interventions. Through these efforts and other partnerships, we hope to develop regional centers of excellence in research and training for trauma-informed mental health services."

Abbott launches region's first diabetes training academy

Abbott, a global player in diabetes care, has opened the region's first dedicated training academy for healthcare professionals working with diabetes patients. The Abbott Diabetes Academy, in Dubai Healthcare City, will offer theoretical and practical training on new diabetes technologies to help support healthcare providers improve diabetes management.

According to the IDF Diabetes Atlas 415 million people live with diabetes across the globe. In the UAE, there are approximately one million people with type one and type two diabetes, with approximately 450,000 of those cases being undiagnosed.

With its mission to act as a Centre of Excellence, the academy will provide practical tools which can be applied by endocrinologists, diabetologists and educators to improve the region's management of diabetes.

Dr Abdulrazzaq Al Madani, President of the Emirates Diabetes Society commented: "The number of cases of diabetes in the nation is on the rise, and it is crucial to support and provide healthcare professionals with the tools required to ensure patients are living their lives to the fullest potential. The Abbott Diabetes Academy will equip physicians and diabetes experts to use advanced technologies to develop

new and improved medical care for diabetics. Abbott's effort in this space, specifically through the introduction of the academy, will help improve and save the lives of people affected with diabetes, filling an important gap in the region".

The Abbott Diabetes Academy program will be made up of learning modules which will include workshop sessions, practice sessions with new technologies and tools, and hands-on experience, which will be delivered by an expert faculty.

Whilst the main focus of the academy will be on training around innovative technologies such as flash glucose monitoring and ambulatory glucose profile reporting systems, it will also open the floor to an exchange of experience and clinical perspectives amongst regional experts and health care professionals.

- The Abbott Diabetes Academy will be open to eight trainees per course. Those who want to attend can register at: *www.abbottdiabetescarepro-me.com*.

Elsevier, HIMSS announce winners of Digital Healthcare Awards

Elsevier and HIMSS Middle East announced the winners of the third Middle East HIMSS-Elsevier Digital Healthcare Award 2017, which recognizes outstanding achievements and innovations globally in the use of health information technology.

The Award features two categories: Outstanding ICT Achievement and Outstanding ICT Innovation. In 2017 there were 14 submissions from Dubai, Abu Dhabi, and the Kingdom of Saudi Arabia. A leading theme among submissions was a focus on deploying solutions to enhance health information exchange across healthcare systems to positively impact patient and resource management.

The winners and finalists are:

Outstanding ICT Achievement Category

- Winner: Dr Sulaiman Al Habib Medical Group, KSA
- Finalist: Cleveland Clinic Abu Dhabi, UAE
- Finalist: King Abdullah bin Abdulaziz University Hospital, KSA

Outstanding ICT Innovation Category

- Winner: Ministry of Health & Prevention (MOHAP), UAE
- Finalist: Dr Sulaiman Al Habib Medical Group, KSA
- Finalist: Ain Al Khaleej Hospital, UAE

Commenting on the awards, Tim Hawkins, Managing Director, Clinical Solutions in EMEALA for Elsevier, said: "It is an exciting time for healthcare in the Middle East, with healthcare providers in the region investing in innovations that help achieve greater outcomes for patients.

"Elsevier extends congratulations to all of the winners and finalists from this year's awards. We believe that technology is extremely important in answering demands on healthcare today and in the future, but this must also be joined with the use of credible, evidence-based information to drive better patient outcomes."

Nominated in both categories and winner of the Outstanding ICT Achievement Category, Abdulelah Al Mayman, ITG-VP, CIO, Dr Sulaiman Al Habib Medical Group, KSA said: "We are extremely honoured to be nominated as finalist for both categories and to win the ICT Achievement Award. Dr Sulaiman Al Habib is committed to innovations across our hospitals. Our tele-radiology and Tele-ICU & Command and Control Center projects have improved patient care in both these departments tremendously since roll-out. We are happy to share our achievements with regional peers."

Dr Sulaiman Al Habib Medical Group's winning project – 'Moving to Centralize Radiology Information System (RIS) and Picture Archiving and Communication System (PACs) to Enhance Collaboration Across Multiple Sites and use Tele-Radiology' – has contributed to higher reports quality, higher services quality with a centralized system and better resource management and staff allocation.

Since implementation there has been significant improvement leading to 77% of routine radiology cases reported within the first two hours in 2017 compared to 2016. Similarly, 7% emergency cases reported within 30 minutes or less in 2017 compared to 2016 and 17.6 % reported within 60 minutes in 2017 compared to 2016. Patient satisfaction has also increased tremendously.

Similarly, since the rollout of the PaCE Dashboard and BI Analytics Project within the UAE's Ministry of Health and Prevention (MOHAP), benefits have been multifold. Patient waiting time in outpatient clinics across all MOHAP hospitals has reduced from 42 minutes to 22 minutes per month. 96% of emergency department patients are now discharged within 4 hours and there is 15% improvement in bed occupancy and bed utilization.

Dr Aamir Ali, Health Information Manager at MOHAP, UAE said: "We are delighted to win the HIMSS-Elsevier ICT Innovation Award. MOHAP wanted to develop a program that can deliver accurate and timely clinical, administrative, operational data and financial data, to help in monitoring and evaluating the delivery of healthcare at MOHAP hospitals in an efficient manner. Utilizing information technology as a tool to bring this project to life has brought about many positive outcomes for us and our patients. We strongly believe by delivering analytics to clinicians and analysts on the frontlines of care, as well as to executives in the boardroom, any healthcare organization can critically

evaluate care processes and aggressively pursue the best opportunities for improving outcomes. In doing so, healthcare organizations will be rewarded with clinical and financial success in a rapidly evolving healthcare landscape."

Islamic Advisory Group launches training manual on polio eradication

The Islamic Advisory Group for Polio Eradication (IAG) launched a new training manual for students of religious studies in support of the effort to eradicate polio. The manual, launched in Cairo on 22 November 2017, provides practical guidance on how to engage with local communities to advocate for vaccination as well as other maternal and child health issues.

The launch took place during the group's fourth annual meeting that convened at the headquarters of Al Azhar Al Sharif in Cairo hosted by Grand Imam Dr Ahmed El-Tayyib.

The Grand Imam expressed his happiness to see the progress achieved to eradicate polio in a satisfactory and reassuring manner, saying: "As Muslims we shouldn't still be discussing a subject that has already been settled a long time ago. This is a situation that has resulted from the misunderstanding of our Qur'an and religion and its teachings."

He asserted Al Azhar Al Sharif's continued support and announced that the Publishing and Translation Department of Al Azhar will translate the training manual into 20 languages.

IAG leaders thanked the health workers and Islamic scholars who are helping the world realize its goal of eradicating polio once and for all. They also recognized the leadership provided by the Governments of Afghanistan and Pakistan and the commitment of their fellow OIC Member States in maintaining adequate support.

Dr Shawky Allam, the Grand Mufti of Egypt, also commended the contribution of the IAG to polio eradication efforts by addressing religious-based refusals on the ground in Afghanistan and Pakistan.

In the past few years, polio eradication efforts have been hindered in some areas of Muslim countries due to misperceptions about the vaccine and the lack of safe access to children. While levels of vaccine refusal are low, they are persistent in certain areas – the very places to which the trained students belong.

Hatem El-Khodary delivered the address of WHO Acting Regional Director for the Eastern Mediterranean, Dr Jaouad Mahjour, in which he commended the work of the IAG and its national affiliates in Afghanistan and Pakistan in supporting the efforts of the national governments and their implementing partners.

"Islam strongly advocates the preservation and protection of children's health and well-being," he said. "Countless prominent Islamic scholars, including those gathered under the IAG banner, have repeatedly confirmed this and have urged Muslim parents and influencers to ensure the immunization of all children."

The launch of the training manual follows IAG's efforts to prepare students of religious studies at key universities in predominantly Muslim countries to act as advocates for critical health initiatives particularly in high-risk areas where marginalized and underserved populations reside. As future religious leaders and scholars the students will be well placed within their local communities to promote healthy behaviour and dispel rumours and misinformation that hamper the work of vaccination teams and deprive their community members of protection against polio and other vaccine preventable diseases.

The manual was produced for the IAG by Al Azhar University's International Islamic Center for Population Studies and Research (IICPSR), which has started training students of Shariah and Arabic language studies from the priority countries of Afghanistan, Pakistan, and Somalia.

In addition to polio eradication, the manual also covers topics related to routine immunization, breastfeeding, birth spacing, care-seeking behaviour for pregnant mothers, and hygiene and sanitation from both health as well as religious perspectives. This can help the students address unhealthy practices and taboos that have been inherited by their local communities when they are found.

Ambassador Muhammad Naeem Khan, Assistant Secretary General to the Organisation of Islamic Cooperation (OIC), commended IAG's expansion into these other health initiatives.

"IAG's decision to broaden the scope of its work to improve mother and child health through raising awareness about healthy behaviours and best practices in seeking care is a timely initiative," he said. "The OIC will continue to accord special significance to the health issues due to their crucial role for the socio-economic development of its Member States."

The IAG plans to expand the training programme to national universities in Afghanistan and Pakistan where polio remains endemic, as well as in Africa where some countries remain at risk of seeing the disease resurge. These countries are among those with the highest maternal and child mortality rates worldwide.

HMC successfully performs Qatar's second liver transplant from a living donor

The Organ Transplant Team at Hamad Medical Corporation's (HMC) Hamad General Hospital has successfully performed Qatar's second ever liver transplant from a living donor. The country's first liver transplant from a living donor was performed at the end of 2016.

The recipient of this latest transplant was a 40-year-old Egyptian man who had been suffering from chronic liver disease. His 30-year-old brother donated part of his liver for the procedure.

Dr Yousef Al Maslamani, Medical Director of Hamad General Hospital and Director of the Qatar Center for Organ Transplantation said living donor liver transplantations are very complex.

"The transplant was planned and performed by HMC's highly qualified team of liver transplant surgeons, anaesthetists, nurses, and technicians. World-renowned Japanese liver transplant surgeon Professor Yasuhiro Ogura supervised the procedures

He added that working with international specialists who are leaders in their

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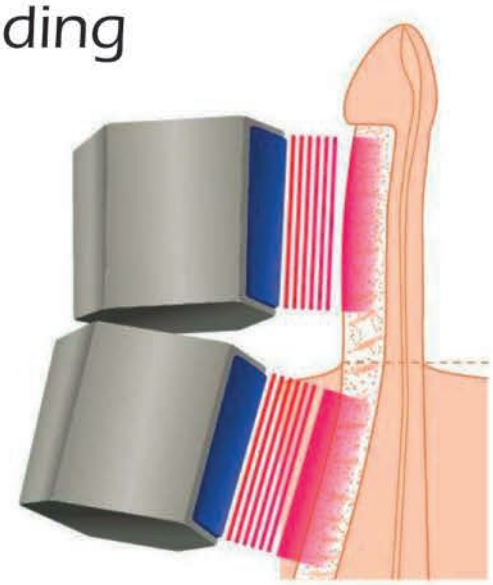

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field is in line with efforts to provide patients with access to renowned experts while also continuing to enhance the quality of healthcare services at HMC.

"The future of our population's health and well-being depends on supplementing our existing expertise and this means working in close partnership with a wide array of leading international agencies and institutions to ensure our self-sufficiency. We remain focused on becoming a regional center of excellence in multi-organ transplantation," said Dr Al Maslamani.

"Since the launch of the Qatar Organ Donation Center (HIBA), we have developed a robust deceased organ donation program. We are continuing to work to expand this program, raising public awareness about organ donation and the importance of registering as an organ donor. There are currently over a quarter of a million registered organ donors in the country, but the need for organ donors has never been greater. Choosing to become an organ donor truly is a life-saving decision."

Dr Yousuf Al Maslamani, Director of the Qatar Center for Organ Transplantation, says HMC has developed a robust deceased organ donation program, liver transplantation program, and pediatric kidney transplantation program.

Qatar's HMC marks 30 years of successful organ transplants

Qatar's Hamad Medical Corporation (HMC), recently marked 30 years of organ transplantation surgeries with an event to honour living organ donors and the families of deceased donors. It also acknowledged Qatari transplant recipients who chose to have their procedure in Qatar rather than go abroad, signaling a confidence in the high professionalism of the organ transplantation team operating at Hamad General Hospital.

Commenting on the milestone in November last year, Dr Hanan Mohamed Al Kuwari, Minister of Public Health, said: "The success of Qatar's organ transplantation program is something which we can be extremely proud of. With fairness and equity at its heart, our transplantation program has been recognized internationally.

"Qatar's national strategy for organ transplantation is not only world-leading in terms of the clinical and ethical standards it applies, but also one that is appropriate to the healthcare needs of our growing country and our diverse population."

In 1986 a surgical team at HMC performed Qatar's first kidney transplant on a Qatari woman who received a donor kidney from her sister. Now, 30 years on, with a 98% success rate, HMC's organ transplantation program is well regarded around the world.

Dr Yousuf Al Maslamani, Director of the Qatar Center for Organ Transplantation, said: "Over the last three decades, HMC has developed a robust deceased organ donation program, liver transplantation program, and pediatric kidney transplantation program.

"Last year saw the launch of our bone marrow transplantation program and currently we are at the final stage of preparation to launch pancreas transplantation and islet cell transplantation.

"The wider organ donation and transplantation program continues to evolve to meet the changing needs of our community and has been striving to fulfill its vision to provide the best quality care for all patients, irrespective of nationality, religion, or race," he said.

Dr. Riadh Fadhil, Director of the Qatar Organ Donation Center, said: said the Center has worked tirelessly with the Qatar Center for Organ Transplantation to implement the Doha Donation Accord.

"HMC's full commitment to the Doha Donation Accord has seen the number of registered donors increase significantly over the last five years from 2000 to more than 259,000," Dr Riadh said. "The greater number of organ donors has led to an increase in kidney transplant procedures, which in turn as enabled new procedures to be implemented. It has also led to most of our patients choosing to have their procedures done in Qatar rather than travel abroad."

RCSI-Dubai confers 69 Master's students

The Royal College of Surgeons in Ireland-Dubai (RCSI-Dubai) conferred 69 students at its annual conferring ceremony. The event took place at Mohammed Bin Rashid Academic Medical Centre in Dubai Healthcare City and was attended by guest of honour, His Highness Sheikh Mansour bin Mohammed bin Rashid Al Maktoum.

The graduates all work as healthcare professionals and as part of their Master's qualifications they are now equipped with the leadership skills and expertise to address the healthcare needs of the UAE. The graduates represent a broad spectrum of health professionals and include consultants, doctors, nurses, health managers, educators, pharmacists, laboratory technicians and other allied healthcare professionals who come from a wide variety of public and private health sector organisations.

RCSI-Dubai has seen a significant increase in enrolment this year, signaling the desire for healthcare professionals to further their education in leadership and management areas and in turn reach their career goals and better the outcome for patients. Over 600 students have now graduated in Healthcare Management, Quality and Safety in Healthcare Management and Leadership in Health Professions Education Masters Degrees and Diplomas from the institution since its inception in 2005.

Just over 80% of the 2017 graduates are female as RCSI-Dubai continues to place a strong emphasis on female empowerment to better help shape the region's healthcare sector and 35% of the 2017 graduates are Emirati Nationals indicating the increasing focus on the need for local leadership.

The ceremony was also attended by a number of RCSI delegates including RCSI President Professor John Hyland who said: "More than 600 health professionals have now graduated from RCSI Masters programmes here in Dubai. Many of our alumni now hold significant leadership positions in the region and continue to make highly influential contributions to the development of quality healthcare. We are immensely proud of their success and we look forward to the 2017 graduating class continuing this tradition of healthcare leadership."

RCSI is ranked in the top 2% of institutions worldwide in the Times Higher Education World University Rankings (2016-2017). It is an international not-for-profit health sciences institution, with its headquarters in Dublin, focused on education and research to drive improvements in human health worldwide.

Established in 2005, RCSI-Dubai offers a Masters Degree in Healthcare Management and a Masters Degree in Quality and Safety in Healthcare - these programmes are accredited by the Commission for Academic Accreditation (CAA) of the United Arab Emirates (UAE) Ministry of Education and by the National University of Ireland (NUI), Ireland's largest university.

UAE MOHAP meets UN task force on NCDs

In the framework of strengthening preventive measures and reducing the incidence of non-communicable diseases, the UAE Ministry of Health and Prevention (MOHAP) met with a UN interagency task force for Non-communicable diseases to review UAE experiences and discuss national multi-sectoral responses.

Dr Hussein Abdel-Rahman Rand, Assistant Undersecretary for Health Clinics and Centers, MOHAP said that the UAE seeks to strengthen international and regional cooperation to support the control of non-communicable diseases, namely (diabetes, cancer, cardiovascular diseases, and chronic respiratory diseases). It also aims to implement prevention programs, develop health awareness and counseling programs, and mobilize governmental and non-governmental sectors to address non-communicable diseases. These will be achieved by promoting a holistic approach to ensure the prevention and control of non-communicable diseases focusing on the goals of the National Agenda for 2021. As well as the WHO global targets for 2025.

Dr Rand pointed out the importance of the visit and its contribution towards effective implementation of the national NCD plan 2017-2021. Uniting the efforts of the ministry and its national partners. The Ministry's strategy aims to promote the practice of a healthy lifestyle for the UAE community and provide comprehensive and integrated health care in innovative and sustainable ways to ensure the prevention of diseases – all in line with the National Agenda 2021 to develop the health system and provide comprehensive health coverage based on the highest international standards.

The visit team included experts from the World Health Organization (WHO), the UN Development Programme (UNDP), and the UN Children's Fund (UNICEF), FAO, and the UNRC for UAE. The program included meeting with members of the NCD national committee and other strategic partners. The agenda also covered visits to the Office of the Prime Minister, Sports and Youth Authority, the Ministry of Education, the Ministry of Climate Change and Environment, the Dubai Health Authority, and the Emirates Authority for Standardization and Metrology.

Dr Buthaina Abdullah bin Belaila, Head of the non-communicable diseases section, MOHAP, said the participation of non-health sectors in development of the national plan for non-communicable diseases (2017-2021) and their engagement in monitoring and evaluation process was a raw model and exemplary.

The UN team praised the outstanding efforts of the country and the multi sectoral collaboration to achieve the national targets.

Qatar sets up National Trauma Registry

Qatar's Hamad Medical Corporation (HMC) officially launched the Qatar Trauma Registry, the first national trauma registry in the Arab world. The database will document the injuries of trauma patients and the acute care they receive. Through the registry, clinicians and public health officials will have the data needed

to make better decisions toward reducing trauma incidents in the country.

Speaking at the launch in Doha in December, Dr Hanan Mohamed Al Kuwari, Minister of Public Health, said: "Our vision for Qatar is to establish an inclusive trauma system that facilitates a coordinated approach with which to deliver the safest, most effective, and most compassionate care to all patients. The establishment of the Qatar Trauma Registry represents another milestone in the growth and development of our national trauma system; one that is based on international best practice and is designed to achieve the best possible health outcomes for patients while also improving our health system."

Dr Hassan Al Thani, Head of Trauma and Vascular Surgery at HMC, under whose leadership the national trauma system and registry concepts were developed with the support of other ministries, noted that trauma registr ies are recognized globally as highly successful ways to reduce preventable deaths and associated losses.

"This program allows us to deliver a more integrated and enhanced system of trauma care in Qatar.

"The Qatar Trauma Registry is essentially a database that documents the injuries of trauma patients and the acute care they receive. It is designed to provide information that can be used to improve the efficiency and quality of trauma care delivery," said Dr Al Thani. "With the data collected, we can identify gaps in the way injury victims are identified and transported to where they receive care."

Dr Al Thani added: "Qatar has been benchmarking its trauma data internationally through a collaboration with the National Trauma Data Bank (a division of the American College of Surgeons), which is a global repository of trauma data."

Hamad Medical Corporation (HMC) is the main provider of secondary and tertiary healthcare in Qatar and one of the leading hospital providers in the Middle East.

Brig. Gen. Mohamed Saad Al Kharji, Director General of Traffic at the Ministry of Interior, said: "Injury is a leading cause of death and disability in people under 45

Dr Hassan Al Thani, Head of Trauma and Vascular Surgery at HMC speaks at the launch of the Qatar Trauma Registry

years old in Qatar. Today's announcement is a significant step towards improving trauma services across the country.

"We want people to keep their safety, and the safety of others, always in mind. With the data we collect it will be easier for us to highlight the main areas of concern where more preventative measures need to be introduced to safeguard the population."

- The American College of Surgeons' National Trauma Data Bank (NTDB) -- National Trauma Data Standard (NTDS) Data Dictionary

WISH launches Young Innovators competition

The World Innovation Summit for Health (WISH) has launched its Young Innovators competition, which will form part of the recently announced fourth edition of WISH. WISH's Young Innovators competition gives people under the age of 30 the opportunity to present novel healthcare-related products and innovations globally to an international audience of policy makers and influencers at WISH 2018, which will take place at the Qatar National Convention Centre in Doha on 13 and 14 November 2018.

Speaking during his opening address at the recent London Innovation in Healthcare Summit, Professor The Lord Darzi of Denham, Executive Chair of WISH, invited talented young innovators to apply to the competition.

"We all understand that innovation is our hope to building a healthier tomorrow and therefore it is vital that we provide a platform for today's young minds to bring forward their novel ideas. Today's gathering emphasizes our joint commitment to look for novel outcomes at the intersection of innovation and healthcare," Lord Darzi said.

The London event was held at the Royal Horticultural Halls on December 11 and was organized by WISH in collaboration with London-based Imperial College Health Partners and Imperial College's Institute of Global Health Innovation. During the event, WISH took the opportunity to showcase talented young Arab innovators including Dr Ahmad Nabeel from Kuwait, inventor of 'Virtual Beam and the Self-Cleaning Laparoscope', which offers an innovative way of cleaning a laparoscope's lens without having to remove the laparoscope from the patient, thereby minimizing risk of infection and significantly cutting surgery time.

Also present at the London event was Syrian entrepreneur Anwar Almojarkesh. He demonstrated his 'Braci' technology, which uses a mobile application to provide communication support for people with hearing loss and also for the elderly, their families, and carers.

Commenting on his participation in the event, Almojarkesh said: "Being part of WISH since 2015 and having the opportunity to connect with leaders from the healthcare industry has allowed our company to move forward here in the UK, Qatar and beyond. Now we are recognized as one of the only Arabic assistive technology companies in the market helping people with hearing loss, and we've been able to prove that technology can be integrated with healthcare knowledge to make life easier and safer."

The World Innovation Summit for Health (WISH) is a global healthcare community dedicated to capturing and disseminating the best evidence-based ideas and practices. WISH is an initiative of Qatar Foundation for Education, Science and Community Development (QF) and is under the patronage of Her Highness Sheikha Moza bint Nasser, its Chairperson.

- To apply for WISH 2018 Young Innovators competition, visit: *http://bit.ly/2jsAK9m* MEH

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Update from around the globe

WMA calls for health system funding to combat climate change

The World Medical Association has issued a call for national governments to provide designated funds for the strengthening of health systems to combat climate change.

In a policy statement adopted at its annual Assembly in Chicago, the WMA emphasises the urgency for taking action and for emergency planning on local, national and international levels.

WMA President Dr Yoshitake Yokokura said: "It is important that the voice of the world's physicians be heard about the risks posed to health by climate change."

The WMA says that human influence on the climate system is clear, with recent emissions of green-house gases the highest in history. Evidence shows numerous health risks from climate change which threaten all countries. These include more frequent and potentially more severe heatwaves, droughts, floods, storms and bushfires.

Climate change, especially warming, is already leading to changes in the environment in which disease paths flourish. There is reduced availability and quality of potable water, and worsening food insecurity leading to malnutrition and population displacement. And although climate change is universal, its effects are uneven, with many of the areas most affected the least able to manage the challenges it poses. Those with generally the poorest health and lowest life and health expectancy will be least able to adapt to the adverse effects of climate.

Dr Yokokura said: "We are also urging national governments to provide for the health and wellbeing of people displaced by environmental causes, including those becoming refugees because of the consequences of climate change."

Dementia Discovery Fund attracts $50 million investment from Bill Gates

The Dementia Discovery Fund (DDF) in November announced a $50 million investment from Bill Gates. The investment is Gates' first to accelerate progress toward disease-modifying therapies for Alzheimer's disease. The DDF, managed by SV Health, is a unique venture fund focused entirely on discovering and developing novel therapies for dementia and was formed through the collaboration of leading pharmaceutical companies, the UK Department of Health and the charity Alzheimer's Research UK (ARUK).

Commenting on the investment, Bill Gates said: "I believe we are at a turning point in Alzheimer's research and development, which the Dementia Discovery Fund is playing an important role in by exploring new approaches to treat the disease. This is a frontier where we can dramatically improve human life. It's a miracle that people are living so much longer, but longer life expectancies alone are not enough. People should be able to enjoy their later years – and we need a breakthrough in Alzheimer's to fulfil that. I'm excited to join the fight and can't wait to see what happens next.

Since its launch in October 2015, the DDF has made significant progress building an initial portfolio of 12 investments in drug discovery companies and projects predominantly in the UK and US in areas including microglial biology and inflammation, mitochondrial dynamics, trafficking and membrane biology and synaptic physiology and function. The DDF team believes there is a significant opportunity to develop dementia drugs targeting biological pathways beyond the prevailing amyloid beta hypothesis and to apply insights from areas such as oncology and immunology to develop novel drugs targeting these other biological pathways that may drive different forms of dementia.

The DDF is uniquely positioned to benefit from the expertise of its world-class Scientific Advisory Board (SAB) which includes heads of Neuroscience and/or R&D from seven major pharma companies (Biogen, Eli Lilly and Company, GSK, Johnson & Johnson, Otsuka (Astex), Pfizer and Takeda) and ARUK, who collectively have a large network and experience in neuroscience drug discovery. The SAB provides ongoing advice and knowledge, offers insights on different approaches and historical failures, suggests priority areas to explore new approaches to treat dementia and advises on strategies to drugging these new pathways.

Doug Giordano, Senior Vice President, Worldwide Business Development, Pfizer, said: "Dementia, including Alzheimer's disease, is one of the greatest healthcare challenges facing the world today. Forty-seven million people were living with dementia in 2015 and this is projected to nearly double every 20 years. The work that the DDF is doing has enormous potential to produce treatments that could arrest the course of dementia and we look forward to continuing to support these efforts."

Patrick Vallance, President, R&D, GSK, said: "Dementia is one of the biggest challenges of global healthcare today and it's a challenge that isn't going to be solved by working in silos. To address the growing burden of dementia, we must collaborate and invest in the early science to really enhance our understanding of the disease and its complex biology, and then apply this knowledge in a way that is targeted towards making treatments. As a founding investor in DDF, we wanted to be part of a fund dedicated to rooting out the new, exciting, different ideas outside of the mainstream, with the focus needed to tackle dementia in the right way."

Hilary Evans, Chief Executive, Alzheimer's Research UK, said: "The gravity of the impact of dementia increases every day and the millions affected worldwide desperately need effective treatment options. We're seeing a step change in global ambitions around tackling dementia, both in understanding the diseases behind the condition and translating the most innovative ideas towards new therapies. I believe that the DDF offers an ideal approach for accelerating the search for new treatments, investing in nimble and innovative drug discovery work in small, focused projects and companies, which have the advantage of being cost and time effective."

Interim results of global survey show people with Type 2 diabetes underestimate cardiovascular risk

The International Diabetes Federation (IDF) recently presented the interim re-

sults of the first ever multi-country online survey on CVD risk awareness and knowledge among people living with type 2 diabetes, indicating low levels of awareness and limited dialogue between patients and healthcare professionals. The global survey - *Taking Diabetes to Heart* - developed in partnership with Novo Nordisk, runs until March 2018 and is open to all people with type 2 diabetes.

Diabetes currently affects 425 million adults worldwide, with most cases being type 2 diabetes. Cardiovascular disease, which includes stroke, coronary heart disease and peripheral artery disease, is the leading cause of disability and death in people with type 2 diabetes.

As of 6 December, 943 responses to the survey have been received from 32 countries and interim findings show that:

- 1 in 3 respondents living with type 2 diabetes consider their risk of CVD to be low
- 26% of respondents had either never learned about CVD or received information on CVD several years following their type 2 diabetes diagnosis
- 1 in 6 respondents had never discussed their type 2 diabetes and CVD risk with a healthcare professional

"The interim results of *Taking Diabetes to Heart* reiterate the importance of raising awareness of the association between type 2 diabetes and cardiovascular disease to promote prevention, timely diagnosis and appropriate treatment to help reduce the current burden that the two conditions represent," said Dr Shaukat Sadikot, outgoing IDF President. "With the world facing an increase in the prevalence of type 2 diabetes, better understanding the link between these conditions is needed more than ever."

- Taking Diabetes to Heart survey – *www.idf.org/takingdiabetes2heart/survey*

World Hepatitis Alliance calls for better screening of expectant mothers and treatment of children

New data presented at this year's World Hepatitis Summit in Sao Paulo, Brazil in November show that 52 million children are living with viral hepatitis worldwide, compared to 2.1 million children living with HIV/AIDS.

An estimated 325 million people were living with viral hepatitis worldwide in 2016. Of these, 4 million were children living with hepatitis C (under 19 years) and 48 million (under 18 years) were children living with hepatitis B. Both viruses can lead to liver disease, liver cancer and deaths.

"Children are suffering a huge burden of viral hepatitis worldwide, and the public health implications of this are enormous," says Raquel Peck, CEO of World Hepatitis Alliance. "Most infected infants and children are not diagnosed, prioritised or treated effectively."

According to new analysis on hepatitis C in children, from Manal El-Sayed, Professor of Pediatrics at Ain Shams University, Cairo, Egypt, and Dr Homie Razavi and his team from the Polaris Observatory, the Center for Disease Analysis (CDA) Foundation, Lafayette, CO, USA, just 21 countries are responsible for around 80% of these paediatric hepatitis C infections, with the highest prevalence rates generally found in developing countries.

Mother to Child Transmission is one of the main causes of hepatitis C in children. However, neither pregnant women nor young children with this cancer-causing illness can be treated with the highly-effective direct-acting antiviral (DAA) medications. Various regulatory agencies such as the US FDA and the European Medicines Agency have now approved DAAs for use in children aged 12 years and over. But in high-income countries, there is as yet little evidence they are being used in this age group. WHO is also yet to recommend DAA in any children regardless of age.

As a result, almost all children are only treated with older pegylated interferon regimens, which often have severe side effects including stunting growth, influenza-like symptoms, anaemia and weight loss, and do not always cure the virus. Trials of DAA drugs in children under 12 years are also ongoing, but they have not

been approved yet in any country for these younger children.

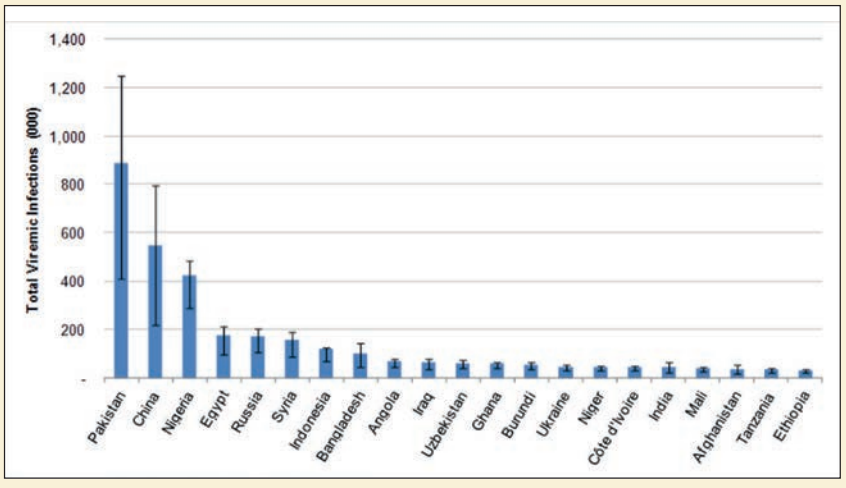
"Currently, 4 million children are living with hepatitis C, which can be cured and 48 million with hepatitis B, which has a vaccine," said Charles Gore, President of the World Hepatitis Alliance. "Enough is enough. Governments and global health organisations must ensure all children are vaccinated for hepatitis B and provided with DAAs for hepatitis C, and that all pregnant women are screened."

Compared to hepatitis C, new hepatitis B infections among children are declining – from approximately 4.7% prevalence in the pre-vaccination era of the early 1980s to 1.3% – due to scaled-up efforts to prevent mother-to-child transmission and global coverage with the three doses of hepatitis B vaccine. Currently, 84% of countries offer hepatitis B vaccinations. However, coverage with the initial birth dose vaccination needed to provide protection to newborns, is still low at 39%.

Cases of hepatitis C in children are, however, likely to continue growing for years to come, given the lack of prevention and control programs for pregnant women living with hepatitis C and women of child bearing age. This is exacerbated by the absence of a public health approach for case definition and management of expectant mothers or children.

"We must act and treat as many children as possible. The economic and social benefit of early hepatitis C treatment in children is substantial," Professor El-Sayed explained. "This includes avoiding disease progression, removing social stigma and improving activity and school performance, and reducing fatigue. However, the fundamental principle is to avoid transmission by adopting 'cure as prevention' at an early age and before high risk behaviours emerge that enable transmission."

"Children are the future," Peck said. "It's imperative that we get it right from the beginning and give them the best possible start in life. Without eliminating viral hepatitis amongst children, its elimination will be impossible."



Countries containing around 80% of the estimated burden of hepatitis C in children aged 0-19 years

Viral Hepatitis

Viral hepatitis is inflammation of the liver caused by a virus. The Global Burden of Data findings illustrate that the total deaths cause by viral hepatitis, including acute cases, cirrhosis and liver cancer account for 1.34 million deaths globally. There are five different hepatitis viruses - hepatitis A, B, C, D and E. Hepatitis A is spread mainly through ingestion of contaminated food and water and the disease is often endemic in countries with a lack of safe water and poor sanitation. Hepatitis B is transmitted through contact with the blood or other bodily fluids of an infected person and approximately 257 million people are living with chronic infections. Hepatitis C is mainly spread through blood-to-blood contact such as unsafe injection practices and inadequate sterilisation of medical equipment. Today, 69 million people are living with the disease. Hepatitis D is passed on through contact with infected blood and only occurs in people who are already infected with hepatitis B. Hepatitis E, like hepatitis A, is transmitted through ingesting contaminated food or water.

New IDF figures show diabetes increasing worldwide

To mark World Diabetes Day on 14 November, the International Diabetes Federation (IDF) released new estimates on the prevalence of diabetes around the world, which confirm that diabetes is one of the largest global health emergencies.

IDF estimates indicate that 1 in 11 adults are living with diabetes, 10 million more than in 2015. Data published in the 8th edition of the *IDF Diabetes Atlas*. The IDF says more action is required at the national level to reduce the economic and social burden that it causes.

Diabetes, which is associated with a number of debilitating complications affecting the eyes, heart, kidneys, nerves and feet, is set to affect almost 700 million people by 2045. Over 350 million adults are currently at high risk of developing type 2 diabetes, the most prevalent form of the disease. Half of all adults with diabetes remain undiagnosed, emphasizing the importance of screening and early diagnosis. Two-thirds of adults with diabetes are of working age and 8 million more adults living with diabetes are over 65 years old.

"Diabetes causes devastating personal suffering and drives families into poverty," said Dr Nam Cho, IDF President-Elect and Chair of the IDF Diabetes Atlas committee. "There is urgency for more collective, multi-sectoral action to improve diabetes outcomes and reduce

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the global burden of diabetes. If we do not act in time to prevent type 2 diabetes and improve management of all types of diabetes, we place the livelihood of future generations at risk."

Diabetes has a disproportionate impact on women, which was the focus of IDF and its affiliated members in over 160 countries on World Diabetes Day. Over 200 million women are living with diabetes and many face multiple barriers in accessing cost-effective diabetes prevention, early detection, diagnosis, treatment and care, particularly in developing countries. Women with diabetes are more likely to be poor and have less resources, face discrimination and have to survive in hostile social environments. Diabetes is also a serious and neglected threat to the health of mother and child, affecting one in six births and linked to complications during and after delivery.

"Women and girls are key agents in the adoption of healthy lifestyles to prevent the further rise of diabetes and so it is important that they are given affordable and equitable access to the medicines, technologies, education and information they require to achieve optimal diabetes outcomes and strengthen their capacity to promote healthy behaviours," said Dr Shaukat Sadikot, IDF President.

IDF welcomes all the international commitments on diabetes that have been made over the past few years and acknowledges that some advances have taken place. However, it is clear that urgent action is still required to achieve the targets agreed by UN member states in 2013 and 2015. These include a 0% increase in diabetes and obesity prevalence; 80% access to essential medicines and devices by 2025; and a 30% reduction in premature mortality from NCDs by 2030. To this end, IDF has launched a call to action for the 2018 High Level Meeting on NCDs, calling on governments to renew their commitments and increase their efforts towards achieving the agreed targets.

"IDF is calling for all nations affected by the diabetes pandemic to work towards the full implementation of the commitments that have been made. We have both the knowledge and the expertise to create a brighter future for generations to come," said Dr Sadikot.

- IDF Diabetes Atlas 8th edition: *www.diabetesatlas.org*

Diabetes in the MENA 2017

- Number of adults living with diabetes: **38.7 million**
- Regional prevalence: **9.6%**
- Number of deaths due to diabetes: **318,036**
- Number of adults with impaired glucose tolerance (these people are at a higher risk of developing type 2 diabetes): **33.3 million**
- Number of children with type 1 diabetes: **175,800**
- Diabetes-related health expenditure: **US$ 21.3 billion**
- Number of adults living with diabetes in 2045 if you do not take action to achieve the WHO and UN targets: **82 million**

- Source: Diabetes Atlas

Global ministerial meeting commits to end tuberculosis

On 17 November 2017, 75 ministers gathered in Moscow agreed to take urgent action to end tuberculosis by 2030 with the issuing of the 'Moscow Declaration to End TB'.

The announcement came at the first WHO Global Ministerial Conference on Ending Tuberculosis in the Sustainable Development Era: A Multisectoral Response, which brought together delegates from 114 countries. President Vladimir Putin of the Russian Federation opened the Conference, with UN Deputy Secretary General, Amina J Mohammed and Dr Tedros Adhanom Ghebreyesus, Director-General of WHO.

"Today marks a critical landmark in the fight to end TB," said Dr Ghebreyesus. "It signals a long overdue global commitment to stop the death and suffering caused by this ancient killer."

The Moscow Declaration to End TB is a promise to increase multisectoral action as well as track progress, and build accountability. It will also inform the first UN General Assembly High-Level Meeting on TB in 2018, which will seek further commitments from heads of state.

Global efforts to combat tuberculosis TB have saved an estimated 53 million lives since 2000 and reduced the TB mortality rate by 37%. However, progress in many countries has stalled, global targets are off-track and persistent gaps remain in TB care and prevention.

As a result, TB still kills more people than any other infectious disease. There are major problems associated with antimicrobial resistance, and it is the leading killer of people with HIV.

"One of the main problems has been lack of political will and inadequate investment in fighting TB," added Dr Ghebreyesus. "Today's declaration must go hand in hand with increased investment."

The meeting was attended by ministers, country delegations, as well as representatives of civil society and international organizations, scientists and researchers. More than 1000 participants took part in the two-day conference which resulted in collective commitment to ramp up action on four fronts:

1. Move rapidly to achieve universal health coverage – by strengthening health systems and improving access to people-centred TB prevention and care, ensuring no one is left behind;

2. Mobilize sufficient and sustainable financing through increased domestic and international investments to close gaps in implementation and research;

3. Advance research and development of new tools to diagnose, treat, and prevent TB; and

4. Build accountability through a framework to track and review progress on ending TB including multisectoral approaches.

Ministers also promised to minimize the risk and spread of drug resistance and do more to engage people and communities affected by, and at risk of, TB. MEH

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Medical research news from around the world

Naturally occurring molecule may help prevent and treat atherosclerosis

Resolvin E1, a molecule produced naturally in the body from an omega -3 fish oil, topically applied on gum tissues not only prevents and treats gum disease as previously shown (Hasturk et al 2006 and 2007), but also decreases the likelihood for advanced arterial atherosclerotic plaques to rupture and form a dangerous thrombus or blood clot.

The findings, which appear in the journal *Current Atherosclerosis Reports*, could lead to effective preventive and therapeutic treatments in people with heart disease and/or gum disease without unwanted side effects.

Inflammation is a key pathology of atherosclerosis and may be a major driving force for heart attacks and stroke. There is increasing evidence from numerous research groups that chronic inflammatory diseases including, diabetes, heart disease, rheumatoid arthritis, colitis, pulmonary and kidney diseases, cancer and Alzheimer's disease can benefit by the use of the pro-resolving lipid mediators, resolvins and lipoxins.

To test the effectiveness of lipid mediators on advanced atherosclerosis, researchers from BUSM and The Forsyth Institute used two groups of an experimental model that possessed highly inflamed advanced atherosclerosis. The first group was treated with a solution applied on gum tissues that contained Resolvin E1 while the second group was treated with salt water as a control. The group treated with the inflammation-lowering lipid mediator (Resolvin E1) had minimal atherosclerosis and reduced plaque rupture in their aortic artery, while atherosclerosis advanced to more severe form of the disease in the control group.

"Current therapies for advanced atherosclerosis are inadequate and often carry high risks, and the Resolvin E1 therapy could provide a very effective and safe therapy that can be taken daily, which would also serve as a preventive approach for plaque inflammation and acute clinical events of heart attack and stroke," explained corresponding author James A. Hamilton, PhD, professor of physiology and biophysics and research professor of medicine at BUSM.

The researchers believe these findings support a paradigm shift in the treatment of both localized and systematic inflammatory conditions that are increasingly prevalent in type 2 diabetes and obesity and may be applicable to other chronic inflammatory diseases.

Kevlar-based artificial cartilage mimics properties of the real thing

The unparalleled liquid strength of cartilage, which is about 80% water, withstands some of the toughest forces on our bodies.

Synthetic materials couldn't match it – until 'Kevlartilage' was developed by researchers at the University of Michigan and Jiangnan University.

"We know that we consist mostly of water – all life does – and yet our bodies have a lot of structural stability," said Nicholas Kotov, the Joseph B. and Florence V. Cejka Professor of Engineering at U-M, who led the study. "Understanding cartilage is understanding how life forms can combine properties that are sometimes unthinkable together."

While other varieties of synthetic cartilage are already undergoing clinical trials, these materials fall into two camps that choose between cartilage attributes, unable to achieve that unlikely combination of strength and water content.

The other synthetic materials that mimic the physical properties of cartilage don't contain enough water to transport the nutrients that cells need to thrive, Kotov said.

Meanwhile, hydrogels – which incorporate water into a network of long, flexible molecules – can be designed with enough water to support the growth of the chondrocytes cells that build up natural cartilage. Yet those hydrogels aren't especially strong. They tear under strains a fraction of what cartilage can handle.

The new Kevlar-based hydrogel recreates the magic of cartilage by combining a network of tough nanofibers from Kevlar – the "aramid" fibres best known for making

bulletproof vests – with a material commonly used in hydrogel cartilage replacements, called polyvinyl alcohol, or PVA.

In natural cartilage, the network of proteins and other biomolecules gets its strength by resisting the flow of water among its chambers. The pressure from the water reconfigures the network, enabling it to deform without breaking. Water is released in the process, and the network recovers by absorbing water later.

This mechanism enables high impact joints, such as knees, to stand up to punishing forces. Running repeatedly pounds the cartilage between the bones, forcing water out and making the cartilage more pliable as a result. Then, when the runner rests, the cartilage absorbs water so that it provides strong resistance to compression again.

The synthetic cartilage boasts the same mechanism, releasing water under stress and later recovering by absorbing water like a sponge. The aramid nanofibers build the framework of the material, while the PVA traps water inside the network when the material is exposed to stretching or compression. Even versions of the material that were 92% water were comparable in strength to cartilage, with the 70%version achieving the resilience of rubber.

As the aramid nanofibers and PVA don't harm adjacent cells, Kotov anticipates

that this synthetic cartilage may be a suitable implant for some situations, such as the deeper parts of the knee. He also wonders whether chondrocytes might be able to take up residence inside the synthetic network to produce a hybrid cartilage.

But his potential applications are not limited to cartilage. He suspects that similar networks, with different proportions of aramid nanofibers, PVA and water, may be able to stand in for other soft tissues.

Gene marker could identify sickle cell patients with highest risk of complications

Researchers have found a genotype that could help identify sickle cell disease (SCD) patients at greatest risk of common, yet severe, complications of SCD. The findings were presented at the American Physiological Society's Physiological and Pathophysiological Consequences of Sickle Cell Disease conference in Washington, D.C.m in November.

The chronic breakdown of red blood cells (haemolysis) is a hallmark of SCD that increases during times of illness. Haemolysis leads to the release of haemoglobin – and a protein that binds with it called haptoglobin – that increase a patient's chances of developing acute chest syndrome (ACS).

"ACS is defined broadly as increased respiratory effort, fever and a new radiodensity on chest X-ray. ACS is a significant cause of hospitalizations and death in children and adults with SCD," said the study's lead author, Shaina Willen, MD, of Vanderbilt University Medical Center in Tennessee. ACS is a common complication among SCD patients, affecting roughly 50% at least once in their lifetime.

HP1-1, HP1-2 and HP2-2 are the three genetic markers (genotypes) associated with haptoglobin. These genotypes predict how effective an individual's haptoglobin is at binding to and clearing away excess haemoglobin. The haptoglobin in people with the HP2-2 genotype is not as effective in haemoglobin-binding, and HP2-2 has been linked to increased cellular (oxidative) damage. The research team hypothesized that patients with the HP2-2 genotype would be more susceptible to SCD-related complications including ACS, pain, stroke, retinal problems in the eyes, kidney disease and high blood pressure in the arteries of the lungs than patients with HP1-1 and HP1-2 genotypes.

The researchers tested 58 adults with SCD and found that 90% of those with the HP2-2 genotype had two or more SCD-related complications compared with 46.7% and 56.3% of those with the HP1-1 and HP1-2 genotypes, respectively.

"Our study has identified an increased risk for the development of sickle cell disease-related complications among adult participants with the HP2-2 genotype," Willen explained. "We have also found that children with the HP2-2 genotype are at increased risk for the development of pain episodes which is the most common cause of hospitalization in children and adults with SCD.

"This finding may identify both adults and children at risk for developing disease-related complications. The impact of the HP2-2 genotype on the ability of haptoglobin to scavenge products of haemolysis may provide therapeutic targets to investigate related to the oxidative effect of cell-free haemoglobin and the pathophysiology of complications in SCD."

Brain astrocytes linked to Alzheimer's disease

Astrocytes, the supporting cells of the brain, could play a significant role in the pathogenesis of Alzheimer's disease (AD), according to a new study from the University of Eastern Finland. This is the first time researchers discovered a direct association between astrocytes and AD. Published in *Stem Cell Reports*, the study investigated the brain cell function of familial AD patients by using stem cell technologies.

Alzheimer's disease is the most common dementia type, with no treatment to slow down the progression of the disease currently available. The mechanisms of AD are poorly understood, and drug therapy has focused on restoring the normal function of neurons and microglia, i.e. cells mediating brain inflammation. The new study shows that astrocytes, also known as the housekeeping cells of the brain, promote the decline of neuron function in AD. The findings suggest that at least some familial forms of AD are strongly associated with irregular astrocyte function, which promotes brain inflammation and weakens neurons' energy production and signalling.

Astrocytes are important brain cells, as they support neurons in many different ways. Astrocytes are responsible, for example, for the energy production of the brain, ion and pH balance, and they regulate synapse formation, the connections between neurons. Recent evidence suggests that human astrocytes are very different from their rodent counterparts and thus, it would be essential to use human cells to study human diseases. However, the availability of human astrocytes for research has been very limited.

The study used the induced pluripotent stem cell technology, which enables the generation of pluripotent stem cells from human skin fibroblasts. These induced stem cells can then be further differentiated to brain cells, e.g. neurons and astrocytes, with the same genetic background as the donor had.

The study compared astrocytes from familial AD patients carrying a mutation in the presenilin 1 gene to astrocytes from healthy donors, and the effects of these cells on healthy neurons were also analysed.

The researchers found that astrocytes in patients with Alzheimer's disease produced significantly more beta-amyloid than astrocytes in persons without AD. Beta-amyloid is a toxic protein that is known to accumulate in the brains of AD patients. In addition, AD astrocytes secreted more cytokines, which are thought to mediate inflammation. AD astrocytes also showed alterations in their energy metabolism which likely led to increased production of reactive oxygen species and reduced production of lactate, an important energy substrate for neurons. Finally, when astrocytes were co-cultured with healthy neurons, AD astrocytes caused significant changes on the signalling activity of neu-

rons when compared to healthy astrocytes.

This study was the first to show that astrocytes in patients with Alzheimer's disease manifest many pathological changes typical of AD. Astrocytes could thus play a key role in the early stages of the disease and changes in the function of these cells could lead to neurodegeneration.

"The induced pluripotent stem cells we used in this study proved to be extremely useful in disease modelling, and they could offer an excellent platform for drug discovery and testing new therapeutic targets for Alzheimer's disease in the future," says Early Stage Researcher Minna Oksanen, the lead author of the study.

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Worldwide, nearly 6% of cancers are attributable to diabetes and high BMI

Diabetes and high BMI (a BMI over 25 kg/m2) were the cause of 5.6% of new cancer cases worldwide in 2012 – equivalent to 792600 cases, according to the first study to quantify the proportion of cancers attributable to diabetes and high BMI published in *The Lancet Diabetes & Endocrinology* journal.

When considered individually, 544,300 cases of cancer were attributable to high BMI (equivalent to 3.9% of all cancers), and 280,100 were attributable to diabetes (2%).

Estimates suggest that 422 million adults have diabetes and 2.01 billion adults are overweight or obese, globally. Both high BMI and diabetes are risk factors for various types of cancer, potentially due to biological changes caused by diabetes and high BMI – such as high insulin, high sugar levels, chronic inflammation, and dysregulated sex hormones such as oestrogen – having adverse effects on the body.

With these two risk factors becoming increasingly widespread, the proportion of attributable cancers is set to grow further.

"As the prevalence of these cancer risk factors increases, clinical and public health efforts should focus on identifying preventive and screening measures for populations and for individual patients. It is important that effective food policies are implemented to tackle the rising prevalence of diabetes, high BMI and the diseases related to these risk factors," says lead author Dr Jonathan Pearson-Stuttard, Imperial College London, UK.

The study assessed the increase in new cases of 18 cancers based on the prevalence of diabetes and high BMI in 175 countries between 1980 and 2002.

To conduct the study, the authors gathered data on the incidence of 12 types of cancer from 175 countries in 2012. They combined this with data on high BMI and on diabetes. They matched the data sets by age group and sex to take account of age differences using diabetes and BMI data from 2002 to calculate cancer incidence in 2012 attributable to these risks.

Most of the cancer cases attributable to diabetes and high BMI occurred in high-income western countries (38.2%, 303,000/792,600 cases), and the second largest proportion occurring in east and southeast Asian countries (24.1%, 190,900/792,600 cases).

Although cancers are still less common in some low and middle-income countries than in high-income nations, the population of these countries experienced particularly large impacts from diabetes and high BMI. For example, between 9% and 14% of all cancer cases in Mongolia, Egypt, Kuwait, and Vanuatu were due to high BMI and diabetes. Meanwhile Tanzania, Mozambique, and Madagascar had the lowest proportion of cases attributable to high BMI and diabetes. This reflects geographical differences in the prevalence of diabetes and obesity as well as incidence of cancers affected by them.

Globally, liver cancer and endometrial cancer contributed the highest number of cancer cases caused by diabetes and high BMI (24.5%, 187,600/766,000 cases, and 38.4% 121,700/317,000 cases, respectively). However, the number of cases of different cancers varied globally, and in high-income Asia Pacific and east and southeast Asian countries liver cancer caused 30.7% and 53.8% of cases respectively, while in high-income western countries, central and eastern Europe, and sub-Saharan Africa breast and endometrial cancers contributed 40.9% of cancer cases.

Globally, the growing number of people with diabetes between 1980 and 2002 led to 77,000 new cases of attributable cancers in 2012 (26.1% increase). Similar increases in the number of people with high BMI led to 174,040 new cases of weight-related cancers (a 31.9% increase) over the same time.

Low- and middle-income countries across Asia and sub-Saharan Africa saw the largest increases in cancers due to diabetes and overweight and obesity, as the levels of diabetes and high BMI in these regions increased substantially between 1980 and 2002. For example, the number of diabetes-related cancers grew by 88% in 2012 for men in south Asia, increasing from 3500 cases in 1990 to 6600 cases in 2012. Similarly, cancer cases attributable to high BMI in women in sub-Saharan Africa increased by 80% - from 5400 cases in 1990 to 9700 cases in 2012.

The proportion of cancers related to diabetes and high BMI is expected to increase even further globally as the prevalence of the two risk factors increases. Using projected prevalence of diabetes and high BMI for 2025 compared with prevalence in 2002, the researchers estimate that the proportion of related cancers will grow by more than 30% in women and 20% in men on average.

Dr Pearson-Stuttard adds: "Increases in diabetes and high BMI worldwide could lead to a substantial increase in the proportion of cancers attributable to these risk factors, if nothing is done to reduce them. These projections are particularly alarming when considering the high and increasing cost of cancer and metabolic diseases, and highlight the need to improve control measures, and increase awareness of the link between cancer, diabetes, and high BMI."

The authors note that the 10 year lag between risk factor exposure and cancer development is a simple estimate of how long it takes for cancer to develop so may not include full exposure to the risk. There is growing evidence suggesting that diabetes is also related to myeloma, bladder, kidney, and oesophageal cancer, meaning the study may underestimate the burden of cancers due to diabetes.

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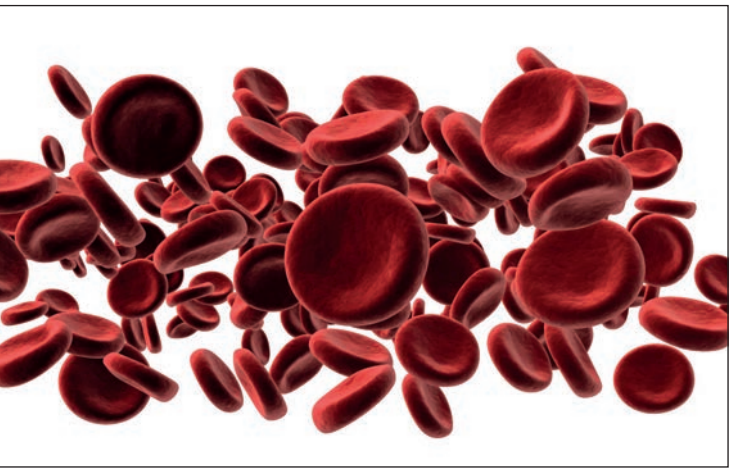


Immediate treatment with clot-stabilising drug could save thousands of lives

Time is of the essence when it comes to administering the clot-stabilising drug tranexamic acid to people with serious injury or women with severe bleeding after childbirth, according to a meta-analysis of over 40,000 patients, published in *The Lancet*. The study found that the likelihood of death due to blood loss was reduced by over 70% if the low-cost, readily-available drug was given immediately after injury or birth. But the chances of survival fell by 10% for each 15-minute delay, with no benefit seen after 3 hours.

"Responding quickly can be the difference between life and death, and that means patients must be treated urgently at the scene of injury or as soon as the diagnosis of haemorrhage is made. We have to make sure tranexamic acid is available before patients reach hospital and whenever a woman gives birth," says Professor Ian Roberts from the London School of Hygiene & Tropical Medicine, UK, who initiated the study.

Every year, more than 2 million people worldwide die from traumatic extracranial bleeding, often as a result of road traffic injuries and violence. Furthermore, post-partum haemorrhage is the leading cause of maternal death worldwide, killing around 100,000 women a year.

Antifibrinolytic drugs such as tranexamic acid, aminocaproic acid, and aprotinin work by stopping blood clots from breaking down and reducing bleeding. They have been used for many years to reduce heavy menstrual bleeding and are often given during surgery to reduce the need for blood transfusions.

This new study builds on previous research from the WOMAN and CRASH-2 trials which showed that tranexamic acid cut deaths due to post-partum haemorrhage and bleeding after serious injury by about a third if given within 3 hours of bleeding onset.

In this new analysis, Roberts and colleagues did a meta-analysis of individual patient data from these two trials, involving 40,138 men and women and found that almost two-thirds of bleeding deaths occurred within 12 hours of onset (884 of 1,408 bleeding deaths). Deaths due to post-partum haemorrhage peaked 2-3 hours after childbirth.

Overall, survival from severe bleeding was increased by a fifth with the use of tranexamic acid compared to placebo, irrespective of the site of bleeding (1.5% of women given tranexamic acid died of bleeding [155/10034] vs 1.9% of women given placebo plus standard care [190/9977], and 4.9% trauma patients given tranexamic acid died of bleeding [489/10060] vs 5.7% given placebo and standard care [574/10067]). This figure rose to 70% if the drug was administered immediately. For every 15-minute delay in treatment, survival benefit was cut by about 10%, even after taking into account age and systolic blood pressure, which are strong risk factors for death due to bleeding. No benefit was seen if treatment was delayed beyond 3 hours.

The researchers also found no evidence of complications or increased risk of clotting (i.e., heart attack, stroke, pulmonary embolism, and deep vein thrombosis) compared to placebo, and fewer cases of heart attacks were noted with tranexamic acid.

The authors explain that because treatment delay may be underestimated in trauma (many injuries are unwitnessed), and overestimated in post-partum haemorrhage (birth is taken as the time of bleeding onset), they did sensitivity analyses to test a range of plausible errors. Their results support the conclusion that prompt treatment is essential.

Professor Roberts explains: "Tranexamic acid is safe, cheap, easily administered, and does not need to be refrigerated. Most haemorrhage deaths occur within hours of bleeding onset. Prompt treatment has the potential to save thousands of additional lives worldwide every year."

"Given the importance of early treatment, time from bleeding onset to early treatment should be audited and communicated to healthcare professionals. Establishing national or regional quality improvement initiatives, with best practice benchmarking of time to treatment, might improve survival. More research is needed to improve our understanding of the mechanism of action of this life-saving treatment."

New imaging technique enables view of sub-cellular structures of living cells

To undergo high-resolution imaging, cells often must be sliced and diced, dehydrated, painted with toxic stains, or embedded in resin. For cells, the result is certain death.

But if researchers can only view the inner workings of dead cells, they're only seeing part of the story. They cannot monitor living cells' dynamic real-time processes, such as metabolic reactions or responses to diseases or treatments.

"Sub-cellular components and structures have a profound influence on the behaviour of the complex cellular machinery and systems biology," said Northwestern University's Materials Science and Engineering Department's Gajendra Shekhawat. "However, unravelling the structures and components inside the cell is very challenging because they are so fragile."

Now Shekhawat and Vinayak P. Dravid, the Abraham Harris Professor of Materials Science and Engineering, have developed a novel non-invasive imaging system that makes it possible to view the sub-cellular architecture of live cells at nanometre-scale resolution.

Called Ultrasound Bioprobe, the technique combines ultrasound waves with atomic force microscopy, interacting with

live cells to determine the changes in their mechanical behaviour.

Supported by the US National Science Foundation (NSF) and the National Heart, Lung, and Blood Institute, the research was recently published in Science Advances. Shekhawat and Dravid served as the paper's co-corresponding authors. Shekhawat, a research associate professor in materials science and engineering, was also the first author of the paper. The research was completed in the Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) Center.

Despite recent advances in imaging, there is currently no single method that provides high-resolution and high-sensitivity images of living sub-cellular structures. Fluorescent and confocal microscopy, which are traditional methods for monitoring the biological interactions inside cells, suffer from poor spatial resolution and require invasive dyes or labels to enhance contrast and highlight structures within biological tissues. Light and acoustic wave imaging are unable to view structures smaller than a few hundred nanometres. Scanning probe microscopy can provide very high spatial resolution but can only identify surface structures rather than peer inside a cell. And while electron microscopy can view fine details at the sub-cellular level, it's a destructive technique that cannot be used for living biological tissues.

"Many roadblocks have existed," said Dravid, who directs the NUANCE Center and the SHyNE Resource. "Characterization of the complex dynamics of biological processes, especially signal pathways at nanoscale resolution, has remained a challenge."

Shekhawat and Dravid's Ultrasound Bioprobe, however, bypasses these issues. Its ultrasound waves non-invasively image deeply buried intracellular features. And its atomic force microscopy probe provides high sensitivity and mechanical contrast of the scattered ultrasound waves. The result? Non-destructive, remarkably high-contrast, nanoscale images of structures and components deep inside living tissues and cells.

"Using this non-invasive approach, we can monitor real-time imaging of the nanomechanical changes in complex biological systems," Shekhawat said. "This could provide clues for early diagnostics and potential pathways for developing therapeutic strategies."

Next, the team plans to expand its technique to diverse biomedical applications, such as the nanomechanics of soft tissues such as skin, enamels, and bones to probe their three-dimensional architecture down to nanoscale spatial resolution.

Pre-hospital treatment can help seriously injured patients

Researchers may have paved the way for the development of potentially new life-saving treatments to be administered to seriously injured patients in the critical first hour of injury.

By testing the blood samples of 91 patients taken at the scene of major accidents, the researchers were able for the first time to establish how quickly the lining of blood vessels are damaged, which can lead to a rapid deterioration and even organ failure.

The research, published in *Shock*, is part of the ongoing 'Golden Hour' study led by scientists from the University of Birmingham's Institute of Inflammation and Ageing, the NIHR Surgical Reconstruction and Microbiology Research Centre (SRMRC) and the Royal Centre for Defence Medicine at Queen Elizabeth Hospital, Birmingham.

A major £10 million study, Golden Hour aims at improving outcomes for patients by developing the understanding of what happens to the immune system within the first 60 minutes from the moment of traumatic injury – a crucial time in which prompt medical treatment is key to survival.

Major David Naumann, a research fellow at the Royal Centre for Defence Medicine and the University of Birmingham, said: "When someone is very seriously injured, for example in a car crash, the body sometimes behaves as if there is a massive infection that it needs to fight, even when none is present. When this happens, the immune system can cause the patient to deteriorate rapidly and could even cause their organs to fail."

Dr Jon Hazeldine, of the University of Birmingham, said: "One of the things that may be to blame for this process is endotheliopathy which occurs when the lining of blood vessels is damaged. Prior to our study, it was not known when this process happens after injury, or whether having endotheliopathy within an hour of injury might lead to organ failure later on in hospital."

Professor Janet Lord, of the University of Birmingham, said: "We found that the damage to the lining of the blood vessels happens within minutes of injury, even before an ambulance has arrived, which has never been shown before. We also found that if the lining of the blood vessels improves in the following few hours that patients have lower rates of organ failure."

Professor Tony Belli, also of the University of Birmingham, added: "Our research has identified a potential target for treatment, to heal the damaged blood vessels, which could be administered by ambulance and helicopter crews on arrival at the scene of injury and improve outcomes for injured patients. As part of our ongoing Golden Hour study we have several ongoing studies examining the causes of endotheliopathy and which treatments may best be used to treat it."

Key to the research was an around-the-clock blood sampling and analysis operation working in collaboration with ambulance and air ambulance services, which has seen paramedics being specially trained to take blood samples from patients at the scene of major traumas.

The observational study used the blood samples taken from 91 seriously injured patients at the scene of a major trauma. Of the 91 patients, who had an average age of 38, 78 were male and 13 were female. Nineteen non-injured individuals were also used as a healthy control. Biomarkers were used to detect endiotheliopathy within the blood. Endiotheliopathy was found to occur five to eight minutes after injury.

- **doi**: 10.1097/SHK.0000000000000999

Better understanding of nasal sinus pathways could lead to new instructions for nasal sprays

Sinus infections, inflammation and nasal congestion constantly plague people

around the world, often leading to unpleasant symptoms and even missed days of work. Traditional nasal spray anti-inflammatory medications attempt to treat the symptoms noninvasively, but are not very efficient in transmitting the active drug ingredients directly into the sinus cavities.

Paranasal sinuses are essentially hollow cavities in the skull surrounding your nasal cavity. While the role of the sinuses is debated, it is believed they function to decrease the weight of the anterior skull, increase voice resonance and buffer against facial trauma. Their location and structure provide the ideal environment for bacterial growth, infection or viral deposition, often leading to diseases like chronic rhinosinusitis (CRS). The typical treatments for these conditions consist of topical medications (nasal sprays) and oral antibiotics.

Researchers Saikat Basu, Zainab Farzal and Julia S. Kimbell of the University of North Carolina's School of Medicine presented their research on the anatomy-based flow physics in nasal cavities which generate "magical" streamlines for sinus drug delivery at the 70th annual meeting of the American Physical Society's Division of Fluid Dynamics, in November 2017, in Colorado.

"We found that current package instructions for such sprays are not optimal for maximal drug transport to the sinuses, which is a function of various factors like head orientation of the patient, breathing rates and the spray bottle orientation during drug spray," Basu said.

For the medication to have the greatest effects, the active ingredients must deposit inside or in close proximity of the affected sinus cavities. To ensure accurate anatomical representation in the numerical simulations of the sprayed drug transport process, they used computed tomography (CT) scans from CRS patients and imaging software to develop anatomically realistic digital 3-D models.

Understanding the physics of sinus airflow pathways enables the identification of optimal release points for the nasal sprays. Advances in anatomical modelling make it possible to determine the effect of specific drug routes.

"Ambient respiratory flow physics exert a considerable influence on the transport of sprayed particles in our nasal cavities," Basu said. "With the advances in computational capacities, it is now possible to develop digital 3-D models of complex physiological systems and track transport processes therein through computational fluid mechanics."

The preliminary results of this study are relevant to both the consumer and the manufacturer of nasal sprays. The researchers found that when the spray nozzle was inserted deeper into the nose (10mm) that it performed better and that while the current instructions for the spray bottle recommend holding it at 22.5 degrees, drug transport was better at an angle of 35-45 degrees. Drug providers will be able to recommend more effective instructions and application techniques to ensure that the spray reaches its target. Findings might also suggest improvements in the design of the spray console that would amplify the medication deposits inside the sinus cavities.

Vaccine for cutaneous leishmaniasis looks promising

A research team at The University of Texas at El Paso is one step closer to developing an effective human vaccine for cutaneous leishmaniasis.

UTEP biological sciences doctoral student Eva Iniguez; her mentors Rosa Maldonado, Ph.D., and Igor Almeida, Ph.D.; and their teams and collaborators in Liverpool (Alvaro Acosta-Serrano, Ph.D.) and Saudi Arabia (Waleed Al-Salem, Ph.D.), recently published their research findings in *PLOS Neglected Tropical Diseases*, the first journal solely devoted to the world's most neglected tropical diseases.

Leishmaniasis is caused by the protozoan leishmania parasites, which are transmitted by the bite of infected female phlebotomine sandflies – flies that are three times smaller than a mosquito. According to the World Health Organization, there are an estimated 700,000 to 1 million new cases annually, and they cause 20,000-30,000 deaths each year. The disease affects some of the poorest people in more than 90 countries in the tropics, subtropics.

"I think we are in a very good position

with this vaccine candidate," Maldonado said. "It is very promising."

During the team's more than four years of research at UTEP's Border Biomedical Research Center, they discovered a vaccine formulation that resulted in a 96% decrease in the lesions caused by the illness and showed an 86% protection rate from the disease in mice. The team counted on the expertise of UTEP chemist Katja Michael, Ph.D., to synthesize molecules used in the study.

"It was really hard to get to this point," Iniguez said. "There was a lot of standardization, but I am very happy. It is significant protection that we observed and we have all the immunology to understand how the vaccine is working in the system."

Maldonado and Almeida have each studied Chagas disease for more than 25 years and recently received a patent for the first synthetic Chagas vaccine. That work helped them initiate this research with leishmaniasis, as molecules are different in the diseases but there are similar carbohydrates between the parasites.

The team has submitted a patent application for their cutaneous leishmaniasis vaccine. Currently, there is no vaccine for the disease in humans. Treatment used now is very toxic, painful and lengthy – requiring patients to be hospitalized for almost three weeks for intravenous treatment. A vaccine does exist to treat cutaneous leishmaniasis in canines. It is approved for use in the United Kingdom.

• **doi**: 10.1371/journal.pntd.0006039

WHO, FAO, OIE issue urgent call for responsible use of antibiotics in humans and animals

They warn resistance is rising to dangerously high levels worldwide

World Antibiotic Awareness Week was held from 13-9 November with an urgent call for the responsible use of antibiotics in humans and animals to reduce the emergence of antibiotic resistance. The call was made jointly by the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO) and the World Organisation for Animal Health (OIE).

Antibiotic resistance is rising to dangerously high levels in all parts of the world and threatening the ability to treat common infectious diseases.

Antibiotics are often overprescribed by physicians and veterinarians and overused by the public. Where they can be bought for human or animal use without a prescription, the emergence and spread of resistance is made worse. Examples of misuse include taking antibiotics for viral infections like colds and flu, and using them as animal growth promoters on farms or in aquaculture.

To tackle these problems, WHO, FAO and OIE are leveraging their expertise and working together in a 'One Health' approach to promote best practices to reduce the emergence and spread of antibiotic-resistant microbes in both humans and animals.

Dr Tedros Adhanom Ghebreyesus, Director-General of WHO, warns: "Antibiotic resistance is a global crisis that we cannot ignore. If we don't tackle this threat with strong, coordinated action, antimicrobial resistance will take us back to a time when people feared common infections and risked their lives from minor surgery."

Commenting on the issue, José Graziano da Silva, Director-General of FAO, notes: "The overuse of antimicrobials blunts their effectiveness, and we must reduce their misuse in food systems. Antimicrobial veterinary medicines are a crucial tool for animal health and welfare and safe food production, but they are by no means the only tool."

Dr Monique Eloit, Director-General of OIE, added: "Like in human health, vet-

erinary medicine has tremendously progressed thanks to antibiotics. Preserving their efficacy and availability through their responsible use associated with good husbandry and prevention practices, is therefore essential to preserve animal health and welfare."

WHO points out that antimicrobial resistance is a complex problem that affects all of society and is driven by many interconnected factors. The organisation notes that single, isolated interventions have limited impact. Coordinated action is required to minimize the emergence and spread of antimicrobial resistance.

All countries need national action plans on antimicrobial resistance, says the WHO.

Greater innovation and investment are required in research and development of new antimicrobial medicines, vaccines, and diagnostic tools.

To this end, a political declaration endorsed by Heads of State at the United Nations General Assembly in New York in September 2016 signalled the world's commitment to taking a broad, coordinated approach to address the root causes of antimicrobial resistance across multiple sectors, especially human health, animal health and agriculture. MEH

> Antibiotic resistance is a global crisis that we cannot ignore. If we don't tackle this threat with strong, coordinated action, antimicrobial resistance will take us back to a time when people feared common infections and risked their lives from minor surgery.

The current status of antimicrobial resistance

Background

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines.

Antimicrobial resistance happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when they are exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintics). Microorganisms that develop antimicrobial resistance are sometimes referred to as "superbugs".

As a result, the medicines become ineffective and infections persist in the body, increasing the risk of spread to others.

Antimicrobial resistance occurs naturally over time, usually through genetic changes. However, the misuse and overuse of antimicrobials is accelerating this process. In many places, antibiotics are overused and misused in people and animals, and often given without professional oversight. Examples of misuse include when they are taken by people with viral infections like colds and flu, and when they are given as growth promoters in animals or used to prevent diseases in healthy animals.

Antimicrobial resistant-microbes are found in people, animals, food, and the environment (in water, soil and air). They can spread between people and animals, including from food of animal origin, and from person to person. Poor infection control, inadequate sanitary conditions and inappropriate food-handling encourage the spread of antimicrobial resistance.

Resistance in bacteria

Antibiotic resistance is present in every country.

Patients with infections caused by drug-resistant bacteria are at increased risk of worse clinical outcomes and death, and consume more healthcare resources than patients infected with non-resistant strains of the same bacteria.

Resistance in *Klebsiella pneumoniae* – common intestinal bacteria that can cause life-threatening infections – to a last resort treatment (carbapenem antibiotics) has spread to all regions of the world. *K. pneumoniae* is a major cause of hospital-acquired infections such as pneumonia, bloodstream infections, and infections in newborns and intensive-care unit patients. In some countries, because of resistance, carbapenem antibiotics do not work in more than half of people treated for *K. pneumoniae* infections.

Resistance in *E. coli* to one of the most widely used medicines for the treatment of urinary tract infections (fluoroquinolone antibiotics) is very widespread. There are countries in many parts of ▶

▶ (continued...)

the world where this treatment is now ineffective in more than half of patients.

Treatment failure to the last resort of medicine for gonorrhoea (third generation cephalosporin antibiotics) has been confirmed in at least 10 countries (Australia, Austria, Canada, France, Japan, Norway, Slovenia, South Africa, Sweden and the United Kingdom and Northern Ireland).

WHO recently updated the treatment guidelines for gonorrhoea to address emerging resistance. The new WHO guidelines do not recommend quinolones (a class of antibiotic) for the treatment of gonorrhoea due to widespread high levels of resistance. In addition, treatment guidelines for chlamydial infections and syphilis were also updated.

Resistance to first-line drugs to treat infections caused by *Staphlylococcus aureus* – a common cause of severe infections in health facilities and the community – is widespread. People with MRSA (methicillin-resistant *Staphylococcus aureus*) are estimated to be 64% more likely to die than people with a non-resistant form of the infection.

Colistin is the last resort treatment for life-threatening infections caused by Enterobacteriaceae which are resistant to carbapenems. Resistance to colistin has recently been detected in several countries and regions, making infections caused by such bacteria untreatable.

Resistance in tuberculosis (TB)

WHO estimates that, in 2014, there were about 480,000 new cases of multidrug-resistant tuberculosis (MDR-TB), a form of tuberculosis that is resistant to the 2 most powerful anti-TB drugs. Only about a quarter of these (123,000 cases) were detected and reported. MDR-TB requires treatment courses that are much longer and less effective than those for non-resistant TB. Globally, only half of MDR-TB patients were successfully treated in 2014.

Among new TB cases in 2014, an estimated 3.3% were multidrug-resistant. The proportion is higher among people previously treated for TB, at 20%.

Extensively drug-resistant tuberculosis (XDR-TB), a form of tuberculosis that is resistant to at least 4 of the core anti-TB drugs, has been identified in 105 countries. An estimated 9.7% of people with MDR-TB have XDR-TB.

Resistance in malaria

As of July 2016, resistance to the first-line treatment for *P. falciparum* malaria (artemisinin-based combination therapies, also known as ACTs) has been confirmed in 5 countries of the Greater Mekong subregion (Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand and Vietnam). In most places, patients with artemisinin-resistant infections recover fully after treatment, provided that they are treated with an ACT containing an effective partner drug. However, along the Cambodia-Thailand border, *P. falciparum* has become resistant to almost all available antimalarial medicines, making treatment more challenging and requiring close monitoring. There is a real risk that multidrug resistance will soon emerge in other parts of the subregion as well. The spread of resistant strains to other parts of the world could pose a major public health challenge and jeopardize important recent gains in malaria control.

Resistance in HIV

In 2010, an estimated 7% of people starting antiretroviral therapy (ART) in developing countries had drug-resistant HIV. In developed countries, the same figure was 10-20%. Some countries have recently reported levels at or above 15% amongst those starting HIV treatment, and up to 40% among people re-starting treatment. Who stresses that this requires urgent attention.

Increasing levels of resistance have important economic implications as second and third-line regimens are 3 times and 18 times more expensive, respectively, than first-line drugs.

Since September 2015, WHO has recommended that everyone living with HIV start on antiretroviral treatment. Greater use of ART is expected to further increase ART resistance in all regions of the world. To maximize the long-term effectiveness of first-line ART regimens, and to ensure that people are taking the most effective regimen, it is essential to continue monitoring resistance and to minimize its further emergence and spread. In consultation with countries, partners and stakeholders, WHO is currently developing a new *"Global Action Plan for HIV Drug Resistance (2017-2021)"*.

Resistance in influenza

Antiviral drugs are important for treatment of epidemic and pandemic influenza. So far, virtually all influenza A viruses circulating in humans were resistant to one category of antiviral drugs – M2 Inhibitors (amantadine and rimantadine). However, the frequency of resistance to the neuraminidase inhibitor oseltamivir remains low (1-2%). Antiviral susceptibility is constantly monitored through the WHO Global Influenza Surveillance and Response System. MEH

Pharmacist takes the lead in spreading awareness in Syria

Many pharmacists in the Syrian Arab Republic admit dispensing antibiotics without asking for prescriptions. Three pharmacy graduates decided to launch a campaign to inform fellow pharmacists of their role in preventing antibiotic resistance.

Hanaya Raad is a Syrian pharmacist who has dedicated herself to spreading awareness on antibiotic resistance in her home country. A topic not covered in her out-dated university curriculum, Raad first heard about antibiotic resistance after she graduated when it was mentioned in a practical course for pharmacists. On hearing about this mounting threat, Raad and two of her fellow graduates Sarah Safadi and Nour Allahham took it upon themselves to take action.

After digging further into the topic and educating themselves on the best course of action for pharmacists, Raad and her colleagues approached the Syrian Pharmacists Association.

"We met the head of the Syrian Pharmacists' Association and the head of the Scientific Committee and explained the problem and the concerns in Syria," she says. "In Syria, antibiotics are purchased in pharmacies and healthcare centres without the need to show a prescription, and lots of patients in Syria don't go to doctors to take advice if they get sick. They consider the pharmacists as the first people to go to, to ask for antibiotics."

The Syrian Pharmacists' Association threw their support behind the graduates and Raad and her colleagues were able to launch an awareness campaign targeting antibiotic-prescribing habits among pharmacists and antibiotic misuse in the population, starting in the capital city of Damascus.

"The campaign aimed to target pharmacists around Damascus, with the plan to cover other Syrian cities in the future," says Raad. "We were able to reach 413 pharmacies, which is roughly half of the pharmacies in Damascus."

The materials developed by these inspired graduates were delivered not only to pharmacies, but also to healthcare centres and hospitals. This was made possible by 19 volunteers who travelled around Damascus, providing advice and talking to pharmacists about the danger of dispensing antibiotics without a prescription from a doctor. They also created small cards for the pharmacists to give to their patients when they buy antibiotics, with instructions on how to use them.

In addition, they created a Facebook page to reach as many Syrians as possible, as the instability made it difficult to cover certain areas in the region. Several lectures and presentations were also held for pharmacists, students, and the general public.

The key messages in these materials and activities highlighted the magnitude of the antibiotic resistance problem and the role of pharmacists in decreasing antibiotic resistance among Syrians.

"It was important that they should know that they cannot give antibiotics without making sure that the patient has a bacterial infection, not a viral infection," says Raad.

The campaign had to navigate various hurdles along the way, including travel restrictions, lack of experience, and reluctance of pharmacists due to economic problems and insecurity in the country.

Yet, despite all the challenges, the campaign received very positive reactions, especially amongst the younger generations of pharmacists.

> Lots of patients in Syria don't go to doctors to take advice if they get sick. They consider the pharmacists as the first people to go to, to ask for antibiotics.
>
> – Hanaya Raad, Pharmacist

"It was a big achievement because there hasn't been any initiative about this problem in Syria," says Raad.

The team have also used the campaign to conduct some preliminary research on the knowledge and attitudes around antibiotic resistance in the Syrian Arab Republic.

"We have a bit of an idea that the problem is big in Syria and it is not something that we can just ignore," says Raad. "Now I am trying to collaborate with the universities in London to do a real research project on this and to assess how big the problem is."

Raad did her Masters of Public Health at London Imperial College in 2016 and is now based in London along with one of the other colleagues who started the campaign, working on improving the campaign strategy. They will continue the campaign with high hopes to expand into even more regions. MEH

A screenshot from a Youtube video published 23 August 2013 of children killed in a chemical weapons attack in the war in Syria - *https://www.youtube.com/watch?v=QYmZ5bC4Ic4*

As the Syrian war continues, the proportion of children killed increases

In 2016, one in four civilian deaths in the Syrian war were children, according to new estimates published in *The Lancet Global Health* journal. The study finds that since 2011, the conflict has claimed the lives of an increasing proportion of children as a result of the systematic use of aerial bombing on populated areas, which disproportionately affects civilian women and children.

The study uses data on deaths in non-government-controlled areas documented by the Violence Documentation Center (VDC), an independent group with a ground network of 30-35 investigators in Syria covering each province. [1]

"Our findings underscore the highly limited efficacy of shelling and aerial bombing against opposition fighters, and the disproportionate lethal impact on civilians, particularly children. These findings call into question the use of these weapons in populated urban areas and suggest possible indiscriminate weapons use contrary to international humanitarian law." says lead author Professor Debarati Guha-Sapir, Université catholique de Louvain, Belgium.

In the first six years of conflict, 70.6% of the deaths documented as part of the study were civilians (101,453/143,630), and 29.4% were opposition fighters (42,177/143,630). The majority of civilian deaths have been men (71.9%, 72,940 men), followed by children (17.2%, 17,401 children) and women (11%, 11,112 women). Because government-controlled areas are unsafe for the VDC staff to enter, the study does not include data from these areas. While the study provides evidence of trends in violent events recorded by VDC, it does not represent the total impact of the conflict.

The Syrian conflict started as peaceful demonstrations in March 2011, but, in June 2011, escalated into an armed rebellion against President Bashar Al-Assad and his government including anti-government groups such as Salafi jihadist groups, the Islamic State of Iraq and the Levant (ISIL), Syrian Democratic Forces,

and Free Syrian Army. Warring parties in Syria have since expanded to include international groups such as Russia, USA, Iran and Palestine.

According to the Syrian Centre for Policy Research, the war has displaced over half of the Syrian population, and resulted in a drop in life expectancy of up to 20 years by 2014.

In *The Lancet Global Health* study, the researchers found that, at the outset of the war, shootings caused most civilian deaths, but that shelling became the main cause of death in early 2013. In August 2012, deaths by aerial bombings increased.

Overall, more than half of civilian deaths documented in this study were caused by shelling and aerial bombs (57.3%, 58,099/101,453), compared to less than one in 10 documented deaths of opposition fighters (9.6%; 4058/42,171 deaths).

While male civilian deaths were caused equally by shells, shootings, executions and aerial bombing (around 23-26% of deaths were caused by each type of weapon), women and children were mostly killed by shells and aerial bombs (shelling caused 37.7% of deaths of women and 37.3-38.7% for children. Aerial bombing caused 36.9% of deaths of women and 39.2-46.3% for children). This impact has increased as the use of these weapons grew from 2014 when international parties intensified the aerial bombing of Syria.

Based on the provinces the VDC staff were able to access, the greatest numbers of civilian deaths were documented in Homs until late 2012, when deaths in Damascus and Aleppo increased dramatically and saw the highest figures. These two locations have witnessed nearly 25% of all deaths, and the highest proportions of child deaths by shelling. Aleppo was also home to 40% of all child deaths by aerial bombing, a figure twice that of other provinces after a rapid increase in deaths of this kind in 2013.

Barrel bombs caused a very high proportion of civilian deaths, and almost all documented deaths from barrel bombs included in the study were civilian (97.2%, 7351/7566 deaths) and a quarter were children (27.3%, 2007/7351)[2].

Almost three-quarters of barrel bomb deaths (72.4%, 5322 deaths) occurred between January 2014 and June 2015, and almost two-thirds (65.6%, 4820 deaths) occurred in Aleppo.

The authors note that barrel bombs have been dropped on hospitals, markets, and homes, and sometimes used in 'double-tap strikes' where a second barrel bomb is dropped minutes after the first in an attempt to eliminate first responders and medical services. In March 2017, *The Lancet* published the first report from its Commission on Syria highlighting how health care was being used as a weapon of war in Syria.[3]

Professor Guha-Sapir notes: "Among the explosive weapons used, the vast impact of barrel bombs on civilians compared with their lesser effect on opposition fighters shows an extreme disparity. This supports claims that barrel bombs may have been used to directly target civilians, or that barrel bombs constitute an indiscriminate weapon. Approximately three quarters of recorded incidents of explosive weapon use in Syria have occurred in densely populated civilian areas, putting civilians at very high risk and suggesting a degree of intentionality."

The authors say that due to changes in intensity of the conflict, control of areas, blocked access or threats to VDC staff, data collection varied over time and location. The number of deaths caused by wide-area explosive weapons is likely to be underestimated due to loss of bodies in these events, however they note this is unlikely to affect the finding that these weapons disproportionately kill civilians.

The study does not include deaths caused indirectly by war (such as increased disease, severe shortages of medical staff and supplies, and reduced access to medical facilities) or deaths of people who have fled the country, been detained or disappeared.

Comment

Writing in a linked Comment, Dr Hani Mowafi, Yale University, USA, says: "The Syrian civil war, now in its 7th year, has inflicted a grave toll on the country's population and public health system. The conflict has destroyed Syria's public health infrastructure, inflicted marked excess direct and indirect mortality, and forced widespread displacement of more than half of the Syrian population… Documentation of the health impact of war and conflict is one of the most difficult yet important public health challenges. An essential effort is to arrive at a robust estimate of who has been killed and injured, by what means, over the duration of hostilities. Countries that descend into conflict frequently have inadequate vital statistics systems and woefully incomplete death registries prior to that descent. Wars further vitiate any attempt at accounting. Yet, the health and population impact of conflicts is dramatic and their effects long lasting. Any attempt to understand these events requires careful data collection and contemporaneous analysis to capture data that would otherwise be lost."

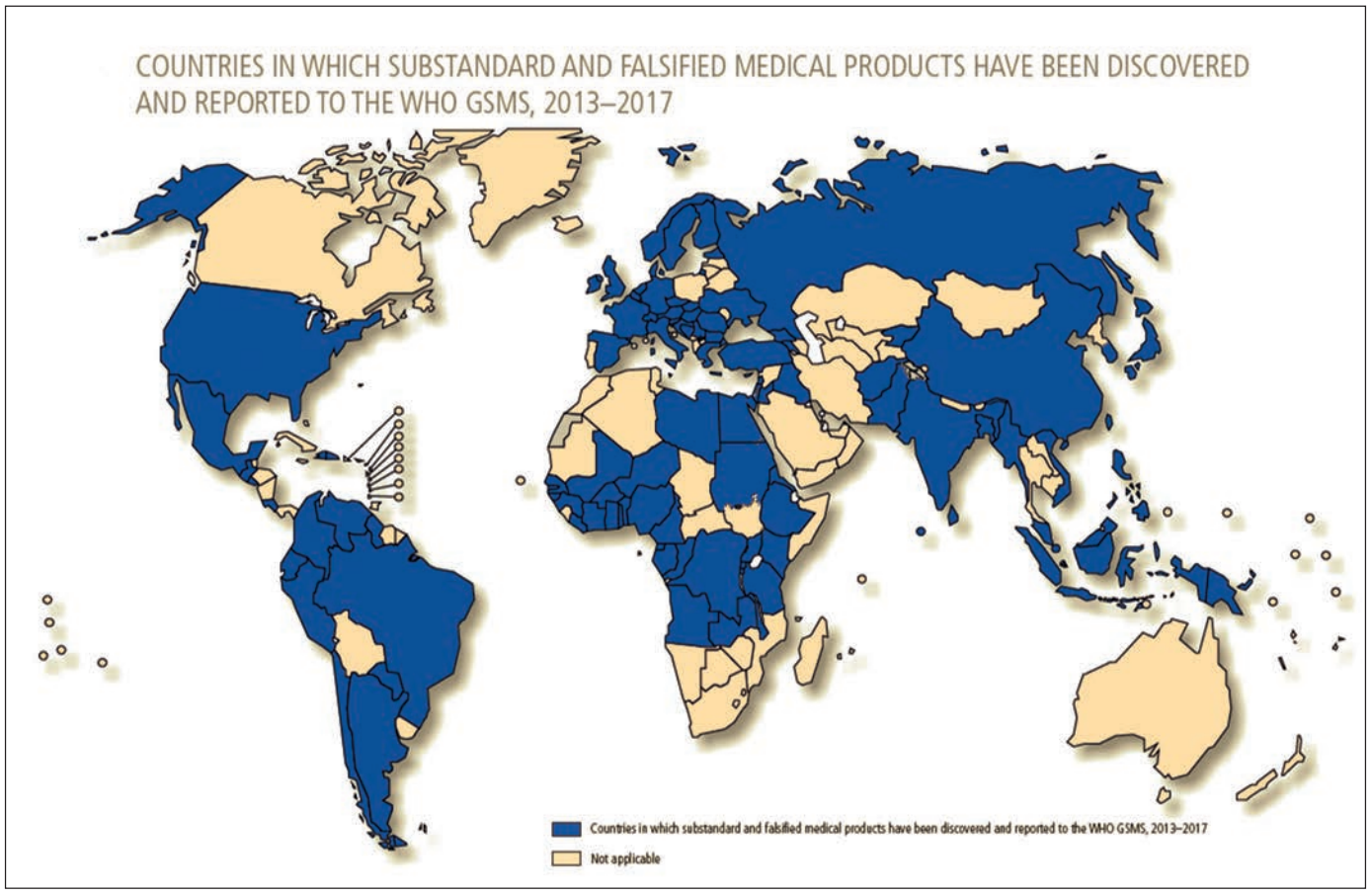
- *The Lancet Global Health* study can be accessed here: *https://tinyurl.com/y92yh2zm*

References

[1] The VDC aim to collect data on all violent deaths in the region, including demographic, date of death, location, cause of death, and whether they were a civilian or fighter.

[2] Barrel bombs comprise of barrels or cylinders filled with explosives, shrapnel, nails, and oil, which are dropped from helicopters or planes and fragment on impact with a large blast radius capable of decimating a city block.

[3] *http://www.thelancet.com/commissions/syria* MEH



Fake drugs problem on the rise

An estimated 10% of medical products circulating in low- and middle-income countries is either substandard or falsified, according to new research from WHO, outlined in a recently published report: WHO Global Surveillance and Monitoring System for substandard and falsified medical products.

This means that people are taking medicines that fail to treat or prevent disease. Not only is this a waste of money for individuals and health systems that purchase these products, but substandard or falsified medical products can cause serious illness or even death.

The report notes that "although it is extremely difficult to quantify the problem precisely, recent efforts by the World Health Organization (WHO) and others to support countries in tracking and reporting substandard and falsified medical products suggest the problem is on the rise".

"Substandard and falsified medicines particularly affect the most vulnerable communities," says Dr Tedros Adhanom Ghebreyesus, WHO Director-General. "Imagine a mother who gives up food or other basic needs to pay for her child's treatment, unaware that the medicines are substandard or falsified, and then that treatment causes her child to die. This is unacceptable. Countries have agreed on measures at the global level – it is time to translate them into tangible action."

Established in 2013, WHO's Global Surveillance and Monitoring System for substandard and falsified medical products (GSMS) is still in its infancy. Prior to 2013, there was no global reporting of this information, however in the past four years WHO has received 1500 reports of cases of substandard or falsified products. It is clear that these cases represent only a fraction of the problem.

Of these, antimalarials and antibiotics are the most commonly reported. Most of the reports (42%) come from the WHO African Region, 21% from the WHO Region of the Americas, and 21% from the WHO European Region.

This is likely just a small fraction of the total problem and many cases may be going unreported. For example, only 8% of reports of substandard or falsified products to WHO came from the WHO Western Pacific Region, 6% from the WHO Eastern Mediterranean Region, and just 2% from the WHO South-East Asia Region.

According to the report the numerical distribution of cases is influenced by the roll-out of the GSMS system, which includes training for staff appointed by national medicine regulators to act as focal points interacting

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What are substandard and falsified medicines

- **Substandard medical products**
Also called "out of specification", these are authorized medical products that fail to meet either their quality standards or their specifications, or both.

- **Unregistered/unlicensed medical products**
Medical products that have not undergone evaluation and/or approval by the national or regional regulatory authority for the market in which they are marketed/distributed or used, subject to permitted conditions under national or regional regulation and legislation.

- **Falsified medical products**
Medical products that deliberately/fraudulently misrepresent their identity, composition or source.

with the global reporting system. As of July 2017, staff from 126 WHO Member States had been trained in 17 workshops. There is a striking association between increased training and increases in cases reported, suggesting that the greater the effort made to look for substandard and falsified medical products, the more of them will be found.

"Many of these products, like antibiotics, are vital for people's survival and wellbeing," says Dr Mariângela Simão, Assistant Director-General for Access to Medicines, Vaccines and Pharmaceuticals at WHO. "Substandard or falsified medicines not only have a tragic impact on individual patients and their families, but also are a threat to antimicrobial resistance, adding to the worrying trend of medicines losing their power to treat".

WHO has received reports of substandard or falsified medical products ranging from cancer treatment to contraception. They are not confined to high-value medicines or well-known brand names and are split almost evenly between generic and patented products.

Treatment failure

In conjunction with the first report from the Global Surveillance and Monitoring System, WHO is publishing research that estimates a 10.5% failure rate in all medical products used in low- and middle-income countries.

This study was based on more than 100 published research papers on medicine quality surveys done in 88 low- and middle-income countries involving 48,000 samples of medicines. Lack of accurate data means that these estimates are just an indication of the scale of the problem. More research is needed to more accurately estimate the threat posed by substandard and falsified medical products.

Based on 10% estimates of substandard and falsified medicines, a modelling exercise developed by the University of Edinburgh estimates that 72,000 to 169,000 children may be dying each year from pneumonia due to substandard and falsified antibiotics. A second model done by the London School of Hygiene and Tropical Medicine estimates that 116,000 (64,000 – 158,000) additional deaths from malaria could be caused every year by substandard and falsified antimalarials in sub-Saharan Africa, with a cost of US$38.5 million (21.4 million – 52.4 million) to patients and health providers for further care due to failure of treatment.

Good governance

Substandard medical products reach patients when the tools and technical capacity to enforce quality standards in manufacturing, supply and distribution are limited. Falsified products, on the other hand, tend to circulate where inadequate regulation and governance are compounded by unethical practice by wholesalers, distributors, retailers and health care workers. A high proportion of cases reported to WHO occur in countries with constrained access to medical products.

Modern purchasing models such as online pharmacies can easily circumvent regulatory oversight. These are especially popular in high-income countries, but more research is needed to determine the proportion and impact of sales of substandard or falsified medical products.

Globalization is making it harder to regulate medical products. Many falsifiers manufacture and print packaging in different countries, shipping components to a final destination where they are assembled and distributed. Sometimes, offshore companies and bank accounts have been used to facilitate the sale of falsified medicines.

"The bottom line is that this is a global problem," says Dr Simão. "Countries need to assess the extent of the problem at home and cooperate regionally and globally to prevent the traffic of these products and improve detection and response."

Tackling the problem

The Executive Summary of the report outlines how the problem can be tackled and notes that three interconnected approaches are required.

I. The first focuses on preventing the sale and consumption of substandard and falsified medical products;
II. the second on implementing systems to detect any substandard or falsified products that are already in the supply chain; and
III. the third requires authorities to respond quickly and proportionately to any incidents that are detected.

on the WEB WHO medical products alert *www.who.int/medicines/regulation/ssffc/medical-products* MEH

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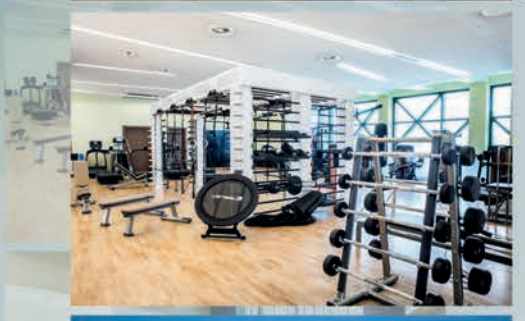

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Half of world's population without access to essential health services

At least half of the world's population – 3.5 billion people – cannot obtain essential health services, according to a new report from the World Bank and the World Health Organization. And each year, large numbers of households are being pushed into poverty because they must pay for health care out of their own pockets.

Currently, 800 million people spend at least 10 percent of their household budgets on health expenses for themselves, a sick child or other family member. For almost 100 million people these expenses are high enough to push them into extreme poverty, forcing them to survive on just $1.90 or less a day.

"It is completely unacceptable that half the world still lacks coverage for the most essential health services," said Dr Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization. "It is unnecessary. A solution exists: universal health coverage (UHC) allows everyone to obtain the health services they need, when and where they need them, without facing financial hardship."

Eastern Mediterranean Region

In the Eastern Mediterranean Region (EMR), around 40% of health expenditure comes directly from people's pockets; most of whom cannot afford it. People with low incomes and without social protection are the hardest affected. As a result, an estimated 7.5 million people are pushed into poverty every year in the EMR due to spending on health. Universal health coverage has a special relevance to people living in countries with acute and prolonged emergency situations, noting that half of the world's internally displaced populations are living in countries of the region and more than 60% of the world's refugees and migrants originate from the region. This is the status even though most countries in the region have adopted universal health coverage as a national vision.

The essence of universal health coverage is the provision of a basic package of health services to the whole population and ensuring that those who cannot pay for health care are financially protected through prepayment schemes. Every country can make progress towards universal coverage, even low-income countries and those affected by emergencies.

Commenting on the report, Dr Jim Yong Kim, World Bank Group President, said: "The report makes clear that if we are serious – not just about better health outcomes, but also about ending poverty – we must urgently scale up our efforts on universal health coverage. Investments in health, and more generally investments in people, are critical to build human capital and enable sustainable and inclusive economic growth.

"But the system is broken: we need a fundamental shift in the way we mobilize resources for health and human capital, especially at the country level. We are working on many fronts to help countries spend more and more effectively on people, and increase their progress towards universal health coverage."

There are wide gaps in the availability of services in Sub-Saharan Africa and Southern Asia. In other regions, basic health care services such as family planning and infant immunization are becoming more available, but lack of financial protection means increasing financial distress for families as they pay for these services out of their own pockets.

This is even a challenge in more affluent regions such as Eastern Asia, Latin America and Europe, where a growing number of people are spending at least 10% of their household budgets on out-of-pocket health expenses. Inequalities in health services are seen not just between, but also within countries: national averages can mask low levels of health service coverage in disadvantaged population groups. For example, only 17% of mothers and children in the poorest fifth of households in low- and lower-middle income countries received at least six of seven basic maternal and child health interventions, compared to 74% for the wealthiest fifth of households. MEH

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Global collaboration treats more than 1 billion for NTDs in 2016

In 2016, more than 1 billion people of the world's poorest people were reached with treatment for at least one neglected tropical disease in one of the most comprehensive global health collaborations in history.

That's one in seven of the world's population. Fewer people are suffering from these debilitating diseases than ever before, and many countries are eliminating them.

These are just some of the highlights of the 5th Progress Report of the London Declaration on Neglected Tropical Diseases, a commitment by the public and private sectors to achieve the World Health Organization (WHO) goals for control, elimination and eradication of 10 NTDs. NTDs affect nearly 1.5 billion people in the world's most impoverished, marginalized and remote communities.

"The story of neglected tropical diseases (NTDs) is one of great progress and remaining challenges," said Dr Tedros Adhanom Ghebreyesus, Director General of the WHO. "Five years ago, the world committed itself to control, eliminate or eradicate 10 NTDs by 2020. Since then, tremendous success stories have been received from around the world."

The 5th Progress Report, launched at the Universal Health Coverage Forum in Tokyo in December, details the accelerated progress since the 2012 London Declaration, demonstrating the impact of collaborative action between the public sector, the private sector, communities and nongovernmental organizations (NGOs).

A Ray of Hope (cover of inaugural issue of *PLOS Neglected Tropical Diseases* journal in 2007)

Highlights from the report:

- Only 2,184 cases of Human African trypanosomiasis, or "sleeping sickness," were reported in 2016 – down from 6,747 in 2011.
- Five countries have eliminated trachoma as a public health problem since 2012: Cambodia, Lao People's Democratic Republic, Mexico, Morocco and Oman.
- Only 26 cases of Guinea worm disease have been reported so far in 2017, a drop of 98% from over 1,060 cases in 2011
- 4 countries in the Americas have eliminated onchocerciasis since 2012: Colombia, Guatemala, Ecuador and Mexico.
- 10 countries have eliminated LF as a public health problem – four in 2017 alone.
- Worldwide, 400 million people no longer require preventive chemotherapy treatment for neglected tropical diseases.
- 1.8 billion treatments donated by industry partners in a record-breaking drug donation programme in global health

"Thanks to this partnership, these neglected diseases are now getting the attention they deserve so fewer people have to suffer from these treatable conditions," said Bill Gates, co-founder of the Bill and Melinda Gates Foundation. "There have been many successes in the past 5 years, but the job is not done yet. We have set ambitious targets for 2020 that require the continued commitment of pharmaceutical companies, donor and recipient governments, and frontline health workers to ensure drugs are available and delivered to the hardest to reach people."

Since the London Declaration was launched in 2012, billions of treatments have been donated by pharmaceutical companies and delivered to impoverished

> There have been many successes in the past 5 years, but the job is not done yet. We have set ambitious targets for 2020 that require the continued commitment of pharmaceutical companies, donor and recipient governments, and frontline health workers to ensure drugs are available and delivered to the hardest to reach people. – Bill Gates

Progress

- **Human African trypanosomiasis**
  2,184 cases reported in 2016. Down from 10,000 cases in 2009
- **Trachoma**
  5 countries have eliminated trachoma as a public health problem since 2012
- **Lymphatic filariasis**
  544 million people no longer require treatment for LF. A drop of 39%.
  10 countries have eliminated LF
- **Guinea worm disease**
  Only 26 cases reported so far in 2017. A drop from 3 million, 30 years ago
- **Onchocerciasis**
  4 countries in the Americas have eliminated onchocerciasis since 2012

These gains were made possible by three factors:

1. Strong country programmes are reaching more people with NTD interventions than ever before.
2. Billions of treatments are donated by the pharmaceutical industry. Within the drug donation programmes, more than 1.8 billion treatments were donated to impoverished communities, reaching over a billion people in 2016 alone.
3. Government donors (led by UK aid and USAID) and private philanthropists are providing generous funding. US$812 million were pledged by governments and private donors at the NTD Summit in Geneva in April 2017.

communities in nearly 150 countries. As the commitment has strengthened, so has the research into medications that can more effectively treat NTDs, thus reducing the burden of pain and lessened quality of life for hundreds of millions of people.

The global NTD elimination effort has become one of the largest health programmes in the world, covering nearly every region at risk. Investments in innovation and technology have yielded better tools to prevent, detect and treat NTDs.

New drug combinations

For example, research shows that new combinations of three existing drugs (ivermectin, diethylcarbamazine, and albendazole [IDA]) can dramatically improve treatment for LF and decrease the duration of programmes. This finding has been endorsed by WHO for use in programmes to accelerate progress towards elimination and is now supported by an extended ivermectin donation from Merck. It is estimated that nearly 100 million people each year will benefit from this new triple drug therapy treatment and from the extended donation from Merck.

The 5th Progress Report and its release during the Universal Health Coverage Forum provides ample evidence of the contribution of NTD programmes to the global health for all agenda. Population coverage is key in the UHC journey, with the World Bank and the World Health Organisation universally agreeing that countries should aim to cover at least 80% of their population with quality essential health care services.

The report shows that in providing services to 1 billion people in 2016, 62% of the population in need were reached, closing in on the WHO's UHC target of 80% essential health care services coverage. The success of the global drive to end NTDs is in part due to millions of health workers and community volunteers trained to reach and provide services to people who are frequently far from a health facility.

Shared prosperity

The unequalled reach of the global NTD programme can provide a gateway to universal health coverage and shared prosperity. In fact, the report shows that NTD control and prevention are among the most cost-effective interventions in public health. 600 million disability adjusted life years could be averted, including 150 million manifestations of irreversible disease (such as blindness), as well as 5 million deaths.

For every dollar invested by funders in NTD control and prevention, the net benefit to affected individuals is $25 because they are able to work and contribute to their local economies.

The global partnership to end NTDs is expanding quickly, as evidenced by the November "Reaching the Last Mile" Forum in Abu Dhabi. At that event, His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, launched the Reaching the Last Mile Fund, expected to raise $100 million with the goal to eliminate and control two preventable neglected diseases: onchocerciasis and lymphatic filariasis.

This followed closely behind an announcement by the Kuwait Fund for a further commitment of $4 million to the Expanded Special Project for the Elimination of NTDs in Africa (ESPEN), building on over 30 years of investments in NTDs. And at same time as the 5th Progress Report launch, the establishment of a Japanese NTD network, was announced. This will be housed at Nagasaki University and will be a multi-partner initiative, involving academic institutions, NGOs and government departments.

on the WEB 5th Progress Report of the London Declaration on Neglected Tropical Diseases *www.unitingtocombatntds.org* MEH

Empowering the GCC Region to take greater care of its health

Dr Mountasser Kadrie, programme director for the Master of Healthcare Administration (MHA) at Walden University, discusses steps the GCC must take to encourage its population to take greater responsibility for its own health.

A growing population with increased life expectancy plus an ongoing struggle against lifestyle-based chronic diseases in the GCC region over the past decade has propelled a critical step change in the healthcare sector. To address the prevalence of ailments such as diabetes, hypertension, cardiovascular conditions and obesity, healthcare spending in the MENA region as a whole is expected to grow to US$144 billion, with approximately $71 billion coming from the GCC countries – a 12% increase from 2015 – to aid in the rising cost of healthcare, according to 2016 research by Alpen Capital.

As investments continue to pour in, it's important for GCC governments – which cover anywhere from 65% to 80% of total healthcare costs, per a report released at the fourth edition of the HealthScape Summit GCC – and the private healthcare industry to ensure that funding is spent correctly. The GCC region can learn from other countries that have had to adapt quickly to primary and preventive care needs. For example, in the US, retail-based clinics have popped up in convenient locations, offering primary health services led by qualified healthcare providers. The UK has started employing digital technologies for timely access to services via Push Doctor, an online doctor consultation service that utilizes telemedicine to monitor and diagnose patients without being present. Research and development of other meaningful technologies and software for early detection is also key.

While improvements in physical infrastructures and state-of-the-art technology are of utmost importance, these only represent the tangible methods of delivering high-quality and affordable health services. For the GCC region to develop a truly advanced and sustainable healthcare ecosystem, it must also empower citizens to take greater care of their own health as well as promote prevention and a primary care healthcare delivery system.

One way of approaching this is by placing a higher focus on health education and prevention of chronic diseases as well as increasing the availability of primary and preventive care services in order to reduce the need for acute-treatment-based healthcare. However, preventive health is massively underfunded in the region, with GCC countries on average spending $77 per capita on preventive care, compared to an average of $400–$500 in countries such as Germany, France and the Netherlands, according to a 2016 EY report.

Another focus area should be local talent development. Both the EY and Alpen Capital reports reveal the GCC region relies heavily on hiring its workforce from abroad, with latest data available indicating expatriates represent 65% of the total healthcare workforce in these countries, including as many as 80% of the physicians in some countries. This compares to the UK, which only has 11% non-British healthcare professionals. Without bridging the local talent gap by promoting job opportunities and careers in the health sector, it will be challenging to develop a homegrown workforce and could otherwise leave the region without the means to create a sustainable healthcare system.

Online education provides the GCC with a unique opportunity to build a strong local workforce that will help advance a sustainable healthcare ecosystem. Online students learn with and from peers and faculty from around the world and acquire the knowledge and skills to immediately and directly respond to the healthcare needs of the GCC region.

As the GCC region prepares for the influx of healthcare funding, it has a responsibility to empower its citizens to take better care of their own health while providing the means to do so. As more people across the region receive healthcare education, increasingly more will access primary and preventive care services. Taking steps toward these two core focus areas in the next few years will prove beneficial for the healthcare industry in decades to come. MEH

Mr Cesare Quatro (left) and Mr Olivier Ghez (right) with visiting professor Shigeyuki Ozaki

Ground-breaking Ozaki treatment used for aortic valve disease

Royal Brompton and Harefield Hospitals experts hope the new Ozaki procedure will revolutionise the way surgery is carried out for patients with the life-threatening aortic valve condition.

As one of the world's most experienced centres for the diagnosis and treatment of heart valve disease, Royal Brompton Hospital (RBH) has a long history of pioneering medical innovations that have increased treatment options and improved the lives of patients with the condition.

The ground-breaking Ozaki procedure, devised by Professor Shigeyuki Ozaki in Japan a decade ago, is the latest cutting-edge technique to be implemented at RBH to benefit patients who require aortic valve surgery. Surgeons use heart tissue from an animal to reconstruct a damaged aortic valve, instead of replacing it entirely with a prosthetic implant.

When the aortic valve function is impaired surgery is usually required to replace it and restore normal function. If left untreated, a poorly-performing aortic valve can seriously reduce a patient's quality of life and eventually lead to heart failure and death. A standard echocardiogram is sufficient to show the problem with the aortic valve and its shape, from which RBH surgeons can determine a patient's suitability for the procedure.

The Ozaki technique uses tissue from the membrane surrounding the heart (the pericardium) to reconstruct the damaged aortic valve. In the UK, surgeons use a treated patch of animal pericardium that prevents calcification, removing surface antigens to ensure it is long-lasting. RBH surgeons use specialist equipment and imaging technology to measure the diseased part of the valve and cut the replacement tissue to the exact size. This means the whole valve does not have to be replaced. Once the tissue is sewn on to the aortic valve it behaves in a similar way to the original valve tissue and restores its normal function.

Conventional aortic valve replacements commonly use a mechanical implant made from synthetic materials, which requires the patient to take lifelong anticoagulant drug therapy to protect against harmful blood clots. Patients can, however, experience side effects and taking the medication indefinitely has lifestyle limitations.

Alternatively, biological implants made from animal tissue do not require blood-thinning drugs, and usually need to be surgically replaced after around 8 to 15 years, depending on the patient's age. The operation lasts for around four hours and patients will usually spend a total of 5-6 days in hospital, which is similar to valve replacement surgery.

Consultant cardiac surgeon, Mr Cesare Quarto, explains: "This is an exciting development for patients in need of aortic valve surgery, evidence shows it can be a longer term solution than the alternative options due to its more natural physiology. We hope many more patients will benefit from this novel technique in the future."

- To refer a patient, email: *privatepatients@rbht.nhs.uk* MEH

Afternoon heart surgery – better outcomes for patients

Outcomes for open heart surgery could potentially be improved by moving surgery to the afternoon, rather than in the morning, according to a study published in *The Lancet*.

A recent study identifies a link between a person's circadian clock and their risk of heart damage and major cardiac events after heart surgery. It suggests that moving surgery to the afternoon, rather than in the morning results in better outcomes for the patient.

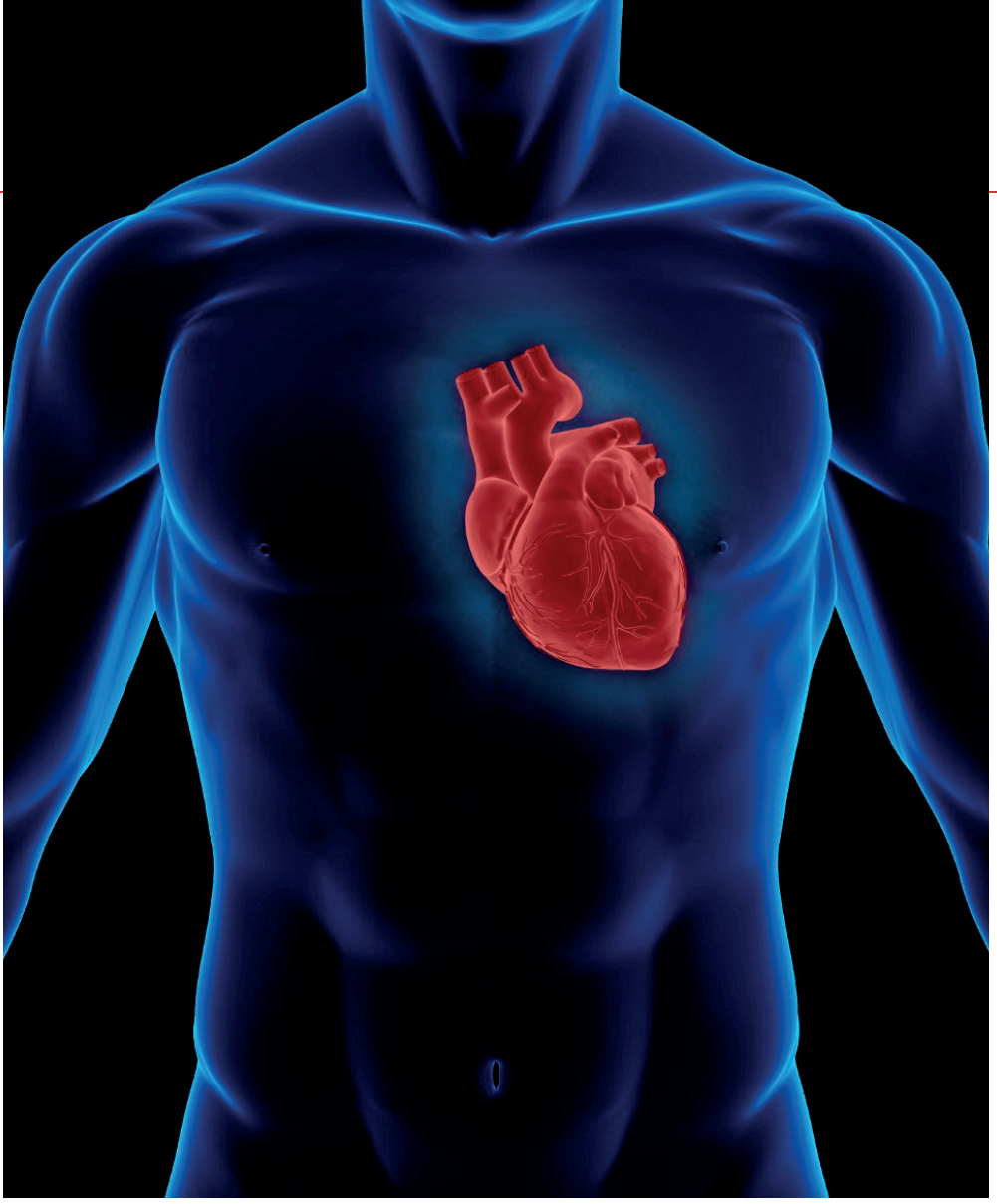
The study – "Daytime variation of perioperative myocardial injury in cardiac surgery and its prevention by Rev-Erb antagonism: a single-centre propensity-matched cohort study and a randomised study" – also provides early insights into the mechanism behind this link, identifying nearly 300 genes linking the circadian clock – the internal body clock that controls when people sleep, eat and wake up – to heart damage.

Following open heart surgery, some patients may develop heart damage impacting on the heart's ability to pump blood, resulting in poor outcomes including onset of heart failure and a heightened risk of death.

Previous research has suggested that cardiovascular events, such as myocardial infarction, that happen in the morning may be associated with a higher risk of damage, compared to afternoon events, but reasons have remained unclear.

The study consisted of four parts: an observational study looking at the association between time of day of surgery and outcomes; a randomised controlled trial to investigate whether there was a causal link between time of day of surgery and outcomes; a human tissue analysis to identify genes involved in the circadian effect on heart surgery; and a mouse model further investigating the biological mechanism and a potential therapeutic approach.

"Currently, there are few other surgical options to reduce the risk of post-surgery heart damage, meaning new techniques to protect patients are needed," says author Professor David Montaigne, University of Lille, France. "Our study found that post-surgery heart damage is more common among people who have heart surgery in the morning, compared to the afternoon. Our findings suggest this is because part of the biological mechanism behind the damage is affected by a person's circadian clock and the underlying genes that con-



trol it. As a result, moving heart surgery to the afternoon may help to reduce a person's risk of heart damage after surgery."

In the observational study, which ran from January 2009 to December 2015, researchers tracked the medical records of 596 people who had heart valve replacement surgery (half had surgery in the morning, half in the afternoon) for 500 days to monitor for any major cardiac events such as a heart attack, heart failure or died from heart disease.

People who had surgery in the afternoon had a 50% lower risk of a major cardiac event, compared to people who had surgery in the morning (28/298 [9.4%] compared to 54/298 [18.1%]) – this could equate to one major event being avoided for every 11 patients who have afternoon surgery.

In the randomised controlled trial, which took place from January 2016 to February 2017, 88 patients were randomly scheduled for heart valve replacement surgery in the morning or afternoon (half had morning surgery and the other half had afternoon surgery) and their health was monitored until they left hospital. There were no deaths in either group and the average time in hospital was 12 days. However, patients who had afternoon surgery had lower levels of heart tissue damage after surgery, compared to morning surgery patients.

To understand why there were these differences in outcomes for morning and afternoon surgery, the researchers tested 30 heart tissue samples from a sub-group of patients from the randomised controlled trial (14 from the morning surgery group, and 16 from the afternoon surgery group). In laboratory tests on the tissue, they found that the afternoon surgery samples more quickly regained their ability to contract when put in conditions that replicated the heart refilling with blood.

A genetic analysis of these samples also showed that 287 genes linked to the circadian clock were more active in the afternoon surgery samples, compared to the morning surgery samples. This suggests that the heart is subject to the body's circadian clock, and the surgical outcomes reflect the heart's poorer ability to repair in the morning than in the afternoon.

To further understand the mechanism, the researchers deleted and replaced the relevant genes in a mouse to study how this affected the sleep-to-wake transition. They also provided a proof of concept for future drug development by demonstrating the cardio-protective activities of a drug targeting the nuclear receptor and clock protein Rev-erba. Developing drugs which modulate these genes could help protect the heart during surgery. However, they note that the mechanism will require further confirmation in humans.

The authors note that the study will need to be replicated in larger trials to fully understand the association between the circadian clock and damage after heart surgery, and to confirm their findings. They also note that the research needs to be replicated in high-risk patients with diabetes and kidney failure, as they are at higher risk of heart disease and poor outcomes, and were not included in this study.

Comment

Writing in a linked Comment, Professor Michel Ovize, Hôpital Louis Pradel, France, says: "In addition to the central clock located in the CNS, each organ and cell type has its own internal (peripheral) clock. Gene-expression analysis – mainly performed in rodents but also in human beings – has shown a rhythmic expression of clock genes in the heart... Whether or not clock genes modulate cell death directly and whether they affect ischaemia injury or reperfusion injury remain to be established. Nevertheless, the authors have clearly shown that circadian rhythm is of clinical importance in aortic valve replacement surgery. Beyond the fact that it brings a new effect-modifying factor into the complexity of ischaemia-reperfusion injury clinical trial design and interpretation, the study by Montaigne and colleagues might already have some practical implications. Even before we have drugs available to regulate the circadian clock, one might propose that high-risk patients should preferentially be operated on in the afternoon."

• **doi:** 10.1016/S0140-6736(17)32132-3 MEH

Researchers produce 3D data to show cardiac conduction system

A pioneering new study is set to help surgeons repair hearts without damaging precious tissue.

A team of scientists from Liverpool John Moores University (LJMU), The University of Manchester, Aarhus University and Newcastle University, have developed a way of producing 3D data to show the cardiac conduction system – the special cells that enable hearts to beat – in unprecedented detail. The findings were published in *Scientific Reports*.

The new data in this study gives them a much more accurate framework than previously available for computer models of the heartbeat and should improve the ability to make sense of abnormal heart rhythms like atrial fibrillation. The data reveals exactly where the cardiac conduction system is in a normal heart. For example, it shows just how close it runs to the aortic valve.

Professor Jonathan Jarvis who is based at the LJMU School of Sport and Exercise Sciences explained: "The 3D data makes it much easier to understand the complex relationships between the cardiac conduction system and the rest of the heart. We also use the data to make 3D printed models that are really useful in our discussions with heart doctors, other researchers and patients with heart problems.

"New strategies to repair or replace the aortic valve must therefore make sure that they do not damage or compress this precious tissue. In future work we will be able to see where the cardiac conduction system runs in hearts that have not formed properly. This will help the surgeons who repair such hearts to design operations that have the least risk of damaging the cardiac conduction system."

Co-author Dr Halina Dobrzynski, who is based in The University of Manchester's Cardiovascular Division, has been working on the anatomy of the cardiac conduction system for 20 years. She says: "This is just the beginning. The British Heart Foundation is supporting my group to visualise this system in 3D from aged and failing hearts. With my research assistant Andrew Atkinson and working with Professor Jonathan Jarvis, Robert Stephenson and others, we will produce families of data from aged and failing hearts in 3D."

How does this work? Soaking post-mortem samples in a solution of iodine, means soft tissue such as the heart can absorb X-rays and become visible.

With X-ray scanners, scientists can make detailed 3D images. In the best images, they can even see the boundaries between single heart cells, and detect in which direction they are arranged. Within the heart, there is a special network called the cardiac conduction system that generates and distributes a wave of electrical activity stimulating the heart muscle to contract. This system makes sure that the various parts of the heart contract regularly and in a coordinated way, a bit like a team of rowers in a boat race. If the system is damaged, and one part of the heart contracts out of time with the rest, then the heart does not pump so efficiently.

This research was carried out in collaboration with the Visible Heart Laboratory, University of Minnesota, Minneapolis, US; National Institute of Legal Medicine, Bucharest, Romania and Auckland Bioengineering Institute, University of Auckland, Auckland, New Zealand

The paper, 'High resolution 3-Dimensional imaging of the human cardiac conduction system from microanatomy to mathematical modelling,' was published in *Scientific Reports*.

• **doi:**10.1038/s41598-017-07694-8 MEH

Cardiac surgeons at Cleveland Clinic Abu Dhabi perform complex valve-replacement procedure

Physicians at Cleveland Clinic Abu Dhabi have successfully performed a rare and complex operation on an Emirati national patient to replace two heart valves that were destroyed by cancer.

The tumour originated in the stomach, spread to the liver and released chemicals that destroyed two right-side heart valves – the tricuspid and pulmonary valves.

A multidisciplinary team worked to treat the tumour and its complications, as well as replacing the heart valves of the patient using an open-chest procedure.

The patient, a retired Emirati national, had visited a number of hospitals for tests before the tumour was detected at Cleveland Clinic Abu Dhabi.

After receiving a correct diagnosis at Cleveland Clinic Abu Dhabi, the patient, who had previously always travelled abroad for medical treatment, flew to Singapore for a second opinion.

Staff at the hospital in Singapore confirmed the diagnosis and advised him to return to Cleveland Clinic Abu Dhabi to have his cancer treatment and valve-replacement surgery.

Dr Rakesh Suri, Acting CEO and Chief of Thoracic and Cardiovascular Surgery at Cleveland Clinic Abu Dhabi, explained: "Complex surgeries to replace the damaged valves in cardiac carcinoid syndrome can only be performed in a few places in the world, because the management of such patients can be challenging and risky. Cleveland Clinic Abu Dhabi has brought the highest level of expertise to the region to provide advanced treatment options for patients and to deliver superior outcomes in cases such as this one."

In the case of the patient, he quickly returned to his normal daily life and now continues to visit Cleveland Clinic Abu Dhabi for check-ups and rehabilitation.

"Although it was major surgery, my experience felt as minor and as painless as having my teeth cleaned at the dentist," said the patient. "Everyone performed their roles to the highest degree and I now recommend Cleveland Clinic Abu Dhabi over and above overseas treatment to my friends and family." MEH

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Performing the historic heart surgery: Dr Johannes Bonatti, Chief of the Heart & Vascular Institute (center, with dark glasses); Dr Rakesh Suri, Acting CEO of Cleveland Clinic Abu Dhabi and Dr Stefan Sanger, Clinical Associate (left, back to camera); with Dr Jehad Al Ramahi, Clinical Associate, and other caregivers from Cleveland Clinic Abu Dhabi.

Historic day as physicians perform UAE 's first full heart transplant

Physicians at Cleveland Clinic Abu Dhabi have successfully completing the United Arab Emirates' first full heart transplant.

The pioneering surgery, which took place on 5 December, was performed by a four-person surgical team that included Dr Rakesh Suri, Acting CEO of Cleveland Clinic Abu Dhabi; Dr Johannes Bonatti, Chief of the Heart & Vascular Institute; Dr Stefan Sanger, Clinical Associate; and Dr Jehad Al Ramahi, Clinical Associate – all of Cleveland Clinic Abu Dhabi.

The patient, a 38-year-old Emirati man, had been suffering from end-stage heart failure and was managed by the Heart Failure and Transplant Program for almost six months. He was placed on Cleveland Clinic Abu Dhabi's transplant waiting list shortly after the UAE Government's decree earlier this year that allows deceased donor transplants.

On the same night, Dr Bashir Sankari, the Chief of the Surgical Subspecialties Institute at Cleveland Clinic Abu Dhabi, performed a kidney transplant from the same donor, providing vital surgery for another patient on the hospital's transplant list.

Sheikh Abdullah bin Mohammed Al Hamed, Chairman of the Health Authority, said: "What we have accomplished today is a historic accomplishment. The passing of the law regulating the transfer and transplantation of organs earlier this year has made a significant impact on enabling such sophisticated operations in the country."

Waleed Al Mokarrab Al Muhairi, Chairman of Cleveland Clinic Abu Dhabi, Mubadala Deputy Group CEO, and Chief Executive Officer, Alternative Investments & Infrastructure, said: "We established Cleveland Clinic Abu Dhabi to provide the people of the UAE with the highest standards of care; to stimulate medical innovation; and to invest in the development of Emirati healthcare professionals. This remarkable series of operations delivered on all three objectives, and marked an important medical first for our hospital and our nation."

Dr Ali Al Obaidli, Chair of the National Transplant Committee, said: "This operation marks the culmination of years of planning and preparation to ensure that the UAE has a comprehensive framework for transplant surgery. Working together, we have ensured that we have the surgical expertise and advanced treatments in place to support a full transplant program, in parallel with necessary regulatory changes."

Dr Suri said: "It is a significant achievement for Cleveland Clinic Abu Dhabi and our transplant team, who have accomplished a historic medical milestone in the UAE. This operation underlines the incredible social impact that our transplant services are having – thanks to one donor, we have transformed the lives of multiple patients and their families.

"The UAE has taken important strides in introducing new legislation to support transplant operations in 2017, and we are very proud that Cleveland Clinic Abu Dhabi is the first and only multi-organ transplant facility in the country. After two years of sophisticated training and preparation, our team was fully prepared to undertake and excel in performing this innovative series of operations," he added.

Demonstrating the remarkable benefits that organ donation can offer, teams from another medical facility in the UAE and from the Kingdom of Saudi Arabia were also involved in the transplants. The donor's second kidney went to a paediatric patient at Sheikh Khalifa Medical City in Abu Dhabi, while a team from the Saudi Center for Organ Transplantation (SCOT) was present for the surgery.

The operation received strong support from the UAE National Organ Transplant Committee, who were heavily involved in the preparations for the transplant.

"This was a demonstration of Cleveland Clinic Abu Dhabi's multidisciplinary excellence at every level," said Dr Bonatti. "The donor heart started beating immediately after implantation and the heart patient was taken to the intensive care unit after six hours in the operating room."

Cleveland Clinic Abu Dhabi has worked closely with Cleveland Clinic in the United States and Mubadala in establishing its organ transplant program. The Cleveland Clinic Transplant Center in the US is a world leader in organ transplantation, and the team in Abu Dhabi has benefitted significantly from sharing best practice and new innovations with their colleagues in the US.

Dr Feras Bader, the Director of Cleveland Clinic Abu Dhabi's Heart Failure and Transplant Program, said: "I was called about the donor 48 hours before the transplant surgery. It was the same day that the world was celebrating the 50th anniversary of the world's first heart transplant in 1967, and also the day the UAE was celebrating its 46th National Day. It's a remarkable coincidence and one that shows the incredible progress this nation has made."

Dr Bader said the 24-member multidisciplinary Heart Failure and Transplant team had been preparing for its first heart transplant for the past two years, including attending extensive education sessions and simulating the transplant process and surgery on multiple occasions.

For Emirati national Dr Jehad Al Ramahi, the opportunity to be part of the first UAE heart transplant team was a career-defining experience. Cleveland Clinic Abu Dhabi is committed to supporting the growth and development of UAE national physicians, as part of its efforts to help build a sustainable healthcare sector. MEH

Percutaneous coronary intervention is well-justified treatment option for severe coronary artery disease

The treatment of left main coronary artery disease by percutaneous coronary intervention is associated with a smaller risk of severe cardiovascular events than coronary artery bypass grafting in the weeks following surgery. A meta-analysis of several trials and nearly 5,000 patients revealed no differences in mortality between the two treatments. The finding is significant when it comes to selecting the form of treatment: percutaneous coronary intervention is less burdensome on the patient, as it does not require long-term hospitalisation and enables rapid return to work.

The prognosis of left main coronary artery disease is worse than in any other form of coronary artery disease. The treatment options include percutaneous coronary intervention and coronary artery bypass grafting. In European and American treatment guidelines, coronary artery bypass grafting is generally regarded as the first-line treatment for severe left main coronary artery disease. However, some studies have suggested that percutaneous coronary intervention with drug-releasing stent implantation would also be a recommendable course of treatment in the severe form of the disease, but the evidence has been inconsistent.

A new study by investigators from the University of Eastern Finland and Oulu University Hospital compared percutaneous coronary intervention with drug-releasing stent implantation and coronary artery bypass grafting in the treatment of left main coronary artery disease. The authors pooled evidence from six comparable, randomised, controlled trials involving 4,700 people.

The researchers analysed all available randomized studies among patients who had undergone percutaneous coronary intervention or coronary artery bypass grafting, comparing their risk of all-cause mortality, major adverse cardiac and cerebrovascular events, and other cardiovascular events at time points of 30 days, one year and three years after surgery. There were no differences between the treatments as regards the risk of death, or cardiac or cerebrovascular events. Percutaneous coronary intervention patients needed repetitive interventions more often over the years.

According to the researchers, the findings suggest that percutaneous coronary intervention with drug-releasing stent implantation should be more frequently considered as a treatment option for patients suffering from left main coronary artery disease. There are no differences in mortality between patients of percutaneous coronary intervention and patients undergoing coronary artery bypass grafting, and as percutaneous coronary intervention is less burdensome on the patient both from the viewpoint of quality of life and functional capacity, it is an option worth considering.

The results of the meta-analysis were published in *Open Heart*.

- **doi**: 10.1136/openhrt-2017-000638

Proteome of the human heart mapped for the first time

A healthy heart beats about two billion times during a lifetime – thanks to the interplay of more than 10,000 proteins. Researchers from the Max Planck Institute of Biochemistry (MPIB) and the German Heart Centre at the Technical University of Munich (TUM) have now determined which and how many individual proteins are present in each type of cell that occurs in the heart. In doing so, they compiled the first atlas of the healthy human heart, known as the cardiac proteome. The atlas will make it easier to identify differences between healthy and diseased hearts.

Proteins are the molecular machines of cells, in which they perform a range of functions. They are produced by the cells based on blueprints stored in their DNA. Changes occurring at the DNA or protein level can lead to disorders. For such changes to be recognized as underlying causes of heart disease, it is important to know precisely which proteins are present in the healthy heart and in what quantities.

Protein map of the heart

The first such protein atlas of the heart was recently published in *Nature Communications* by a research team from Munich. The scientists determined the protein profile of cells in all the regions of the heart, such as heart valves, cardiac chambers and major blood vessels. In addition, they investigated the protein composition in three different cell types of the heart: cardiac fibroblasts, smooth muscle cells and endothelial cells. In this way, the researchers were able to map the distribution of proteins in the various regions of the heart. Using mass spectrometry, they identified nearly 11,000 different proteins throughout the heart.

Previous studies had focused for the most part only on individual cell types, or they used tissue from diseased hearts.

"This approach has two problems," says Sophia Doll of the MPIB and lead author of the study. "First, the results did not give a full picture of the heart across all its regions and tissues; and second, comparative data on healthy hearts were often missing. Our study has eliminated both problems. Now the data can be used as a reference for future studies.

"Looking at the protein atlas of the human heart, you can see that all healthy hearts work in a very similar manner. We measured similar protein compositions in all the regions with few differences between them," says Doll. "We were also surprised to find that the right and left halves of the heart are similar, despite having quite different functions: the right half pumps oxygen-poor blood to the lungs, while the left half pumps oxygen-rich blood from the lungs to the body.

Sick vs healthy: identifying differences

In the next step, the team wanted to test whether the data from healthy hearts could serve as a control for detecting changes in diseased hearts. They compared their values with the cardiac proteomes of patients with atrial fibrillation, a very common rhythm disorder of the heart. The results indeed provided initial clues as to the cause of the disease. The tissue of the diseased hearts was most different in proteins responsible for supplying energy to the cells.

The comparison provided yet another interesting finding: Although the proteins involved in energy metabolism were changed in all the patients, those changes differed between individuals.

"These findings show us how important personalized medicine is. Although all the patients had very similar symptoms, we see from the data that a different molecular dysfunction was responsible in each case. We need to learn to recognize and treat such individual differences – especially in cardiac medicine," says Adjunct Teaching Professor Dr Markus Krane, Deputy Director of the Department of Cardiovascular Surgery of the German Heart Centre Munich at TUM.

Nearly 11,000 proteins in less than two days

Together with his colleagues at the Department of Cardiovascular Surgery (Director: Professor Rüdiger Lange), Markus Krane has collected more than 150 tissue samples from over 60 cardiac operations and forensic samples. Using elaborate cell culture methods, they were able to extract the various cell types from them. This large amount of cardiac material was a crucial factor for studying the individual heart regions so precisely. Professor Matthias Mann, director of the Department of Proteomics and Signal Transduction at the MPIB, and his team carried out extensive mass spectrometric measurements. Thanks to advances in mass spectrometry and sample processing, the researchers are lighting the way towards personalized medicine.

These findings show us how important personalized medicine is. Although all the patients had very similar symptoms, we see from the data that a different molecular dysfunction was responsible in each case. We need to learn to recognize and treat such individual differences – especially in cardiac medicine.

The team at MPIB attaches great importance to precise, repeatable and fast analytical methods. They have improved the measuring technique to the extent that an entire heart region can now be determined in less than two days – twice as fast as before. This is crucial, especially for potential use on patients.

- The data will be available in the public database MaxQB *http://maxqb.biochem.mpg.de*
- **doi**: 10.1038/s41467-017-01747-2 MEH

Dubai-based cardiologist pioneers new procedure

Dr. Talib Majwal

Successful first commercial CoreValve Evolut PRO implant in MEACAT Region

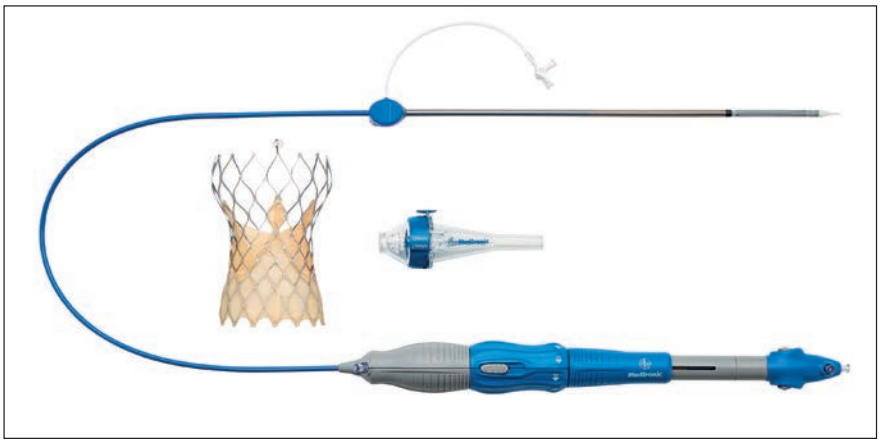
Mediclinic City Hospital has announced the success of the first CoreValve Evolut PRO (*) implant in the Middle East, Africa, Central Asia and Turkey (MEACAT); making the United Arab Emirates the birthplace of yet again another technological breakthrough in the field of medicine in the region.

The procedure was performed by leading Consultant Interventional Cardiologist Dr Talib Majwal in Dubai Healthcare City. Dr Majwal successfully completed the percutaneous coronary interventional procedure where he executed it by inserting an advanced transcatheter aortic valve replacement using femoral access.

The pioneering minimally invasive procedure was conducted using the CoreValve Evolut PRO, the newest transcatheter aortic valve replacement (TAVR) system by global medical technology developer Medtronic. The self-expanding device is intended to treat patients with severe aortic stenosis who are considered at high or extreme risk for open-heart surgery.

The Evolut PRO System offers unique value design and advanced sealing technology to enhance valve sealing performance and in turn addresses the occurrence of blood leaking through the sides of the valve. Preventing leakage in turn leads to preserving patients' heart muscles for an extended period of time.

The Evolut PRO technology is proven to allow for faster recovery of patients as well as cause fewer complications compared to other technologies. The pioneering procedure in Dubai by Dr Majwal, took place on 23 November 2017, where the female patient was admitted, treated and discharged in a total of 48 hours.



The CoreValve™ Evolut™ PRO System by Medtronic

Dr Majwal said: "Given the heavily calcified annulus of the patient, the valve was deployed without pre or post dilatation, which reflects a sufficient radial force at the inflow portion of the valve."

The Evolut PRO is designed with an outer biocompatible pericardial tissue wrap that adds surface area contact between the valve and the native aortic annulus and hence allows it to improve valve-sealing performance in order to address the occurrence of blood leaking through the sides of the valve. The valve used in this pioneering surgery also features various clinical advantages including a self-expanding nitinol frame that helps achieve excellent hemodynamic performance and the ability to position and deploy the Evolut PRO device with greater control.

Dr Majwal stated: "The PVL (Para Valvular Leakage) was trivial given this much of annular calcification which confirms the functionality of the externally added pericardial wrap."

In line with the manufacturing company Medtronic's mission of contributing to human welfare, the Evolut PRO is clinically proven to lead to an improvement in the quality of life of patients, allowing patients to finally return to their daily activities, partake in sports, travel and engage in various activities that they were previously unable to engage in due to their medical condition.

Dr Majwal added: "In this procedure the valve was deployed without rapid pacing, presenting hope for patients with reduced ejection fraction."

The procedure by Dr Majwal, a first of its kind in the MEACAT region, is considered a milestone in the evolution of minimally invasive cardiology solutions and acts as a future indicator of the role of advancement in medical technology in alleviating pain, restoring health, and improving the overall quality of life of patients in the region.

* CoreValve™ and Evolut™ are trademarks of Medtronic. MEH

Study shows low mortality, stroke risks for minimally invasive aortic valve replacements

By Dipali Pathak

An analysis of more than 1,000 minimally invasive aortic valve replacements and more than 400 additional associated procedures over a five-and-a-half year period performed by Dr. Joseph Lamelas, professor and associate chief of cardiac surgery in the division of cardiothoracic surgery at Baylor College of Medicine, showed low stroke rates and high survival rates in all age groups within 30 days of surgery. His report appears in the *Journal of Thoracic and Cardiovascular Surgery*.

Aortic valve replacements are performed when treating aortic valve stenosis or aortic valve regurgitation. Aortic valve stenosis occurs when the aortic valve opening is narrowing and restricts the blood flow from the left ventricle to the aorta. This makes the heart work harder to pump blood to the body. Aortic valve regurgitation takes place when there is a leakage of blood through the aortic valve into the left ventricle.

Dr. Lamelas performs a minimally invasive procedure to replace the aortic valve. The procedure requires only a two-inch incision between the ribs rather than opening the breast bone. This results in a shorter stay in the hospital and a faster recovery time.

To document the results of this particular approach, Dr. Lamelas assessed more than 1,000 of his aortic valve replacement procedures over a five-and-a-half-year period. He also assessed more than 400 additional concomitant procedures, meaning the patient had an aortic valve procedure with another procedure such as mitral valve repair or ascending aorta replacement. The procedures were performed when Dr. Lamelas was with Mount Sinai Heart Institute in Miami Beach, Florida, between January 2009 and July 2015. Dr. Lamelas currently conducts surgeries at Baylor St. Luke's Medical Center.

Dr. Joseph Lamelas, professor and associate chief of cardiac surgery in the division of cardiothoracic surgery at Baylor College of Medicine

Dr. Lamelas and colleagues compared patients less than 80 years old to those over 80 years old.

They found the mortality rate in patients who only had the aortic valve replacement was 1.3% and 3.2% in the group that had a concomitant procedure. The risk of stroke was 0.8% and 1.1%, respectively, in both age groups.

"We found that the risk for mortality and stroke was a little bit higher for older patients, but not statistically significant compared to the younger patients," said Dr. Lamelas.

In addition, they found low rates of complication in all age groups, a significantly reduced length of stay in the hospital, low postoperative complication rates and a low postoperative length of stay. In the concomitant group, results also were similar.

"These results further demonstrate that there is no need to do a full sternotomy if we have this procedure available," said Dr. Lamelas, who is a pioneer in the field of minimally invasive heart surgery and has developed facilitating instruments for the procedure.

Others who took part in the study include Dr. Maurice Mawad, Dr. Roy Williams, Ursula Weiss Keller, Qianzi Zhang and Dr. Angelo LaPietra with Mount Sinai in Miami.

Dr. Lamelas receives honoraria from Medtronic, St. Jude and On-Q and has ownership interest in Miami Instruments.

• For more information contact International Services at Baylor St Luke's Medical Center
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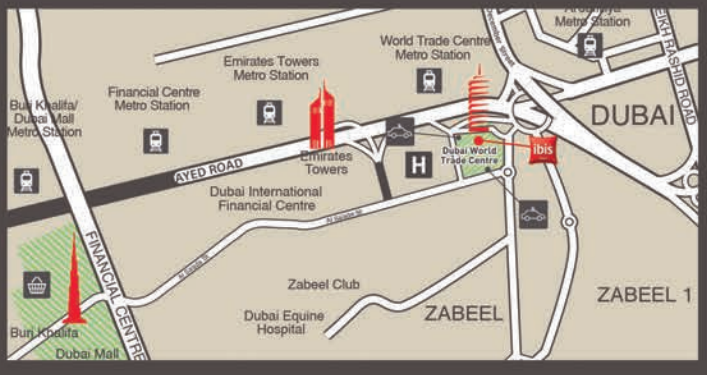

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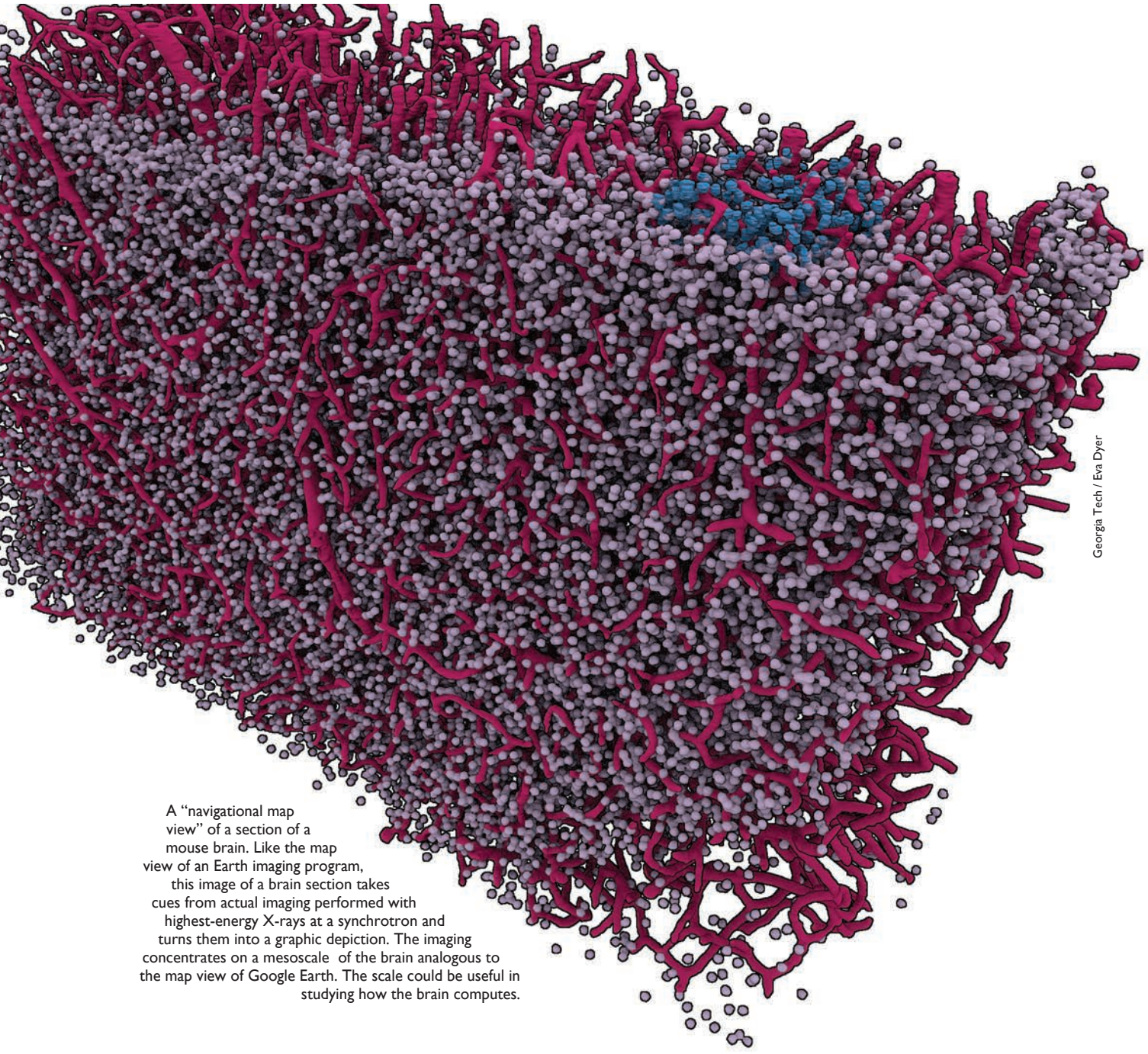


Georgia Tech / Eva Dyer

A "navigational map view" of a section of a mouse brain. Like the map view of an Earth imaging program, this image of a brain section takes cues from actual imaging performed with highest-energy X-rays at a synchrotron and turns them into a graphic depiction. The imaging concentrates on a mesoscale of the brain analogous to the map view of Google Earth. The scale could be useful in studying how the brain computes.

Mesoscale view of the brain

If brain imaging could be compared to Google Earth, neuroscientists would already have a pretty good "satellite view" of the brain, and a great "street view" of neuron details. But navigating how the brain computes is arguably where the action is, and neuroscience's "navigational map view" has been a bit meagre.

Now, a research team led by Eva Dyer, a computational neuroscientist and electrical engineer, has imaged brains at that map-like or "meso" scale. (Mesoscale is approximately 1µm3 resolution.) The imaging scale gives an overview of the intercellular landscape of the brain at a level relevant to small neural networks, which are at the core of the brain's ability to compute.

Dyer, who recently joined the Georgia Institute of Technology and Emory University, also studies how the brain computes via its signalling networks, and this imaging technique could someday open new windows onto how they work.

Highest-energy X-rays

A powerful X-ray tomography scanner – synchrotron X-ray microtomography (μCT) – allowed the researchers to image particularly thick sections of the brains of mice, which afforded them views into intact neural areas much larger than are customary in microscope imaging. The scanner operated on the same basic principle as a hospital CT scanner, but this scan used high-energy X-ray photons generated in a synchrotron, a facility the size of dozens of football fields.

"Argonne National Laboratory (ANL) generates the highest-energy X-ray beams in the country at its synchrotron," said Dyer, who co-led the study with ANL's Bobby Kasthuri at the Advanced Photon Source synchrotron. "They've studied all kinds of materials with really powerful X-rays. Then they got interested in studying the brain."

The technique also revealed capillary grids interlacing brain tissues. They dominated the images, with cell bodies of brain cells evenly speckling capillaries like pebbles in a steel wool sponge.

"Our brain cells are embedded in this sea of vasculature," said Dyer, an assistant professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory.

The study on the new images appeared in the journal *eNeuro* on 17 October 2017. The team included researchers from Johns Hopkins University, the University of Chicago, Northwestern University, the Argonne National Laboratory, and the University of Pennsylvania. The work was funded by the U.S. Department of Energy, the National Institutes of Health, the Intelligence Advanced Research Projects Activity, and the Defense Advanced Research Projects Agency.

Neural forest for the trees

Electron microscopy already captures neuronal details in impressive clarity. Functional magnetic resonance imaging (fMRI) makes great visuals of brain structures and broad neural signalling.

So, why do researchers even need mesoscale imaging?

"FMRIs image at a high level, and with many microscopes, you're zoomed in too far to recognize the forest for the trees," Dyer said. "Though you can see a lot with them, you also can miss a lot.

"If you look at brain signaling on the level of individual neurons, it looks very mysterious, but if you take a step back and observe the activity of a population of hundreds of neurons instead, you might see simpler, clearer patterns that intuitively make more sense."

In an earlier study, Dyer discovered that hand motion directions corresponded with reliable neural signalling patterns in the brain's motor neocortex. The signals did not occur across single neurons or a few dozen but instead across groups of hundreds of neurons. Mesoscale imaging reveals a spatial view on that same order of hundreds of neurons.

Megamap dreams

The researchers have also been able to couple their new meso-level imaging technique with extremely detailed electron microscopy. And that has the potential to take them closer to a kind of Google Earth for the brain by combining mesoscale or map-like views with zoomed-in or street-like views.

"We have begun doing X-ray tomography on large brain tissues, then we've gone deeper into specific tiny regions of interest in the same tissue with an electron microscope to see the full connectome there," Dyer said. The connectome refers to the total scheme of the hundreds of individual connections between neurons.

The researchers hope to someday be able to switch from a mesoscale view to close-up view, a bit like Google Earth.

Zeroing in then zooming in

"I think what we're going to need in neuroscience is this ability to traverse across different scales," Dyer said. She envisions a future multi-scale imaging technology that is useful in understanding neurological diseases.

"We want to be able to tell somebody researching a disease what the underlying anatomy of their lab sample is in an automated way," she said. "You could navigate using this mesoscale view to get the context of where the damage is."

Then the user could zoom in on a blocked artery or destroyed tissue analogous to the way satellite imagery can zoom in on traffic jams to see what's causing them.

From X-ray to graphic image

Like a navigational map, the final images in the study were colourful, clear, mesoscale graphic depictions. They were based on the X-ray tomography, but a lot was involved in getting from the X-ray to the image.

First, the thick section of brain rotated in the high-energy X-ray beam, which was transformed into an image analogous to the output of a CT scanner. Then structures and characteristics were identified by humans and algorithms before they were computed into three-dimensional, colour-coded vasculature and cell bodies.

The details of individual cells were very basic. In neurons, often the nuclei were visible in the X-ray tomography image, and axons wrapped in myelin (white matter) sometimes appeared as well.

Pragmatic computation

The new mesoscale imaging of brain samples also has pragmatic advantages.

It may be possible to examine minuscule brain regions piece by piece with electron microscopes then compute them together into a complete image of the brain, but it's hardly practical. "Producing a three-dimensional map of just a cubic millimetre of the brain with an electron microscope requires processing petabytes of data," Dyer said.

By contrast, the researchers need 100 gigabytes of data to compute a one-cubic-millimetre image of brain tissue using mesoscale X-ray tomography scans of thicker brain sections. But the researchers' goal is to not have to slice the tissue at all.

"Eventually, we want to be able to image whole brains, as is, with this method to see the entirety of their neural networks and other structures."

• **doi**: 10.1523/ENEURO.0195-17.2017 MEH

Nano-CT provides 3D images at 100 nanometres resolution

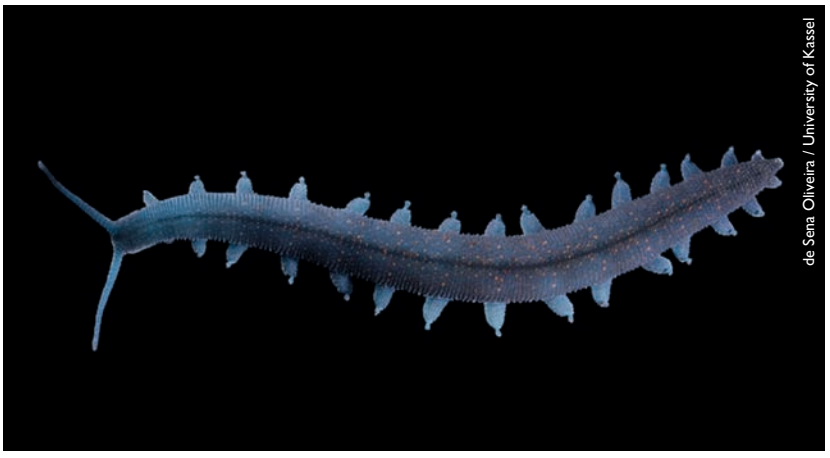
Computed Tomography (CT) is a standard procedure in hospitals, but so far, the technology has not been suitable for imaging extremely small objects. A team from the Technical University of Munich (TUM) describes a Nano-CT device that creates three-dimensional x-ray images at resolutions up to 100 nanometres. To test the application, the researchers analysed the locomotory system of a velvet worm.

During a CT analysis, the object under investigation is x-rayed and a detector measures the respective amount of radiation absorbed from various angles. Three-dimensional images of the inside of the object can be constructed based on several such measurements. Up until now, however, the technology reached its limits when it came to objects as small as the tiny, 0.4 millimetre-long legs of the velvet worm (Onychophora).

High-resolution images of this magnitude required radiation from particle accelerators, yet there are only a few dozen such facilities in Europe. Approaches suitable for the typical laboratory still had to struggle with low resolutions, or the samples investigated had to be made of certain materials and could not exceed a certain size. The reason was often the use of x-ray optics. Put simply, x-ray optics focus x-ray radiation similar to the way optical lenses focus light – but they also have several limitations.

The TUM Nano-CT system is based on a newly developed x-ray source, which generates a particularly focused beam, without relying on x-ray optics. In combination with an extremely low-noise detector, the device produces images that approach the resolution possible with a scanning electron microscope, while also capturing structures under the surface of the object under investigation.

"Our system has decisive advantages compared to CTs using x-ray optics," says TUM scientist Mark Müller, lead author of the article published in PNAS. "We can make tomographies of significantly larger samples and we are more flexible in terms of the materials that can be investigated."



The Nano-CT device can create 3D-X-ray images of very small objects, such as the tiny legs of velvet worms (pictured: Euperipatoides rowelli).

The test

A team of scientists in the Department of Zoology at the University of Kassel, Germany are studying the evolutionary origin of arthropods. Their current research focuses on velvet worms (onychophorans), which can be thought of as worms with legs and are closely related to arthropods. They used the Nano-CT to get images which made it possible to investigate the individual muscle strands of the velvet worm leg.

"In contrast to arthropods, onychophorans do not have segmented limbs, as is also the case with their presumed common fossil ancestors," says one of the researchers. "The investigation of the functional anatomy of the velvet worm's legs plays a key role in determining how the segmented limbs of the arthropods evolved."

Future applications in medicine

The Nano-CT system was developed and installed at the Munich School of BioEngineering (MSB). This TUM interdisciplinary research centre is Europe's thematically most comprehensive university facility for the intersection of medicine, engineering sciences and natural sciences.

"Our goal in the development of the Nano-CT system is not only to be able to investigate biological samples, such as the leg of the velvet worm," says Franz Pfeiffer, TUM Professor for Biomedical Physics, Director of the MSB, and a Fellow at the TUM Institute for Advanced Study (TUM-IAS).

"In the future, this technology will also make biomedical investigations possible. Thus, for example, we will be able to examine tissue samples to clarify whether or not a tumour is malignant. A non-destructive and three-dimensional image of the tissue with a resolution like that of the Nano-CT can also provide new insights into the microscopic development of widespread illnesses such as cancer."

• **doi:** 10.1073/pnas.1710742114

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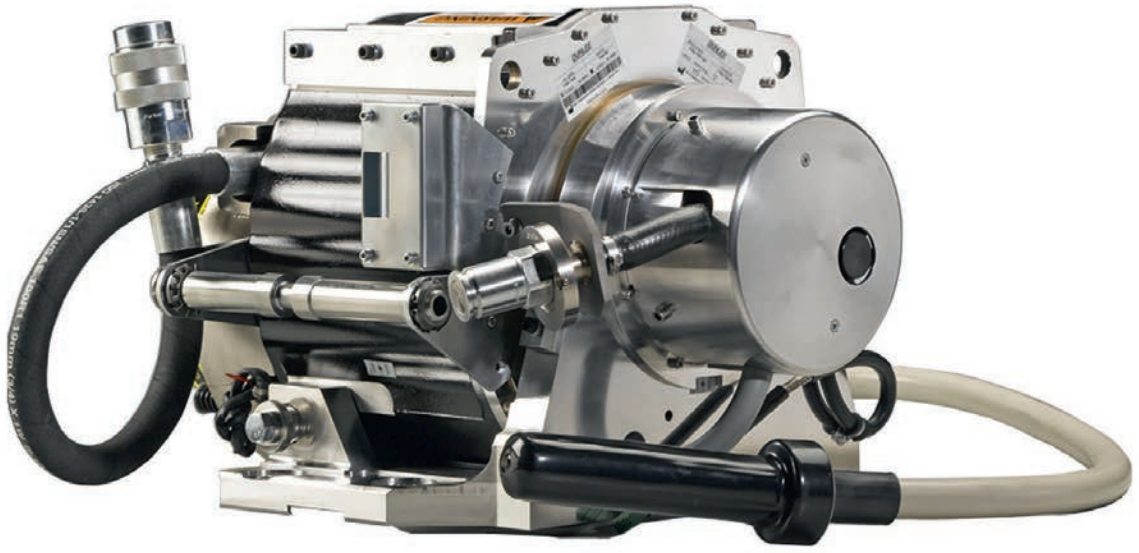

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An artist's impression of KCH

The importance of design

Stas Louca, Director of Architecture and Middle East Healthcare at Perkins+Will's Dubai office, speaks about designing Dubai's latest healthcare project – Kings College Hospital – and highlights the impact of patient-centric design on the healing process.

As evidence about the benefits of healing environments accumulates, healthcare architects around the world are starting to incorporate features into hospital design that reduce stress and promote healing.

Our company, Perkins+Will, has seen a growing awareness among healthcare organisations in the Middle East of the importance of findings from studies of environmental psychology, geography, sociology, architecture, landscape architecture, interior design, nursing, medicine and public health that demonstrate how patient-centric design can reduce stress and alleviate the physical outcomes associated with it. These considerations in design can also help prevent medical errors and hospital acquired infections.

Our company places a strong focus on the end user of our projects and we always consider the level of wellness we can provide. This type of design within the healthcare sector is called 'patient-centric' and we are delighted to be given the opportunity to exercise our core values on the new Kings College Hospital (KCH), in Dubai.

Project overview

King College Hospital is a new specialised facility focusing on four centres of excellence: Obstetrics and Gynaecology,

Paediatrics, Orthopaedics, Endocrinology and liver transplants.

Centrally located in Dubai, between downtown Marina to the south and the Financial District to the north, this site has a prominent presence and the potential to create a strong architectural identity for both the KCH and its developer, Dubai Hills Estate Development. The hospital was positioned to provide visual prominence from Marabea Street and easy way finding for visitors. The central Dubai location provides the opportunity to capitalise on a wide range of views of the Dubai skyline, all of which are factors intentionally maximised upon to create this patient-centric development.

The site was a vacant lot with an area of approximately 25,488 sqm. The north side provides the main public access to the project and this entrance leads directly into a drop-off loop with canopy protection at the main entrance. Visitors to the hospital have easy access to surface parking immediately adjacent to the drop-off loop to both the east and west sides, with a valet option at the main entrance. The south side provides access for staff, service vehicles and ambulances.

The project will be a phased construction, with phase one comprising a 23,000 sqm floor area, which is organised over eight floors and will accommodate three levels of treatment and diagnostics and four floors of inpatient beds. Phase one will also accommodate 325 car parking spaces for staff and visitors.

Phase two will be a horizontal expansion of approximately 16,000 sqm to all levels of the project and a five-level parking structure to accommodate approximately 410 cars. This expansion is designed to be seamlessly integrated into phase one of construction as a single architectural expression.

The main building entrance is a public lobby complete with a three-story atrium. A bank of elevators to all visitor-accessible floors is located on the western side of the building, adjacent to the entry lobby. Visitors will experience first contact with hospital personnel at the reception upon entry and be directed to their destination. A café space is provided at the northeast end of the ground floor.

The main public lobby of KCH

A typical patient room at KCH

Patient-centric design

The hospital is designed, in its entirety, to consider the patient experience, from the moment the patient arrives to moment they complete their treatment and leave KCH while ensuring a high level of sustainability. Protection from the harsh sun is provided through multiple means, such as self-shading exterior façades, multiple soaring canopies surrounding the building and sheltered gardens. At the entrance, a fountain provides a cooling

effect while multiple lush gardens at ground level provide needed shade. The development is capped by a roof garden accessible to the public, patients and staff where it is planned to include areas for rehabilitation and relaxation.

There are plenty key healing features we have incorporated into the design of KCH as follows:

Design: Outside of the consideration for patient-led design, it is important to consider the external environment. We endeavour to fit our designs into their particular surroundings, considering culture, climate and surrounding buildings. The brief given to us for this project was to create something with a modern feel yet in keeping with the site's landscape, including the skyline, nature and surrounding buildings. The exterior draws inspiration from the natural beauty of the desert and the façade is an interpretation of the shading effect generated by the textured landscape of wind-blown sand. This texture has been abstracted as an architectural expression wrapping the hospital to provide self-shading and aid in direct solar exposure.

Sustainable: We have worked on the premise of using a thermal mass façade to control solar gain and cooling, reducing air conditioning consumption needs. We have considered solar orientation and detail to include LED lighting and natural shading.

Increased connection to nature: Studies have shown as little as three minutes of contact with nature significantly reduces stress, anger and fear. For KCH we have built in windows with landscape and downtown skyline views in each, single patient increasing levels of natural light, in turn inducing calmness. In addition, particularly with the paediatric ward we have included artwork into the design of the walls to create texture and nature designs on the ceilings in the form of back-lit stretch fabrics.

Way finding: From the moment you arrive at KCH you are able to easily navigate through distinct signage and key landmarks within the hospital. To create a feeling of control this element is important for patients, staff and visitors alike.

Good use of space: We have included multiple green spaces for proven improvement to mood and shorter hospital stays. We have designed a stunning garden within the compound and made use of the rooftop to include a vegetable garden to support the rehabilitation for dexterity patients.

Control of your environment: Giving patients a sense of control can significantly decrease stress. In our design of KCH we have enabled each patient to control their own in-room environment. We have created an area where patients are able to control everything from lighting, sound and temperature to when they would like their meals and what they would like to eat. All of these components are centrally controlled by a handset attached to the patient's bed.

Safety and infection control: Paramount to healing, combined with global best practice and conformity to DHA standards, everything from surfaces to air control is considered in our design.

Positive diversion: when healing it is important to create positive and calming distractions for patients. This can include nature inside the building, play areas, overhead back-lit screens, nature based artwork-which we integrate as part of the overall design. Family spaces and common rooms plus calming outside spaces can be maximised for use during the cooler months. Positive diversion works for patients, visitors and staff with an overall positive calming effect.

Visitors: It has been proven patient visits from family and friends promote healing. To this end we have ensured we have catered to visitors' comfort as well, providing rooms, which can accommodate visitors comfortably, a sofa which converts to a bed and common spaces with amenities to cater to the needs of comfort.

There are a multitude of considerations taken into account and adapted for this project and the above are key examples for future consideration within the healthcare design space.

In conclusion

This project holds historical sentiment due to the UAE's strong ties with King's College Hospital London going back to 1979, when the nation's founder, His Highness Sheikh Zayed bin Sultan Al Nahyan, provided a donation that helped establish the King's liver research centre; now among the top three liver specialist centres in the world. It has been a pleasure for our 15-strong team of architects, purposely selected from our 105 specialist architects in the firm to work on this project and create an optimal healing, patient-centric environment. At Perkins+Will we have access to a centralised hub of global 'knowledge experts' allowing us to draw on a multitude of specialist skillsets and global expertise. For the programming and design review elements of this project, for example, the Los Angeles, London and Dubai offices collaborated to create a brief. This has enabled us to create an evidenced based design approach with core local knowledge. MEH

Perkins+Will

Perkins+Will is an interdisciplinary, research-based architecture and design firm established in 1935. Founded on the belief design has the power to transform lives and enhance communities, we collaborate with clients all over the world to create healthy, sustainable places in which to live, learn, work, play and heal. Perkins+Will has been a specialist in healthcare design since the mid-1900's with the Dubai office introducing its healthcare division in March 2015, headed up by Stas Louca. The young team of architects has the skillset to accommodate a 360-degree project to include healthcare planning and medical equipment planning to landscape and interiors. More than 2,000 professionals across more than 20 Perkins+Will offices include some of the brightest minds in architecture, interior design, branded environments, urban design, and landscape architecture.

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Centre of excellence

Ireland is recognised as a centre of excellence in the global medical technology sector. *Middle East Health* was invited to the Med in Ireland exhibition to speak to people in the sector and see first hand some of the innovative products that have been developed in the country.

Med in Ireland, held in Dublin in October last year, is Enterprise Ireland's largest medical technologies event. It provides a platform to showcase a wide spectrum of products from the Irish medical technology sector. It also plays host to more than 1000 scheduled partnering meetings between Irish companies and international guests.

The event promotes Ireland as a globally recognised centre of excellence in medical technologies – marking Ireland as the location of choice for the design, research and development, prototyping, manufacture and marketing of innovative medical products and services.

Ireland's strength in this arena is based on skills availability, technical competency, operational excellence, regulatory track record, design and manufacturing, and dynamic leadership teams. Additionally, Ireland has a very strong sub-supply base with many indigenous companies becoming globally preferred vendors of choice for leading multinational enterprises.

Ireland also has a world-class research infrastructure, world-leading clinicians and growing industry-clinical partnerships. The symbiotic relationship between the clinical community, researchers and that of private enterprise provides great opportunities both in terms of improving patient health and reducing healthcare costs, as well as driving enterprise development and job creation. MEH

Briefly…

- Ireland is the second largest exporter of med tech products in Europe behind only Germany
- Ireland is recognised as a major centre of excellence in the medical technologies sector and the Irish cluster is now on par with some of the world's leading med tech clusters
- The med tech industry in Ireland employs 38,000 people in this sector, making Ireland – per capita – the largest med tech employer in the EU.
- There are over 348 medical technology companies in Ireland of which 234 are indigenous.
- 18 of the world's top 25 medical technology companies have a base in Ireland, including companies such as Boston Scientific, Medtronic, Cordis, DePuy, Stryker, Covidien, Baxter, Abbott, and Cook.
- Ireland's med tech industry has world-class capabilities in research, as well as specialised clinical capabilities

Making the right connections

Tanya Mulcahy, the manager of Health Innovation Hub Ireland, speaks to *Middle East Health* about how they assist people, companies and healthcare professionals to bring to fruition their innovative ideas for improving healthcare.

Health Innovation Hub Ireland was formed by the Irish Government.

"We help by taking an innovative idea, figuring out if it is a good innovation, and then connecting the people behind it with the healthcare system or clinical setting to test their innovation.

"They see a 'need' and they have a potential solution, but don't know what to do with it, how to test it or they don't have the time to work with it. So, we assess it to see if it is really a good idea and if there is a market for it. We then give them the tools – such as a team of academic staff, clinical research expertise, link them to Enterprise Ireland for funding or help them with IT expertise, to bring the idea through the whole process to commercialisation."

It's a free service and the projects are generally quite short lasting from a few weeks to 12 months, she explained.

Irish govt support for research and innovation

Middle East Health speaks to **Pat Breen**, Irish Minister of State for Trade, Employment and Business about government funding for med tech research.

Pat Breen, Irish Minister of State for Trade, Employment and Business

Minister Breen says the Irish Government sees research as very important for Ireland's future.

"There are huge challenges in today's world. Industry can't stay still with the changes that are coming, particularly with digital technologies. You have to continuously upgrade and invest in Research and Development (R&D)," he said.

"We have spent a lot of money on our R&D facilities and initiatives, such as our research sites in Galway where we work with a number of US institutions and multinationals."

He said the Irish Government does give some financial support, but pointed out that they also use financial support initiatives, such as the European Union's Horizon 2020.

Horizon 2020 is the biggest EU research and innovation programme, with nearly Euro 80 billion of funding available over 7 years (2014 to 2020). This is in addition to the private investment that this money attracts. One of the aims of the initiative is to support more scientific breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Horizon 2020 is the financial instrument implementing the 'Innovation Union', a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. Importantly, it is a means to drive economic growth and create jobs.

"R&D is extremely important, and I encourage continued investment in this sector because it promotes innovation," said Minister Breen.

"The fact that we have this 'Med in Ireland' conference every two years – run by Enterprise Ireland – and with the 800 attendees we have this year, shows the level of interest in this sector and how highly regarded it is in Ireland.

"We compete well with the big med tech sectors in other parts of the world. We are very proud of this sector and the role it has played in our economic recovery.

"The med tech sector is worth around Euro 12.5 billion in exports. It employs more than 38,000 people. Since 2012 the sector has seen a 15% annual growth rate. And the fact that we have so many big brand names here in this sector is a good signal that Ireland is a good place to invest."

He explained that when you have multinationals, such as Medtronic, Boston Scientific, Cordis, DePuy, Stryker, Covidien, Baxter, Abbott among others, you get a lot of smaller companies that will sub-supply these large companies. This expands the industry and promotes innovation.

"This is why our indigenous med tech sector is extremely important to us. It employs around 6,500 people," he said.

He added that Ireland is also proud of the connection between the Arab world medical sector.

"The connection is very strong and goes back to 2005 when the Royal College of Surgeons in Ireland set up in Dubai. We have trained a lot of doctors [in the Arab world]. We continue to work with Dubai Health Authority. We participate in Dubai's Arab Health expo each year. In 2017 we had a very successful show there with many contracts signed." MEH

"We don't provide funding for the project. We provide the people – our network of contacts – and we can assist with running the project. We are an intermediary, a neutral organisation. We see ourselves as a kind of match maker," she said.

"Basically, we encourage innovation and enterprise, as well as help improve the healthcare system."

Mulcahy gave an example of one of their successful projects. An Irish company called FastForm Medical – *www.fastformmedical.com* – had developed a polymer-based replacement for a plaster or resin cast used in orthopaedics, which needed to be tested and proved viable as a better solution to the traditional cast.

"What sets this product apart from other plaster casts, is that this can be reheated and remoulded. You can swim or shower with it and it can be dried with a blow dryer. You can take it off, heat it, remould it and reuse it. The big benefit of it – particularly in sports med rehabilitation – is that you can swim with it," Mulcahy explained.

"They needed to demonstrate that it was being used in an Irish hospital by an orthopaedic surgeon who could check that it was as good as the standard resin cast and had additional benefits. We helped them with the study by introducing them to an orthopaedic surgeon and ran a study over six months comparing their product with the resin cast to demonstrate that it healed in the same way and had added benefits.

The product is now commercialised and being exported to the United States.

• Health Innovation Hub Ireland – *http://hih.ie* MEH

Enterprise Ireland plays important role in stimulating Irish export trade

Deidre Glenn, Director, Lifescience & Food Commercialisation, Manager Lifescience sector, Enterprise Ireland, speaks to *Middle East Health* about the role the organisation plays in stimulating innovation and trade in the med tech sector.

Deidre Glenn, Director, Lifescience & Food Commercialisation, Manager Lifescience sector, Enterprise Ireland

Enterprise Ireland is a big organisation and plays an important role in Ireland's economy. There are approximately 200,000 businesses in Ireland – about 5000 are clients of Enterprise Ireland.

"We only work with companies that have the ability to trade internationally and they are either manufacturing technology or service-type companies," Glenn explained.

"Our role is to stimulate innovation and grow companies. We act as the lead agency in company creation in Ireland. We are the leading seed investor. We're actually the biggest seed investor in start-ups in Europe. So, we fund funds. All our funding comes from the Irish Government.

"And, of course, from an innovation perspective we tap into the international funding that is available to drive projects, but as an agency our funding comes from government."

She explained that there is a significant amount of money that goes directly into supporting companies, either in their innovation agenda, in their overseas agenda, in their leadership agenda, in their lean agenda. On the innovation side, Enterprise Ireland spends a significant amount of money funding innovative research and technology within Ireland's universities and institutes of technology.

"So, we're unusual as an enterprise agency in that not only are we here to support established companies, we also fund a lot of what we call 'market-focused research' within our universities, with the ambition of either starting new companies or developing technologies that are of relevance to the established company base.

"And that is unusual. People say why is an enterprise agency spending so much money funding research. But we're funding industry-led research and market-focused research and ultimately, we're doing it so that it's going to impact on industry in Ireland either in new company formation or assisting established companies to get access to really innovative tech," she explained.

"As an agency we're a large organisation. The practical reality is that we have as many people overseas as we do in Ireland, if not more and that's because it's of critical importance to us that our companies are able to compete in a global setting and having people on the ground [facilitates this]."

Engaging the patient

Oneview Healthcare specialises in patient engagement technology solutions. *Middle East Health* speaks to **Patrick Masterson**, the Group Chief Commercial Officer.

Oneview Healthcare is an Irish company based in Dublin. They trade in the Middle East as well as other global markets. The company started over 10 years ago delivering entertainment systems in hospitals and quickly realized that this piece of equipment in the hospital room is 'very valuable real estate which can be used to deliver all sorts of services to engage the patient, reduce costs to the hospital, improve clinical work flow and ultimately deliver better outcomes for the patient'.

The system is built on the Oneview Core Platform which provides the foundation for all Oneview services and applications. Some of their key services that can be delivered to the patient include a care team console which allows clinicians to review patient information and status in a single view, and to engage patients with education, goals and messages. It also enables the provision of patient entertainment and serves as a platform to enhance communication between the patient and the care team.

"All our information is stored on the hospital server and delivered across the hospital IP network. In this way we can deliver any type of content to enhance patient engagement," Masterson explained.

He pointed out that an empowered and engaged patient is more likely to respond to treatment and is less likely to present for readmission.

The system can be integrated with various hospital information systems from other vendors, such as electronic medical record systems, hospital administration systems, nurse call systems, billing management systems, meal order systems, etc.

"This integration ensures that what appears on the TV screen in the room is content specifically related to that patient in their language. This includes Arabic," he said.

"Most patients want to be in control of their environment and this system enables that."

Oneview provides the platform and can also provide the content. "Some hospitals prefer to provide their own content and we

International presence

Enterprise Ireland has 33 offices internationally.

"I believe this this quite unique as an enterprise agency. There're many other enterprise agencies worldwide that do similar activities, but for us we've got people on the ground [around the world] to make the connections, to make the alliances and really to help our companies to sell on a regional basis," Glenn explained.

"The companies that we deal with range from entrepreneurs that are starting up their companies through to what we call high potential start-ups through to established companies through to very large companies.

"A critical part of what we do is about bringing our customers to the market and, depending on the sector, there are very important strategic events that we prioritise. The Arab Health exhibition, for example, represents a key market and its a key target for our wider life science community, well beyond med tech.

"We prioritise this because we know that there is a demand from customers and partners in that region to engage with Irish companies and we've had some great successes there.

"We also do a lot of trade missions. The key point is about bringing our clients to the market where they can meet face-to-face with customers." MEH

Patrick Masterson (left) and John Kelly of Oneview Healthcare

can supplement this," he said.

In the Middle East, Oneview is live in Mediclinic in Dubai. They have a base in Dubai and are active in Abu Dhabi, Saudi Arabia and Qatar.

- For more information, visit: *www.oneviewhealthcare.com* MEH

Identify the need, create the innovation

Middle East Health speaks to **Dr Paul Anglin**, Strategic Development Lead, Bioinnovate about their programme and its role in the med tech sector.

Bioinnovate is national programme in Ireland. It focusses on innovation.

The model they use is focused on combining the idea of 'needs-led innovation meets entrepreneurship in a regulated environment'.

"It was adapted from the Stanford Biodesign Model. We are affiliates of the Stanford Biodesign Program which is the oldest practitioner of this type of model in the world," Dr Anglin said.

"The traction with the model is that it is centred around 'needs that require innovation'."

Dr Anglin explained that this needs-based innovation is different to someone coming around and saying 'this is my technology, this is what it does' and then trying to identify a need for it.

This is a 'tech push' scenario – the innovation first and then one tries to find the market, the need.

"We flip it around and say where is the problem? Where is the need? Is there a market opportunity associated with the need?

"We then set up multidisciplinary teams of 4 people – selected from technical, commercial, medical, law, IT, and commercial fields.

"We show them to how to do a 'needs finding and observation', and then we put them in the hospital for eight weeks so they can follow the entire path of patient care in the hospital," he said.

"That's the real differentiator of this approach. It's the idea that you go in and find problems. We have no interest in starting with a solution. We start with a team and identify a problem, or multiple problems and filter those problems down. Then when they start to find solutions, those are filtered down to determine whether they are viable by assessing the regulatory risks, reimbursement prospects, etc."

Dr Anglin provided the example of Embo Medical, which was initially supported by Bioinnovate.

"They were part of our team and focused on cardiology in an interventional radiology setting. While watching a physician trying to embolise a blood vessel, they noticed the physician used multiple devices and saw that the procedure took a long time. They figured 'surely there is a better way to do this'.

Dr Paul Anglin, Strategic Development Lead, Bioinnovate.

"So, they researched it. They talked to doctors around the world and in Ireland. They researched the market and the competitor landscape. They then started to develop solutions, checked the regulatory risks and then got commercialisation funding of Euro 2.8 million. They developed a new, safer, and more cost-effective way of carrying out embolization procedures with a device they called a Caterpillar. They were acquired 18 months later for Euro 43 million," he noted.

"They had identified a very clear need and provided an elegant solution."

He explained that Bioinnovate is funded through multiple sources with Enterprise Ireland being their primary sponsor.

He said there are multiple programmes like this in the world, however what sets Bioinnovate apart is that they can recruit senior fellows with work experience who are well equipped to deliver a new company.

"Our recruitment is global. Our products are global. But the development is done in Ireland," he said.

Bioinnovate is in its seventh year and has 65 alumni; out of those they have 25 technologies in development. MEH

Revolutionary anti-microbial coating

Kastus Technology recently started marketing an innovative anti-microbial coating for ceramic and glass. Called Log4+ it has seemingly limitless application, is scratch proof and never wears off. *Middle East Health* speaks to **John Browne**, the Chief Executive Officer, about the product.

"Log4+ is an indoor light-activated anti-microbial coating for glass and ceramics. It's a novel and unique product in that it uses indoor light and moisture in the air to disrupt the bacterial cell wall and kill bacteria. It kills both gram-positive and gram-negative bacteria, such as MRSA and fungi," Browne explained.

"So, it has huge potential uses in healthcare environments," he added.

Kastus Technology is a spin out from the Dublin Institute of Technology where the product was developed over almost 10 years and commercialised in the past four years during which the company raised finance, registered patent protection worldwide and undertook external testing.

"It is a unique technology. The difficulty with getting antimicrobials onto hard surfaces is that they typically wear off or they leach harmful chemicals into the environment. Ours doesn't. This technology is applied during the manufacturing process where it is spray-applied and then heated up to 1100°C in the case of ceramics. The anti-microbial coating is sintered – or blended – with the top surface of the ceramic or glass. So, they are super scratch resistant, and it never wears off. It's unique in that you can't see it. It's very thin – just 5 microns thick," Browne said.

Tests show that the product is extremely effective – resulting in the decomposition of organic and inorganic substances and offering bacteria kill rates up to 99.99%.

The company has another complementary product – Kastus Metal. It provides both an anti-bacterial and anti-corrosion coating to metal. This product was launched at the Med in Ireland event in October.

"It's very useful in architectural hardware, door handles, handrails, medical devices, etc," explained Browne.

John Browne (left) and colleague at the Kastus Technology booth at the Med in Ireland event.

"There is a huge market for this and we're seeing opportunities from healthcare to aerospace."

It is still relatively early days for the company. They have set up a commercialization team and are looking to supply Log4+ to manufacturers of ceramics.

The manufacturers can simply apply it during the manufacturing process.

"We've designed it so it is relatively easy to apply. There is no additional capital expenditure required and no major additional production steps involved. This took us quite a bit of development time to be able to do this," he said.

"Their products should remain commercially viable, so the chemical is inexpensive.

"The goal is to have this incorporated into the whole line of the manufacturer's products. The early adopters are starting to see the benefits of this and we expect the rest will follow," Browne said.

"We recently won the Irish Times Innovation Award for the product in the Life Science and Healthcare category. In addition, we won the overall award."

Global markets

The company is exploring all global markets, but with regards the Middle East he said they are working with eight ceramics manufacturers. "Saudi Ceramics is one that we hope to launch products with very soon."

Browne noted that the development process they used is a good model of what Ireland does so well in terms of developing innovative products through the universities and then commercialising them.

- For more information, visit: *www.kastus.com* MEH

Children's Hospital of Pittsburgh of UPMC is a leading international center for liver transplantation as a treatment for metabolic disease.

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We've performed more liver transplants for patients with metabolic disease than any other transplant center.

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Our experience, expertise, and commitment to innovation and compassionate care are reasons why patients and families from around the world travel to Children's Hospital of Pittsburgh of UPMC. For a free phone consultation with one of our experts on liver transplantation as a therapeutic option for metabolic disease, please visit **www.chp.edu/metabolic** or send an email to **international@chp.edu**

Sources: Internal data, Hillman Center for Pediatric Transplantation; Scientific Registry of Transplant Recipients (www.srtr.org), December 2015 release.

Children's Hospital of Pittsburgh of UPMC

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AT THE FOREFRONT
UChicago Medicine
International Programs

Like Lego blocks – next-generation DNA bricks can self-assemble into 3D nanostructures at GigaDalton scale

By **Benjamin Boettner**

DNA, present in almost every cell, is increasingly being used as a building material to construct tiny, but sophisticated structures such as autonomous 'DNA walkers' that can move along a microparticle surface, fluorescent labels for diagnostic applications, 'DNA boxes' that serve as smart drug-delivery vehicles programmed to open up at disease sites to release their therapeutic content, or programmable factories for nanoparticles of defined sizes and shapes for new optical and electronic applications.

To accommodate these functions, researchers at Harvard's Wyss Institute for Biologically Inspired Engineering and around the world have developed ways that allow DNA strands to self-assemble into increasingly complex 3D structures such as scaffolded DNA origamis. DNA origamis, however, are limited in their sizes because they rely on the availability of scaffold strands that can be difficult to manufacture and manipulate. In 2012, Peng Yin and his team at the Wyss Institute presented an alternative method in *Nature* (2D) and Science (3D) that is based on DNA 'bricks', which do not use a scaffold but rather are able to connect like interlocking Lego® bricks and thereby self-assemble into origami-sized structures with prescribed shapes.

Leapfrogging technology

As reported in *Nature*, the team leapfrogged their technology by two orders of magnitude, enabling next-generation DNA bricks to self-assemble into three-dimensional nanostructures that are 100 times more complex than those created with existing methods. DNA origami and first-generation DNA bricks self-assemble from hundreds of unique components to produce nanostructures on the MegaDalton scale, whereas the new DNA bricks approach allows 10,000 components to self-assemble into GigaDalton-sized structures (1 GigaDalton equals 1000 MegaDaltons or 1 billion Daltons. A Dalton is a unit used in expressing the molecular weight of proteins, also referred to as unified atomic mass unit. It has a value of 1.660539 × 10−27 kg). The study provides user-friendly computational tools to design DNA nanostructures with complex cavities (and possibly surfaces) that have the potential to serve as building components in numerous nanotechnological applications in medicine and engineering.

"By adding functional moieties to DNA bricks that can carry out assembly and enzymatic processes, they can be converted into powerful tools for commercial and biomedical nanofabrication processes on a new scale," said co-corresponding author Yonggang Ke, Ph.D. The researchers believe that, in the future, the method could also be used to generate large nanostructures with sculpted and application-specific outer surfaces.

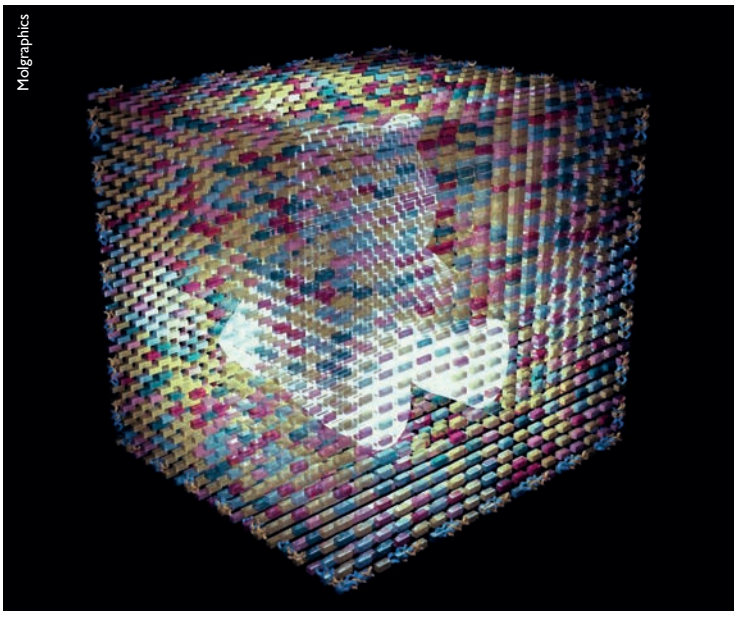
"The principle and promising capabilities of our first-generation DNA bricks led us to ask whether we can enhance the system to attain significantly more complex nanostructures with much higher yields in one-pot assembly reactions. Here we managed to do all this. We worked out an easily accessible practical platform that allows researchers with very different interests and applications in mind to create a molecular canvas with 10,000 bricks and use it to build nanostructures with unprecedented complexities and potential," said corresponding author Yin, Ph.D., who is a Wyss Institute Core Faculty member, co-leader of the Institute's Molecular Robotics Initiative, and Professor of Systems Biology at Harvard Medical School.

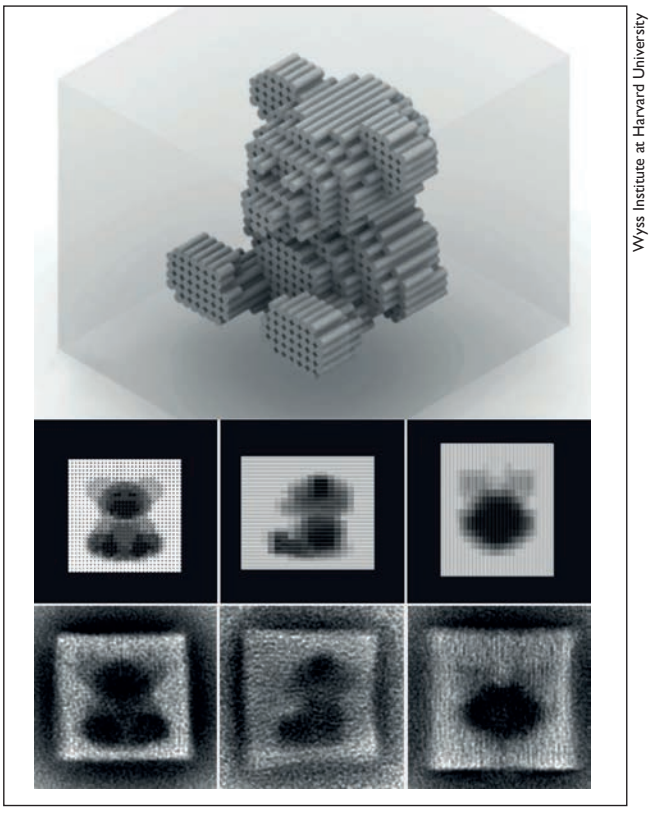
DNA brick technology is based on the stable and highly programmable nature of DNA. A single DNA brick is a short strand of synthetic DNA made up of a pre-defined sequence of the four universal nucleotide bases: adenine (A), cytosine (C), guanine (G), and thymine (T). The Wyss Institute's researchers create large 3D nanostructures by mixing various bricks, each carrying its own unique sequence of nucleotides that is designed to fit and bind to a complimentary domain of nucleotide bases in another brick so that they can self-assemble. In the technology's new version, by varying the length of individual binding domains within the bricks, the team ended up with a substantially increased diversity among possible bricks that, in addition, bind much stronger to each other. The study also developed a user-friendly computer software so designers can simply input a required 3D shape and automatically receive a list of DNA brick sequences that can be synthesized and used to form the desired structure.

30,000 bricks

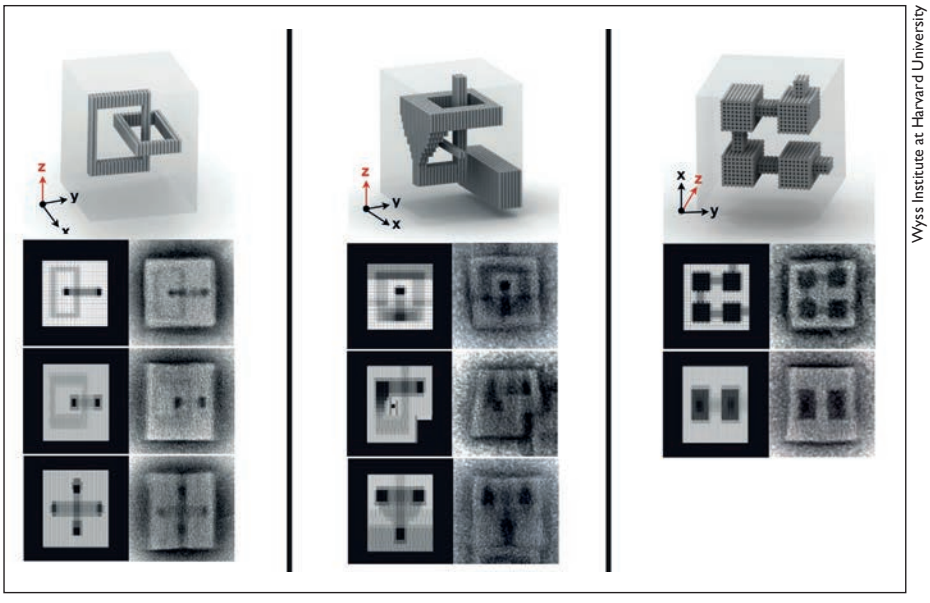
"We demonstrated the capabilities of our technology by constructing massive cuboids containing up to 30,000 bricks and showed a few exemplary shapes that can be built from subsets of those bricks. It is remarkable that the bricks were able to distinguish between tens of thousands of potential partners to find their correct neighbours, and it was exciting to see that the DNA bricks technique could be used to form rather complex cavities such as a teddy bear, the word 'LOVE' or a Möbius strip, amongst many others," said first author Luvena Ong, Ph.D., a former Graduate Student in Yin's laboratory and now a Research Investigator at Bristol-Myers Squibb.

Yin's team collaborated with researchers at the National Center for Scientific Research (CNRS) and the French National Institute of Health and Medical





▲ 10,000 next-generation DNA bricks are used to self-assemble a complex cavity with the shape of a teddy bear.



These examples show how next-generation DNA bricks can create cuboids with a range of complex cavities.

Research (INSERM) in Montpellier, France and the Max Planck Institute of Biochemistry in Munich, Germany to deploy a collection of state-of-the-art microscopy methods to visualize the designed cavities in 3D cuboids.

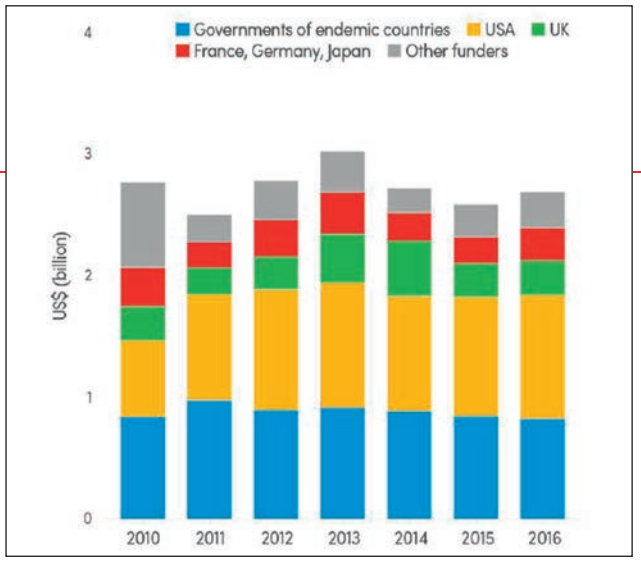
"Cavity structures composed of DNA bricks are of much interest as they offer the possibility to design nano-containers in which biomolecules like proteins can be place in very defined arrangements to study their interactions and leverage their activities," said Ke, who developed the first DNA brick platform with Yin as a Postdoctoral Fellow at the Wyss Institute, and is now Assistant Professor at the Georgia Institute of Technology and Emory University. Ke, working together with his Graduate Student Pengfei Wang, was instrumental in advancing the technology to its new version.

"The way the multifaceted DNA bricks technology is evolving shows how the Wyss Institute's Molecular Robotics Initiative can reach deep into the field of DNA nanotechnology to enable new approaches that could solve many real-world problems," said Wyss Institute Founding Director Donald Ingber, M.D., Ph.D., who is also the Judah Folkman Professor of Vascular Biology at HMS and the Vascular Biology Program at Boston Children's Hospital, as well as Professor of Bioengineering at SEAS.

Other authors on the study are co-corresponding author Gaetan Bellot, Ph.D., who led the 3D electron tomography reconstruction effort of the DNA nanostructures together with Patrick Bron, Ph.D., and Josephine Lai-Kee-Him, Ph.D., at the CNRS and INSERM in Montpellier, France, and Ralf Jungmann, Ph.D., faculty at the LMU Munich and the Max Planck Institute of Biochemistry in Germany and his Graduate Students Florian Schueder and Maximilian Strauss. Additional authors are past and present members of Yin's Wyss Institute team including Visiting Student Nikita Hanikel, Research Fellow Casey Grun, Ph.D., Jocelyn Kishi, Ph.D., and Cameron Myhrvold, Ph.D., who at the time of the study were Graduate Students, Graduate Student Bei Wang, and Research Assistants Omar Yaghi and Allen Zhu.

The study was supported by the Wyss Institute for Biologically Inspired Engineering, the US Office of Naval Research, the US Army Research Office, an Emory Winship Cancer Institute Billi and Bernie Marcus Research Award, and fellowships from the US National Science Foundation, the German National Academic Foundation and German Academic Exchange Service. MEH

Malaria control at crossroads as funding plateaus



Malaria funding, 2010-2016

Insufficient funding has resulted in a reversal of some of the major gains made in malaria control globally. According to the *World Malaria Report 2017*[i] there were an estimated 5 million more malaria cases in 2016 than in 2015 and malaria deaths stood at around 445,000, a similar number to the previous year.

Insufficient funding at both domestic and international levels has resulted in major gaps in coverage of insecticide-treated nets, medicines, and other life-saving tools.

Dr Tedros Adhanom Ghebreyesus, Director-General of WHO, said: "We are now at a turning point. Without urgent action, we risk going backwards, and missing the global malaria targets for 2020 and beyond."

The WHO Global Technical Strategy for Malaria[ii] calls for reductions of at least 40% in malaria case incidence and mortality rates by the year 2020. According to WHO's latest malaria report, the world is not on track to reach these critical milestones.

"With current levels of funding, and coverage of current tools, we have reached the limits of what can be achieved in the fight against this disease. The fact that funding for malaria has plateaued, that the number of malaria cases in 2016 is similar to the number of cases in 2012, and that there remain huge gaps in coverage of key malaria control tools, all make clear that unless we increase our efforts, we are not going to see any further progress," said Dr Abdisalan Noor, Team Leader Surveillance, Global Malaria Programme.

"Malaria represents one of the biggest success stories in recent times in terms of best value for money in public health. Millions of cases and deaths have been averted since 2000 through the scale-up of effective interventions.

"Having said that, I am concerned that we have become complacent and expect progress to continue at the same levels of funding. Since 2013, the rate of progress has either slowed or stalled in many malaria-endemic countries. We have an opportunity to double down our efforts, and it is not just about increasing financing. It also means better and smarter ways to invest available resources. Closing gaps in coverage of the tools that we know work is absolutely critical, as is continued investment in the research and development of new tools," said Dr Noor.

Funding

An estimated US$2.7 billion was invested in malaria control and elimination efforts globally in 2016. That is well below the $6.5 billion annual investment required by 2020 to meet the 2030 targets of the WHO global malaria strategy.

In 2016, governments of endemic countries provided $800 million, representing 31% of total funding. The United States was the largest international funder of malaria control programmes in 2016, providing $1 billion (38% of all malaria funding), followed by other major donors, including the United Kingdom, France, Germany and Japan.

The report shows that, in 2016, there were an estimated 216 million cases of malaria in 91 countries, up from 211 million cases in 2015. The estimated global tally of malaria deaths reached 445,000 in 2016 compared to 446,000 the previous year.

While the rate of new cases of malaria had fallen overall, since 2014 the trend has levelled off and even reversed in some regions. Malaria mortality rates followed a similar pattern.

African Region

The African Region continues to bear an estimated 90% of all malaria cases and deaths worldwide. Fifteen countries – all but one in sub-Saharan Africa – carry 80% of the global malaria burden.

In most malaria-affected countries, sleeping under an insecticide-treated bednet (ITN) is the most common and most effective way to prevent infection. In 2016, an estimated 54% of people at risk of malaria in sub-Saharan Africa slept under an ITN compared to 30% in 2010. However, the rate of increase in ITN coverage has slowed since 2014, the report finds.

Spraying the inside walls of homes with insecticides is another effective way to prevent malaria. The report reveals a steep drop in the number of people protected from malaria by this method – from an estimated 180 million in 2010 to 100 million in 2016 – with the largest reductions seen in the African Region.

The African Region has seen a major increase in diagnostic testing in the public health sector: from 36% of suspected cases in 2010 to 87% in 2016. Most patients (70%) who sought treatment for malaria in the public health sector received artemisinin-based combination therapies (ACTs) – the most effective antimalarial medicines.

However, in many areas, access to the public health system remains low. National-level surveys in the African Region show that only about one third (34%) of children with a fever are taken to a medical provider in the public health sector.

According to the report the global trends do not appear to be the result of drug or insecticide resistance. Overall, the immediate threat of antimalarial drug resistance is low. While insecticide resistance is more widespread, the data show that nets and indoor spraying remain efficacious tools for malaria prevention.

References

[i] World malaria report 2017 *www.who.int/malaria/publications/world-malaria-report-2017*

[ii] The WHO Global Technical Strategy for Malaria 2016-2030 (GTS), approved by the World Health Assembly in May 2015, is a framework for all countries working to control and eliminate malaria. To access the strategy, visit: *www.who.int/malaria/areas/global_technical_strategy* MEH

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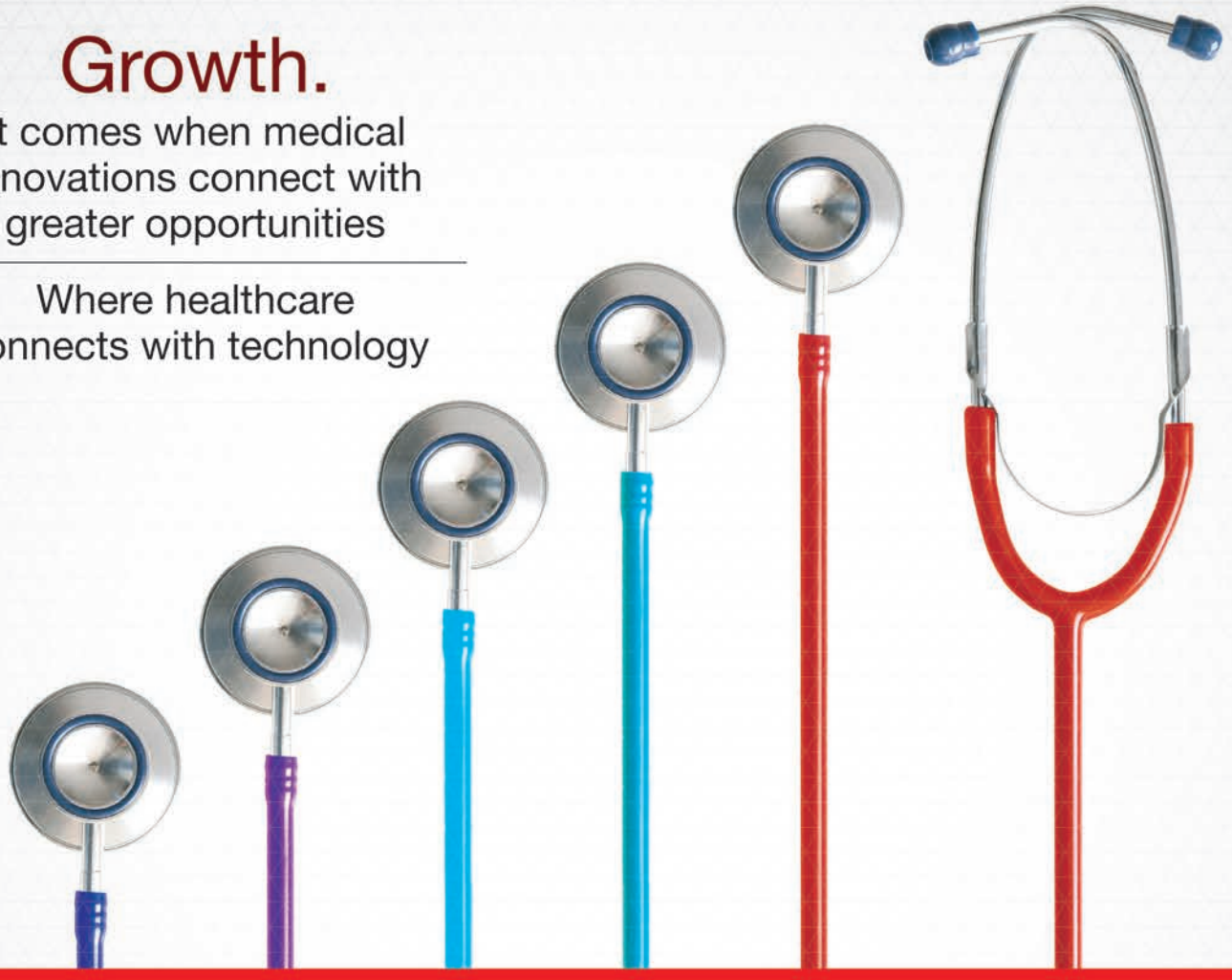

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Progress encouraging, but danger zones remain

The WHO, although encouraged by the steady progress in polio-eradication in all three wild poliovirus (WPV1) infected countries – Afghanistan, Nigeria and Pakistan – as well as a fall in the number of cases globally, noted that there remain areas of poor surveillance and immunization, particularly in the Syrian Arab Republic and the DR Congo.

For this reason, the Emergency Committee under the International Health Regulations (2005) (IHR) convened on 14 November 2017 at WHO headquarters in Geneva, unanimously agreed that the risk of international spread of poliovirus remains a Public Health Emergency of International Concern (PHEIC), and recommended the extension of revised Temporary Recommendations for a further three months.

The remarks were made at the fifteenth meeting of the Emergency Committee which reviewed the data on WPV1 and circulating vaccine-derived polioviruses (cVDPV).

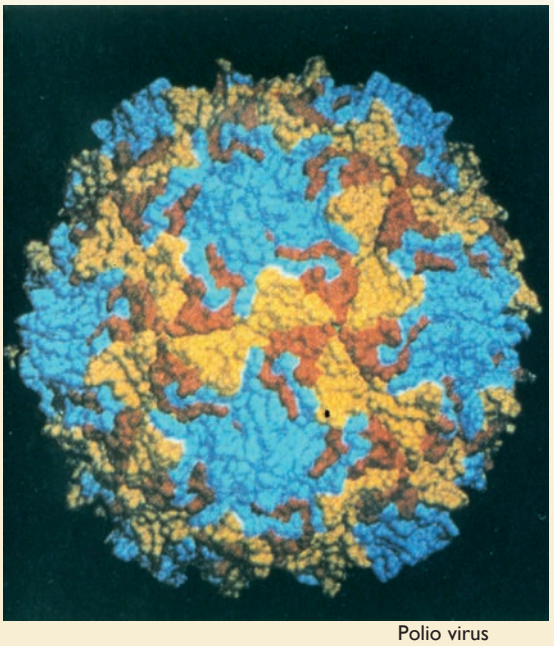
The Committee commended the high-level commitment seen in both Afghanistan and Pakistan, and the high degree of cooperation and coordination, particularly targeting the high risk mobile populations that cross the international border.

Stopping transmission in these populations remains a major challenge that cannot be under-estimated, underlining the critical continuing need for cross border activities in surveillance and vaccination, the WHO said.

The Committee commended the achievements in Pakistan that have resulted in the number of cases falling to just five so far in 2017; achievements included the improved accessibility, improved communication to reduce missed children and better quality supplementary immunization activities (SIA). However, WPV1 transmission continues to be widespread geographically as detected by environmental surveillance and this remains a source of major concern, notwithstanding that the intensity of environmental surveillance is now higher than previously, meaning the probability of environmental detection is now higher.

The Committee was concerned by the ongoing risks to eradication posed by the number of inaccessible and missed children in Afghanistan, particularly in the southern region resulting in ten cases to date in 2017.

The Committee was impressed by the innovations that continue to be made in Nigeria to reach children in Borno, but was very concerned that although the number of inaccessible settlements has fallen, there remains a substantial population in Borno state that is totally inaccessible, including around 160,000 - 200,000 children aged under five. It said there was substantial risk that polioviruses are still circulating in these inaccessible areas.



Polio virus

There was ongoing concern about the Lake Chad basin region, and for all the countries that are affected by the insurgency, with the consequent lack of services and presence of IDPs and refugees. The risk of international spread from Nigeria to the Lake Chad basin countries – Cameroon, Chad, the Central African Republic, and Niger – or further afield in sub-Saharan Africa remains high.

Outbreak in Syria causes concern

The Committee commended the efforts made in some very challenging circumstances in DR Congo and Syria. These outbreaks highlighted the presence of vulnerable under-immunized populations in areas with inaccessibility, either due to conflict or geographical remoteness. Furthermore, the delay in detection of these outbreaks illustrated that serious gaps in surveillance exist in many areas of the world, often related to weak health systems or to conflict resulting in disrupted health systems.

The Committee noted with concern the large number of cases in the Syrian outbreak within a short space of time and close to the international border with Iraq. It pointed out that in the context of ongoing population movement because of conflict, the risk of international spread is considerably heightened.

As type 2 population immunity rapidly wanes, the risk of spread within Syrian and beyond its borders will increase substantially, meaning urgent action is needed to stop transmission. The Committee commended countries surrounding the outbreak zone that are responding to prevent importation, particularly among Syrian refugees in Lebanon, Jordan, and Turkey. The Committee urged any country receiving Syrian refugees, particularly from Deir Ez-Zor and Raqqa, to ensure polio vaccination with IPV.

In DRC, there has been transmission after the initial SIA's with geographical spread outside the health zones covered, into Tanganyika, necessitating further rounds with mOPV2. Risks are compounded by poor surveillance in many areas, and widespread gaps in population immunity.

The Committee noted with concern the recent detection of a single highly diverged VDPV2 in sewage in Mogadishu in Somalia, with genetic evidence of more than three years of replication without detection. MEH

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Progress masks disparities, challenges in fight against AIDS

World AIDS Day was marked on 1 December under the slogan "Everybody Counts" with the aim of advocating access to safe, effective, quality and affordable healthcare services, diagnostics and medicines.

Commenting on the occasion, Dr Tedros Adhanom Ghebreyesus, WHO Director-General, said: "Since the very beginning of the epidemic, the HIV response has been centred on human rights, equity and communities, the very foundations upon which universal health coverage has been built.

"As the HIV epidemic has evolved over the years, it has been the most vulnerable, marginalized communities and individuals that have been disproportionately affected," he said.

"It soon became evident that the meaningful involvement of those communities was not only a moral imperative but also constituted good public health practice.

"The HIV response has played a critical role in transforming public health, and in turn has influenced the shaping of the universal health coverage agenda.

"We have achieved much in the past 30 years. Today 21 million people are receiving antiretroviral therapy that is enabling them to live full and productive lives. Every day, fewer people are becoming infected with HIV and fewer people are dying. But these successes are masking the many disparities and challenges that persist.

"Why, after three decades of recognizing the critical role of communities in driving the HIV response are we still seeing those populations most at risk being left behind, marginalized and discriminated against?

"Why is it that men who have sex with men, sex workers, transgender people, people who inject drugs and prisoners, representing 40% of new HIV infections in 2016, continue to be denied the most basic health services?

"Why is it that many young women, adolescents, migrants and displaced persons find themselves particularly vulnerable to HIV infection?

"And, why is it that adolescent boys and young men do not access the HIV and other health services provided ?

"On this World AIDS Day we are here to remind you that 'Everybody Counts'!"

The Eastern Mediterranean Region

Commenting on World AIDS Day, Dr Jaouad Mahjour, acting WHO Regional Director for the Eastern Mediterranean, said the region has witnessed progress in HIV surveillance, prevention, treatment and care, but noted that despite this progress the epidemic is still growing in the region.

"Between 2012 and 2016 the number of people living with HIV (PLHIV) receiving antiretroviral treatment increased steadily to more than double in number. In spite of this progress, the epidemic is still growing in the region. Our region features the lowest coverage of HIV prevention, diagnosis, treatment and care services in the world."

He emphasised that 85% of people living with HIV in the Region who need life-saving antiretroviral therapy do not receive it. This is attributed partially to the fact that about 70% of PLHIV in our Region are not aware of their infection and, consequently, do not demand antiretroviral therapy though they need it to save their lives.

HIV testing in countries of the Region is available mostly through public health facilities and nongovernmental organizations.

"Encouragingly, community-based testing programmes are operating in an increasing number in some countries. Pakistan, Egypt, the Islamic Republic of Iran, Morocco and Sudan have been working on increasing testing services through running community testing services for key populations and in locations where the HIV risk is high. In Morocco, the application of diverse approaches has resulted in 63% of PLHIV knowing their HIV status. In Sudan, focusing HIV testing in health care settings has contributed to increasing the efficiency of testing, Dr Mahjour noted.

"WHO calls on individuals to seek HIV testing."

Integrated people-centred care

Dr Ghebreyesus noted that an effective HIV response embraces integrated people-centred care, in which the full health needs of individuals and communities are addressed, not just those related to HIV. Countries are showing us how HIV interventions and services are being integrated into broader health programmes, how they are being effectively linked to other services, such as those for tuberculosis, viral hepatitis, sexual and reproductive health, non-communicable diseases and substance use disorders. By doing so, health systems are being strengthened and people living with HIV are reaching their full health potential.

"Providing the right health services to those who need them, in itself, isn't enough. If we are to achieve equity, to reach universal health coverage and to ensure the right to health for all, we need to work beyond the health system. The broader policy and social environment continues to play a critical role in shaping HIV epidemics and facilitating or hindering effective responses. The principle of 'everybody counts' must be enshrined in policies, laws and practices that span across all relevant sectors, adopting a whole-of-government approach." MEH

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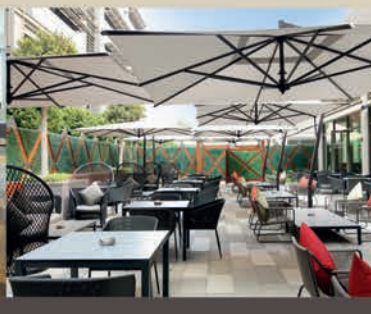

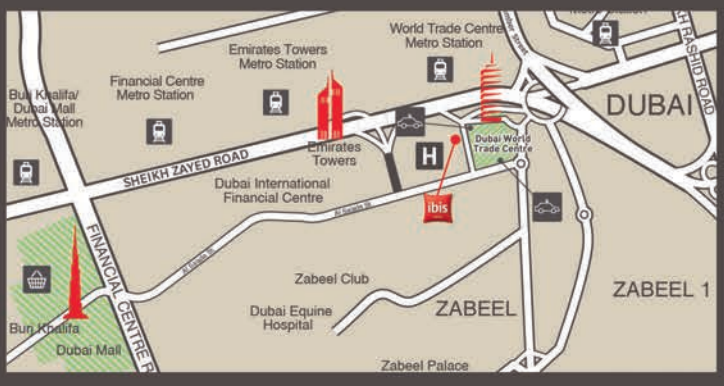

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Mayo Clinic Ranked No. 1 Hospital in the United States

Mayo Clinic was again named the best hospital in the United States in *U.S. News & World Report*'s annual list of top hospitals. Mayo Clinic was also ranked the No.1 hospital in Arizona, Florida and Minnesota.

Mayo Clinic has ranked at or near the top of "Honor Roll" hospitals throughout the history of *U.S. News & World Report*'s Best Hospitals rankings.

'Breadth of excellence'

Mayo Clinic is part of a select group on the *U.S. News* Honor Roll recognized for "breadth of excellence", according to the magazine. The Honor Roll consists of 20 hospitals with the highest combined overall scores in 16 medical and surgical specialties. Hospitals are measured for various factors, including safety, survival, patient services and reputation with other specialists.

Mayo Clinic is No. 1 overall in the magazine's annual Honor Roll ranking of its 2017-18 Best Hospitals list. Mayo Clinic also ranked No. 1 in six specialties:

- Diabetes and endocrinology
- Gastroenterology (GI) and GI surgery
- Geriatrics
- Gynecology
- Nephrology
- Neurology and neurosurgery

Mayo Clinic ranked No. 2 in four specialties: cardiology and heart surgery, orthopedics, pulmonology and urology.

Mayo Clinic ranked No. 3 in cancer and No. 4 in ear, nose and throat.

Mayo Clinic has more No. 1 rankings than any other provider based on factors such as reputation, mortality index, patient safety, nurse staffing and Magnet status, patient services, and technology. Mayo Clinic staff work to deliver the highest standards of care and transform scientific discoveries into critical advances for unmet patient needs.

Consistently top ranked

"Mayo Clinic is consistently top ranked more often than any other hospital because of the thousands of people here who shared a vision," says John Noseworthy, M.D., president and CEO, Mayo Clinic. "Our physicians, scientists, researchers, educators and allied health staff bring their expertise to focus on the individual needs of each patient."

More than 1.3 million patients from around the world seek Mayo Clinic's expertise each year. Mayo Clinic's physicians are salaried to eliminate any financial pressure from patient care decisions.

More than 150 years of quality

Mayo Clinic's commitment to quality dates back more than 150 years to when the Mayo brothers invented the team-based approach to medicine – an approach that is continually evolving. Mayo Clinic's experts work across specialties to provide comprehensive and coordinated care for patients with the most serious and complex conditions.

This *U.S. News & World Report* honor follows a recent Mayo Clinic report, Remarkable Moments of Sharing, which provides insight into what makes a top hospital and highlights Mayo's effect on the economy, health system and patients.

"Our patients tell us that the Mayo Clinic experience is unparalleled, offering answers quickly and giving them confidence and hope," Dr. Noseworthy says. "Our unwavering focus on the patient is the bedrock on which Mayo Clinic is built."

Many outside agencies rate quality in health care. Mayo Clinic is the only healthcare organization that consistently ranks among the top providers in the U.S. regardless of the quality measure used.

This is the 28th year that *U.S. News & World Report* conducted a rankings list, which encompasses 16 medical specialties. *U.S. News & World Report* analyzed data for 4,500 medical centers to determine the rankings.

■ For more information or to make an appointment, visit *mayoclinic.org* or *mayoclinic.org/arabic*. MEH

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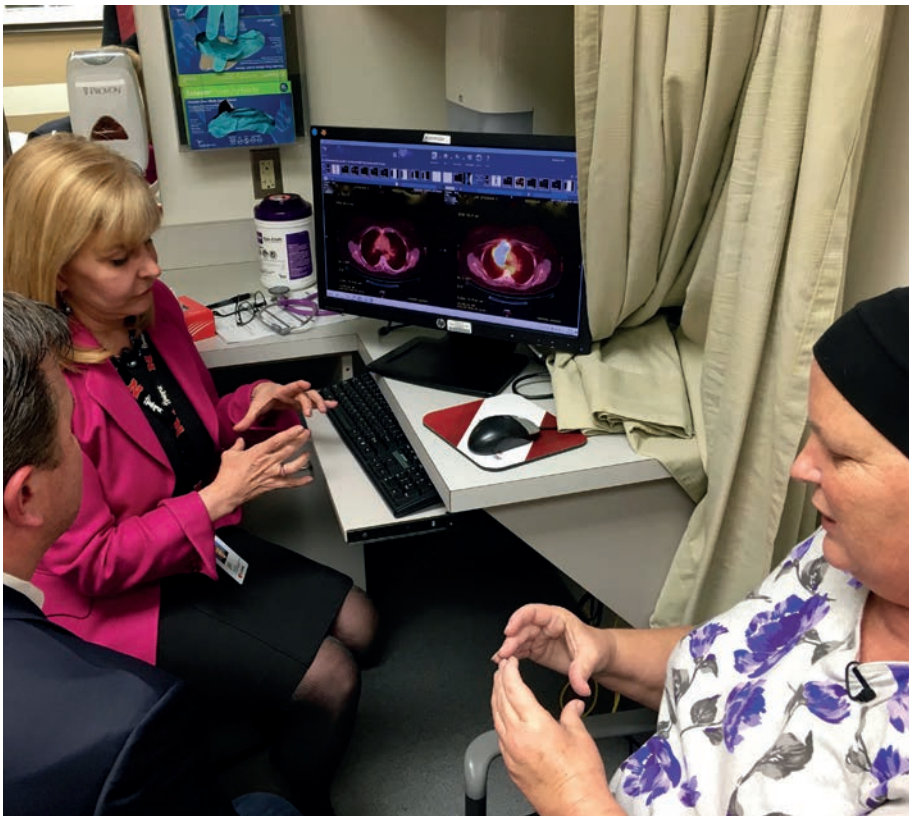
Promising new cancer treatment offered at University of Nebraska Medical Center/ Nebraska Medicine

Dr Julie Vose MD, the immediate past President of ASCO, is globally recognized as a leading expert on non-Hodgkin lymphoma, and has played a critical role in advancing cancer care and bone marrow transplantation, discusses the promising CART-Cell treatment program at University of Nebraska Medical Center /Nebraska Medicine (UNMC).

When Dr Vose's patient, Amy Cheese, first arrived at UNMC, she had a tumour inside her chest the size of a grapefruit and was out of any treatment options. Today, Amy is in remission and back to teaching.

Non-Hodgkin lymphoma (NHL) is the fifth most common type of cancer in U.S. adults. For years, traditional therapies to treat have included chemotherapy, radiation and a stem cell transplant. But after several years of clinical trials for Chimeric Antigen Receptor (CAR T-cell) therapy, a promising new option has been recently approved by the U.S. Food and Drug Administration (FDA) and is now being offered to UNMC patients.



"This clinical trial has been unbelievably successful in patient populations where they have failed every other type of treatment, so this is a big home run," says Dr Vose.

CAR T-cell therapy is a process of taking the patient's own immune system and modifying it to attack the cancer. "T cells are white blood cells that help our bodies fight infection and cancer," explains Dr Vose. "In lymphoma patients, these cells have gone haywire. They don't fight the cancer properly. This clinical trial has allowed us to take the patient's own T cells outside the body and restimulate them to be able to fight their own lymphoma."

"I can't stop smiling," says Amy. "I am so thankful that I was able to participate in this clinical trial. I think of the people who will not have to hear the words, 'there is nothing else we can do.' I am just so thankful."

Nizar Mamdani, executive director of UNMC's International Healthcare says: "Dr Vose and her expert team are remarkable examples of the calibre of specialists and researchers working tirelessly, to help provide better treatment options.

"Through collaborative strategic partnerships with 124 institutions in 44 countries, we continue to offer innovative treatment options, as well as specialized tele-pathology and second opinion consultation services for cancer care, neurology and transplantation patients around the world."

UNMC also provides no-cost, training and educational programs.

"Our customized training programs for international healthcare specialists, facilitate patients around the globe to be the ultimate beneficiaries of the most advanced treatment options at UNMC and empower them to receive the latest treatments in their own home countries," says Mamdani.

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Mr Tahir Khan (left) in surgery

Early diagnosis and treatment of hip problems

By Mr Tahir Khan
Consultant Orthopaedic Surgeon
Royal National Orthopaedic Hospital

The hip joint is pivotal to normal bipedal ambulation. Any deformity in the articulation leads to significant disability in young, active individuals. Patients with hip problems, typically complain of the following:

- Groin pain after physical activity
- Dull ache or discomfort after walking, running, dancing or prolonged sitting
- Stiffness affecting hip movements

If hip symptoms last longer – an underlying hip joint problem may need to be investigated promptly and comprehensively. Advanced imaging may detect hip pathologies before they lead to irreversible damage.

Young adults (typically aged 16–50 years) with persistent hip pain and no signs of hip joint arthritis present a diagnostic challenge for the un-initiated. Our understanding of the causes of hip pain in young adults has increased significantly over the last decade. This has led to the recognition that subtle hip abnormalities can cause symptomatic soft tissue damage and may initiate osteoarthritis (OA). Therefore, identifying and treating young adults with pre-arthritic symptoms (the 'at-risk' hip) is now possible.

Early diagnosis and treatment is extremely important to minimize symptoms and prevent premature onset of hip joint deterioration.

Hip conditions in young adults

Some of the causes of hip pain include:

- Abductor and gluteus muscle injuries
- Piriformis syndrome
- Snapping hip syndrome (ITB or iliopoas)
- Trochanteric bursitis
- Inguinal ligament strain
- Referred pain from lumbar spine
- Femoroacetabular impingement (FAI)
- Avascular necrosis of the femoral head (AVN)
- Developmental dysplasia of the hip (DDH)
- Legg-Calvé-Perthes Disease
- Acetabular labral tear
- Osteo-chondral defect
- Ligamentum teres injury

Femoroacetabular impingement

The term FAI describes deformities in hip joint morphology that results in impingement between the femoral neck and acetabulum. The impinging surfaces can irritate and damage the soft tissues of the hip joint – in particular, the acetabular labrum and the adjacent articular cartilage. Three types of deformities in the hip joint have been described:

1. **CAM type** – Asphericity of the femoral head; term borrowed from the cam-lobes on engine cam-shafts
2. **Pincer type** – over coverage of the anterosuperior acetabular wall; a deep socket. Similar to the tips of pincer forceps
3. **Mixed type**

Patients with hip pain have a higher prevalence of articular anatomy abnormality. A retrospective review of the pelvic radiographs of 157 patients aged 18–50 years revealed that 87% were found to have a hip shape abnormality.

Early specialist referral may be indicated in athletes where the prevalence of hip shape abnormality has been shown to be substantially higher than in the general population.

Treatments often involve targeted physiotherapy, which has shown good short-term outcomes in pain and function for patients with mild FAI, although there is limited experimental data.

Surgical management may be considered for extra- and intra-articular hip pathologies when patients do not improve with non-operative care and where the symptoms are judged severe enough to justify the risks of surgery.

Arthroscopic hip surgery may help with the management of trochanteric bursitis, snapping hip syndrome, and morphological corrections for the treatment of FAI as well as soft tissue repairs (e.g. labral repair/reconstruction, microfracture and repair of ligamentum teres injuries).

A growing body of literature now exists showing favourable outcomes of arthroscopic surgery for FAI in young adult and adolescent populations. MEH

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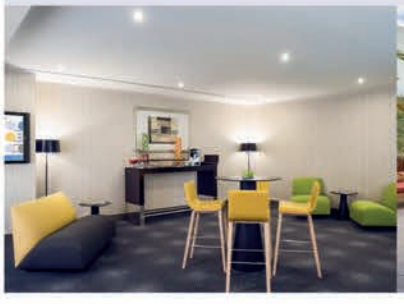

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(L-R) Dr Nabeel Azeez Awadh Allah, Gabriel Carter, HH Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, HE Abdullah Khalifa Al Ghafli, Daniel Madit Kuol Madut, Dr Adamo Kyana Salao, Bill Gates, Co-chair and Trustee of Bill & Melinda Gates Foundation and Regina Lotobay Lomar, stand for a photograph during the Global Health Forum.

Champions of health honoured with inaugural Mohamed bin Zayed Global Health Awards

Several world leaders were honoured for their outstanding contributions toward eliminating infectious diseases at the inaugural Mohamed bin Zayed Global Health Awards – Recognizing Excellence around Champions of Health (REACH). The awards were held during a global health forum in Abu Dhabi in November titled *Reaching the Last Mile: Mobilizing Together to Eliminate Infectious Diseases*.

The ceremony was attended by Idriss Deby, President of Chad; Ibrahim Boubacar Keïta, President of Mali; H.H. Sheikh Hazza Bin Zayed Al Nahyan, Deputy Chairman of Abu Dhabi Executive Council; Jim Young Kim, President, World Bank Group; Dr Tedros Adhanom Ghebreyesus, Director-General, World Health Organization; Bill Gates, Co-chair & Trustee, Bill and Melinda Gates Foundation; H.H. Sheikh Hamed Bin Zayed Al Nahyan, Chief of the Abu Dhabi Crown Prince Court; Lt. General H.H. Sheikh Saif Bin Zayed Al Nahyan, Deputy Prime Minister and Minister of the Interior; H.H. Sheikh Khalid Bin Zayed Al Nahyan, Chairman of the Board of Zayed Higher Organisation for Humanitarian Care & Special Needs; H.E. Sheikh Nahyan Bin Mubarak Al Nahyan, Minister of Tolerance; H.E. Sheikh Sultan bin Tahnoon Al Nahyan, Member of Abu Dhabi Executive Council; H.E. Abdul Rahman Mohammad Al Owais, Minister of Health and Prevention; H.E. Reem Ibrahim Al Hashemi, Minister of State for International Cooperation; H.E. Dr Maha Taysir Barakat; and a number of health ministers from different countries.

Also at the forum, a US$100 million *Reaching the Last Mile* Fund, supporting regional efforts to eliminate river blindness and lymphatic filariasis through innovation and collaboration, was launched by His Highness Sheikh Mohamed bin Zayed Al Nahyan, in partnership with the Bill & Melinda Gates Foundation and the END Fund. Speaking at the event, Gates outlined plans for the UAE to develop a disease elimination institute in Abu Dhabi, led by His Highness Sheikh Mohamed bin Zayed.

His Highness Sheikh Mohamed bin Zayed expressed his gratitude for the interaction among countries, organizations and individuals during the forum. "Our message is that we are united in our goal to put these infectious diseases behind us," he said.

"There are many people around the world who are driven to help others by pure conscience. These people deserve our respect, appreciation and honour. The UAE, under the leadership of His Highness Sheikh Khalifa Bin Zayed Al Nahyan, is one of the leading countries focused on long-initiatives that support people in need, in terms of health, education and living. It makes us happier when others are happy, and this firms our long-term approach."

Sheikh Mohamed emphasised that of all the various methods of giving, contributions to health and saving humans from debilitating diseases are the most rewarding because their impact exceeds expectations.

"Many inspirational examples of giving have affected people's lives and left a clear imprint on humanity as a whole. Most notably, my dear friend Bill Gates, who warrants extensive gratitude and appreciation for his philanthropic efforts, deserves the UAE's Order of Federation. I thank him for joining the Reaching the Last Mile Fund, which aims to eliminate river blindness and elephantiasis. Together we can save the world from these preventable diseases."

Sheikh Mohamed presented the REACH awards to:

■ **President Jimmy Carter**: The former US President, 2002 Nobel Peace Prize winner and Founder of The Carter Center was awarded the *REACH Lifetime Achievement Award* for his longtime, vocal advocacy for disease eradication efforts, particularly Guinea worm disease. His son, Chip Carter, accepted the award on his behalf.

He commented: "On behalf of The Carter Center and its partners, I am honoured to accept the REACH award, alongside outstanding heroes in the campaign to eradicate Guinea worm disease, whose efforts to eliminate infectious disease in marginalized, vulnerable communities create opportunities for people to transform their lives and reach their full potential."

■ **His Excellency Abdullah Khalifa Al Ghafli**: The director of the United Arab Emirates Pakistan Assistance Program, was awarded the Special Achievement Award for his work in forging new partnerships to drive progress on infectious diseases.

He commented: "Disease eradication saves millions of lives and partnership is key to this. I am proud to support the His Highness Sheikh Mohamed bin Zayed al Nahyan's global partnerships with governments, and international development and philanthropic organizations, which are focused on using the UAE's unique position to contribute to the global fight against disease."

■ **Dr Nabil Aziz Awad Alla:** A Former National Program Coordinator for Guinea worm disease eradication in Sudan's Federal Ministry of Health received the *REACH Courage Award* for going above and beyond to push forward progress against Guinea worm disease, at times at great personal risk.

He commented: "My work in Guinea worm disease eradication has taken me from war zones to remote villages. However, one thing remained constant throughout every tricky situation I found myself in – and that is hope. I am driven by the hope that I see in both sufferers and health workers, and I am honoured to be recognized on behalf of the community and the amazing individuals fighting to end Guinea worm disease."

■ **Dr Adamu Keana Sallau**: A Director for Integrated Health Programs in the Imo/Abia States at The Carter Center in Nigeria, received the *REACH Last Mile Award* for directly contributing to reaching elimination of Guinea worm disease in Nigeria.

He commented: "Guinea worm eradication is highly complex because the disease affects some of the most marginalized communities in Africa where remote villages and traditional beliefs create challenges for health workers. I am proud to be a part of the fight to help eliminate Guinea worm disease from my country, prevent millions of my people from needless suffering, and give more people a chance at a healthy life."

■ **Regina Lotubai Lomare Lochilangole**: A Social Mobilizer in South Sudan's Federal Ministry of Health received the *REACH Unsung Hero Award* for making significant contributions to ending Guinea worm disease in her community.

She commented: "I have seen firsthand the suffering caused by the disease and urge the world to continue supporting this important fight. We need people working at all levels – from community health workers to global advocates – to end this disease once and for all."

■ **Daniel Madit Kuol Madut**: A Senior Program Officer in South Sudan's Federal Ministry of Health received the REACH Unsung Hero Award for making significant contributions to ending Guinea worm disease in his community.

He commented: "We are now closer than ever to eradicating Guinea worm disease. However, reaching the last mile is sometimes the hardest. We must redouble our efforts and work closely together – only then will we reach zero." MEH

Prolific scientific endeavour

There is a tremendous amount of medical research taking place around the world, probably more than at any time previously. It's fascinating to follow it, as laboratories at academic institutions are prolifically publishing their findings in a vast swathe of peer-reviewed clinical journals. Some ground-breaking innovations, some less so, but all playing a role in advancing the field of medicine at an increasingly faster pace. The investigations cover all spheres of medicine, from genetic engineering to materials innovation for advanced medical devices. To give an indication of just how prolific is this scientific endeavour we've chosen a small sample of research papers published just in the past few weeks of November and December alone. Keep in mind however, that research like this continues to be published on a daily basis. This also serves as a call to all medical practitioners, that it is imperative they keep abreast of the latest research in their fields.

Ground-breaking gene therapy trial may offer cure for haemophilia

A 'cure' for haemophilia is one step closer, following results of a ground-breaking gene therapy trial led by the NHS in London.

The research is published in the *New England Journal of Medicine*, 9 December 2017.

Clinical researchers at Barts Health NHS Trust and Queen Mary University of London have found that over one year on from a single treatment with a gene therapy drug, participants with haemophilia A (the most common type) are showing normal levels of the previously missing protein, and effectively curing them.

A single infusion of the gene therapy drug showed improved levels of the essential blood clotting protein Factor VIII, with 85% of patients achieving normal or near-normal Factor VIII levels even many months after treatment.

The 'transformational' results have particular significance as the first successful gene therapy trial for the haemophilia A.

Haemophilia A is a hereditary genetic condition dominantly affecting men. People with severe haemophilia A have virtually none of the protein factor VIII which is essential for blood to clot. It puts those affected at risk of excessive bleeding even from the slightest injury as well as causing spontaneous internal bleeding, which can be life-threatening. Recurring bleeding into joints can also lead to progressive joint damage and arthritis. The only current treatment involves multiple weekly injections to control and prevent bleeding, but there is no cure.

The trial saw patients across England injected with a copy of the missing gene, which allows their cells to produce the missing clotting factor. Following patients for up to nineteen months, tests show that eleven out of thirteen patients in the trial now have normal or near normal levels of the previously missing factor and all thirteen patients have been able to stop their previously regular treatment.

Professor John Pasi, Haemophilia Centre Director at Barts Health NHS Trust and Professor of Haemostasis and Thrombosis at Queen Mary University of London explained: "We have seen mind-blowing results which have far exceeded our expectations. When we started out we thought it would be a huge achievement to show a 5% improvement, so to actually be seeing normal or near normal factor levels with dramatic reduction in bleeding is quite simply amazing. We really now have the potential to transform care for people with haemophilia using a single treatment for people who at the moment must inject themselves as often as every other day. It is so exciting."

The team will now hold further tests widening participants globally to include people in the USA, Europe, Africa and South America.

Professor Pasi continued: "Incredibly exciting is the potential for a significant change in how haemophilia is treated globally. A single dose of medication that can so dramatically improve the lives of patients across the world is an amazing prospect."

Professor Jo Martin, President, The Royal College of Pathologists said: "Pathology research is often responsible for ground-breaking developments in diagnoses and treatments that transform the lives of patients.

"What is truly remarkable about this revolutionary new gene therapy are the profound life-changing effects it offers patients with haemophilia. We would like to congratulate College fellow, Professor Pasi, and his team at Barts Health NHS Trust and Queen Mary University of London for their work in creating a simple but transformational treatment for patients."

• **doi**: 10.1056/NEJMoa1708483 MEH

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Brain imaging reveals ADHD as a collection of different disorders

Researchers have found that patients with different types of attention-deficit/hyperactivity disorder (ADHD) have impairments in unique brain systems, indicating that there may not be a one-size-fits-all explanation for the cause of the disorder. Based on performance on behavioural tests, adolescents with ADHD fit into one of three subgroups, where each group demonstrated distinct impairments in the brain with no common abnormalities between them.

The study, published in *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, has the potential to radically reframe how researchers think about ADHD.

"This study found evidence that clearly supports the idea that ADHD-diagnosed adolescents are not all the same neurobiologically," said first author Dr Michael Stevens, of the Olin Neuropsychiatry Research Center, Hartford, CT, and Yale University. Rather than a single disorder with small variations, the findings suggest that the diagnosis instead encompasses a "constellation" of different types of ADHD in which the brain functions in completely different ways.

The researchers tested 117 adolescents with ADHD to assess different types of impulsive behaviour – a typical feature of ADHD. Three distinct groups emerged based on the participants' performance. One group demonstrated impulsive motor responses during fast-moving visual tasks (a measure of executive function), one group showed a preference for immediate reward, and the third group performed relatively normal on both tasks, compared to 134 non-ADHD adolescents.

"These three ADHD subgroups were otherwise clinically indistinguishable for the most part," said Dr Stevens. "Without the specialized cognitive testing, a clinician would have had no way to tell apart the ADHD patients in one subgroup versus another."

Dr Stevens and colleagues then used functional magnetic resonance imaging (fMRI), a technique that allows researchers to make connections between behaviour and brain function, to investigate how these different impulsivity-related test profiles related to brain dysfunction.

"Far from having a core ADHD profile of brain dysfunction, there was not a single fMRI-measured abnormality that could be found in all three ADHD subgroups," said Dr Stevens. Instead, each subgroup had dysfunction in different brain regions related to their specific type of behavioural impairment.

"The results of this study highlight that there are different neural systems related to executive functions and reward processing that may contribute independently to the development of ADHD symptoms," said Dr Cameron Carter, Editor of *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*.

It will take more research to prove that ADHD is a collection of different disorders, but this study provides a big step in that direction.

"Ultimately, by being open to the idea that psychiatric disorders like ADHD might be caused by more than one factor, it might be possible to advance our understanding of causes and treatments more rapidly," said Dr Stevens.

According to Dr Carter, the findings suggest that future approaches using clinical assessments to identify the specific type of brain dysfunction contributing to a patient's symptoms may allow a more targeted approach to treatment. For example, medications that may not appear to work well in a group of ADHD patients as a whole, may be effective for one particular subgroup that arises from a specific causal pathway.

• **doi**: 10.1016/j.bpsc.2017.09.005

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The carbon footprint of surgery

– choice of anaesthetic significant contributor to emissions

The first analysis of the carbon footprint of surgical suites at three hospitals in the UK, Canada and the USA highlights that the choice of anaesthetic gases used in surgery can be a major contributor to greenhouse gas emissions from operating theatres.

The study, published in *The Lancet Planetary Health* journal, highlights the potential for reducing emissions in health care settings and at the same time potentially reducing costs.

The health sector is one of the largest service industries, with a considerable carbon footprint. In the USA, the health care system generates 8-10% of all greenhouse gas emissions. In the UK, the National Health Service is responsible for 25% of public sector emissions.

The new study measured the carbon footprint of three surgical suites in Canada (Vancouver General Hospital), the USA (University of Minnesota Medical Centre) and the UK (John Radcliffe Hospital, Oxford). The researchers measured direct emissions (eg. volatile gases), indirect emissions (eg. electricity consumption), and other emissions (eg. surgical waste), according to the Greenhouse Gas Protocol. Data were collected for each source and evaluated during 2011.

The annual carbon footprint of surgical suites ranged from approximately 3218 tonnes of CO2 equivalents (CO2e to 5187 tonnes of CO2e. While there were differences in the size and case load among all three surgical suites, there was also wide differences in the major contributors to greenhouse emissions. For instance, at Vancouver and Minnesota, anaesthetic gases were responsible for 63% and 51% of the total surgical emissions, compared to only 4% at Oxford.

Emissions due to anaesthetic gases accounted for approximately 2000 tonnes of CO2e at each North American site – 10-fold higher than the anaesthetic gas emissions from the UK hospital. The authors say this is largely the result of a higher usage of desflurane in the two North American hospitals. Desflurane has a high global warming potential (GWP), approximately 5 to 18 times higher than other anaesthetic gases, such as isoflurane and sevoflurane. It is also expensive, accounting for 83-86% of the cost of volatile agents at the two North American hospitals.

Dr Andrea MacNeill, Vancouver General Hospital, BC, Canada, and lead author of the study says: "Not only is desflurane a primary contributor to global anaesthetic gas emissions, it is also one of the most expensive anaesthetic gases. One of the greatest barriers to widespread implementation of low-carbon practices is the lack of awareness regarding the environmental impacts of anaesthetic choices. The climate impacts of surgery are generally accepted as necessary for the provision of quality care, but our study shows that it's possible to reduce the carbon footprint of surgery, which also reduce costs, without compromising patient care."

Due to the building standards of operating theatres, heating, ventilation, and air conditioning made use up 90-99% of overall theatre energy (compared to 52% in general inpatient healthcare facilities).

In Oxford, energy consumption was responsible for 84% of site emissions, compared to 17% in Vancouver and 36% in Minnesota. The authors say that reducing heating, ventilation and air conditioning in theatres overnight and at weekends, while leaving a minimum number of theatres online for emergencies, could significantly reduce emissions.

The average emissions per operating theatre, based on this study, were 188 tonnes of CO2e per theatre per year. Assuming the hospitals studied were representative of their respective regions, extrapolating these results to the number of operating theatres in the UK, USA and Canada would yield a total carbon footprint estimated at 9.7 million tonnes of CO2e per year, equivalent to 2 million passenger vehicles.

The study did not include emissions involved in the manufacture, sterilisation or transport of surgical items (including pharmaceuticals) so the study likely underestimates the emissions.

• doi: 10.1016/S2542-5196(17)30162-6 MEH

New pharmacological agent accelerates nerve regeneration

Researchers at the Institute of Neuroscience of the Universitat Autònoma de Barcelona (INc-UAB) have discovered a new pharmacological agent, Neuroheal, which helps to maintain motor neurons alive and accelerates nerve regeneration after traumatic injuries to peripheral nerves. There is currently no drug with these effects being applied in clinical practices.

The research, published in *Scientific Reports*, was directed by Caty Casas and included the participation of David Romeo and Xavier Navarro, researchers at the INc-UAB and CIBERNED, and Joaquim Forés of the Hospital Clínic Barcelona.

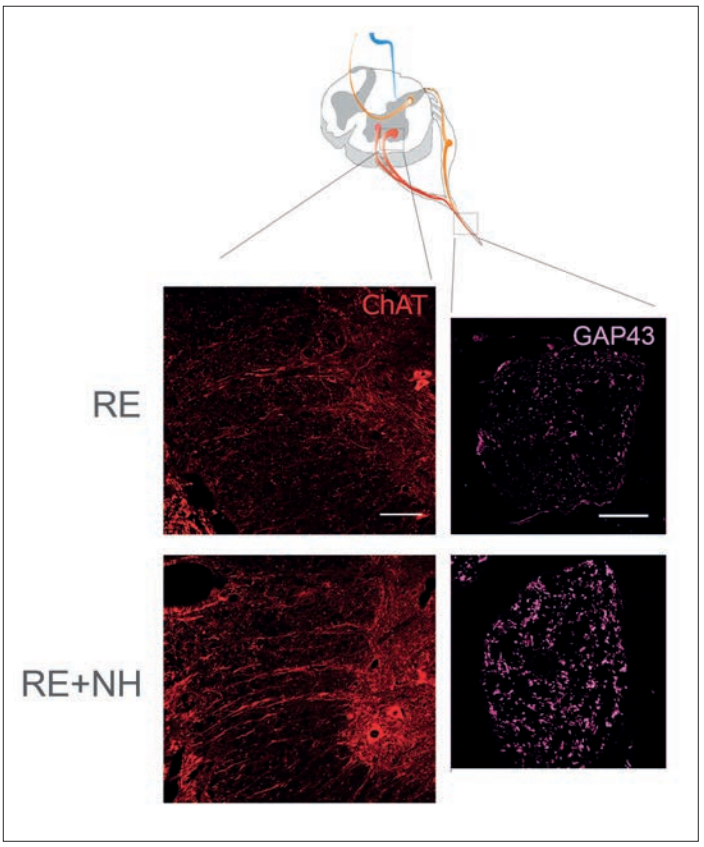
NeuroHeal was designed to imitate and strengthen neuroprotective mechanisms which naturally command neurons to deal with minor injuries successfully.

The pre-clinical trials indicate that oral administration permits long-lasting maintaining the survival of damaged motor neurons, for at least six months, after peripheral nerve root avulsion, even in cases of delayed surgical reimplantation, as it happens in clinical practices. In addition, the treatment accelerates nerve regeneration, drastically reduces denervation-induced muscular atrophy and increases functional contacts between the nerve and affected muscles.

"There is currently no pharmacological treatment indicated as an adjuvant therapy to maintain alive a neural population after such a severe injury and until surgical intervention, nor is there any to accelerate nerve regeneration. This new drug acts in both senses," Casas explained.

Injuries to peripheral nerves can be a consequence of traffic, work and sporting accidents that can cause nerve sectioning or compression. For example, a digital nerve section or injury in someone who works with dangerous machinery, or a high-energy impact to the shoulder in a motorcycle accident can produce nerve root avulsion in the most vulnerable areas, such as lumbar or brachial roots. The surgical reconstitution may be done days after the accident while the patient is stabilized and diagnosed but during that time, disconnected motor neurons due to nerve traction undergo a fatal and irreparable degenerative process.

In addition, after surgical repair of the surviving nerves, motor neurons must regenerate their axons through these same nerves until a connection with the muscles they controlled is re-established to recover functional movement. Is also a race against time. It can take up to two years for patients to regenerate their nervous circuit. The longer it takes to regenerate, the worse muscle atrophy becomes, hindering a good recovery.



The analysis of the spinal cord ventral horn and sciatic nerve (diagram indicating the areas) through confocal microscope clearly demonstrates that in the reimplantation model (RE), animals treated with NeuroHeal (NH) present more motor axonal ramifications (positive ChAT, in red) and more regenerated fibres (positive GAP43, in magenta) than untreated animals.

NeuroHeal is a particular dose combination of two repurposed drugs, Acamprosate and Ribavirin, which are currently used to treat other unrelated diseases. Researchers designed it by using artificial intelligence-based computational tools and systems biology approaches to interpret available biological big data and simulate biological responses to thousands of pharmacological combinations. The combination to conform NeuroHeal presented the best profile amongst all of them. This computational study was conducted thanks to the collaboration with Anaxomics Biotech.

Researchers have already patented the new drug and hope that it will be used in the near future.

"The fact that the two compounds in NeuroHeal are already being used and have demonstrated their pharmacokinetics and safety in humans, allow faster implementation for clinical use," the researchers said.

• **doi**:10.1038/s41598-017-11086-3 MEH

Advantech launches HIT-W101C 10" information terminal for healthcare applications

Advantech, a leading provider of medical computing systems and services, has launched the HIT-W101C – a 10" healthcare information terminal specifically designed for hospital applications. Featuring a Freescale i.MX6 A9 quad-core processor, Android 5.1 operating system, and 10.1" 16:9 widescreen multi-touch display with projected capacitive (PCAP) touch control, HIT-W101C offers healthcare providers a cost-effective and highly flexible medical computing device.

In addition to a 2-megapixel camera and microphone with acoustic echo cancellation (AEC), HIT-W101C is equipped with rear-access I/O that includes USB, mini USB OTG, RJ12, RJ45 with power-over-Ethernet (PoE) support, and micro SD slots for convenient connectivity and integration.

The IP65-rated true flat front panel protects against water and dust ingress and can be easily cleaned to ensure the highest levels of hygiene and infection control are maintained.

Compliant with EN 60950 and EN 60601-1-2 certifications, the HIT-W101C's lightweight (740 g) and slim (22 mm) design allow it to be easily mounted on walls, counter tops, mobile carts, and bedside swing arms to serve as medical equipment control panels, nurse station terminals, pharmacy information systems, medical cart devices, and patient infotainment terminals. Moreover, to expand the functionalities according to specific usage needs, HIT-W101C terminals can be integrated with a camera, and RFID/NFC/Wi-Fi/Bluetooth modules, as well as a voice-over-IP (VoIP) handset.

High flexibility for diverse patient and caregiver applications

HIT-W101C can be installed in bedhead units or mounted on bedside swing arms to function as bedhead terminals or patient infotainment devices, respectively. Healthcare staff can use the terminals to access medical records and hospital information systems, retrieve laboratory results, monitor patient vital signs, and document treatment observations.

Meanwhile, patients can use the terminals to watch movies/TV, make phone calls, play games, surf the Internet, send emails, request nurse assistance, and manage the ward environment, such as to adjust the bed height, lighting, curtains, and other equipment.

In other words, Advantech's HIT-W101C information terminal is a single solution that enables the efficient provision of digital entertainment and clinical services at the point-of-care. Furthermore, when mounted on nurse stations or mobile medical carts, healthcare staff can use the terminals for medication tracking and administration to reduce paper usage and potential data errors, thereby improving productivity and overall care service quality.

Supports a wide range of peripherals for easy expansion

Advantech's high-performance HIT-W101C terminal can be integrated with diverse peripherals, such as a VoIP handset, camera, and RFID/NFC/Wi-Fi/Bluetooth modules, to expand the system functions according to application requirements and ensure compatibility with existing hospital systems and processes. Additionally, although installed with Android 5.1, HIT-W101C can be equipped with a Linux operating system upon request. Regarding mount options, HIT-W101C's ergonomic small form factor is suitable for counter top, cart, swing arm, and wall mount bracket ensuring flexible installation in even the most challenging of healthcare environments.

Key features

- Freescale i.MX6 A9 quad-core processor
- 10.1" 16:9 widescreen display with multi-touch PCAP control
- 2-megapixel camera for high-quality imaging applications
- Integrated microphone with AEC and dedicated audio codec
- 1 x USB, 1 x mini USB OTG, 1 x micro SD, 1 x RJ12, and 1 x RJ45 port with optional PoE capabilities
- Compatible with Android 5.1 and Linux operating systems
- Supports counter top, cart, swing arm, and wall mount bracket

Advantech's HIT-W101C information terminal is available for order now.

■ For more information about this or any other Advantech product or service, contact your local sales support or visit the company website at: *www.advantech.com.* MEH

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Where healthcare meets technology

Future-ready medical innovations at 12th edition of Medical Fair Asia

Technology encapsulates our everyday lives, nowhere is this more obvious than in healthcare, where technology goes beyond convenience, it is helping to save lives. At MEDICAL FAIR ASIA 2018, preparation is in full swing for the 12th edition, which will deliver a future-ready platform of drivers and enablers highlighting new approaches that have the potential to revolutionise the medical world. The 3-day exhibition is the region's leading event for all those involved in medical and healthcare.

New models of healthcare delivery: FTR4H Pavilion | Community Care Pavilion

At the forefront of MEDICAL FAIR ASIA 2018 is the FTR4H Pavilion, powered by MEDICA - the world's leading medical event held in Germany – an international showcase aimed at driving the digital health ecosystem that explores the effects of digital transformation (mobile, IoT, big data) to the healthcare industry as well as a presentation of technologies and solutions from the digital and mobile healthcare fields. From new mobile apps, hardware and software technology, the inaugural FTR4H Pavilion is where healthcare meets technology.

Further augmenting this focus on technology and future-ready solutions at MEDICAL FAIR ASIA 2018 is the inaugural Community Care Pavilion – a comprehensive platform focused on medical solutions for the silver generation which will include a full suite of geriatric medicine, products and solutions such as rehabilitative equipment, mobility products using robotic technology, assistive technology to smart fabrics and wearable technology.

Commenting on the exciting developments expected at MEDICAL FAIR ASIA 2018, Mr Gernot Ringling, Managing Director of Messe Düsseldorf Asia, said: "The digital age of medicine is upon us. The healthcare landscape is changing exponentially and the growth opportunities driven by innovative healthcare technology, an ageing population, increasing chronic diseases, and empowered consumers, are immense, thus making new models of healthcare delivery inevitable."

"MEDICAL FAIR ASIA has always been about staying ahead of the curve and reflecting the needs of the region's medical and healthcare sectors and it is our goal to ensure that the exhibition continues to be seen as a must-attend event," he added.

MEDICAL FAIR ASIA 2018 is highly-anticipated to be the largest edition in the twenty-year history of the trade exhibition, with 1,000 exhibitors from 50 countries and 20 national pavilions.

Healthy outlook in Southeast Asia

The 12th edition comes against a healthy backdrop where Southeast Asia's healthcare market is expected to grow to S$510.7 billion by the end of 2017, and is predicted to corner close to 30% of global revenues, according to research firm, Frost and Sullivan. It remains one of the fastest growing regions globally. While on the global digital healthcare front, according to Global Market Insights, the global IoT healthcare market is expected to exceed US$10 billion by 2024, while the global mHealth market is set to reach US$10.2 billion by 2018.

Co-located events

Beyond the stellar line-up of exhibitors and technologies, MEDICAL FAIR ASIA also serves as a centre of knowledge for industry professionals to exchange ideas and share insights. The MEDICINE + SPORTS CONFERENCE will return for its second edition. The one-day conference is a multidisciplinary exchange forum where participants learn, network, and engage with those passionate about science and sports medicine.

Co-located with MEDICAL FAIR ASIA 2018, is the synergistic exhibition – MEDICAL MANUFACTURING ASIA. With its 4th edition, it is now well-established as the region's leading specialist trade fair for Asia's medtech and medical manufacturing processes sectors. Jointly organised by Messe Düsseldorf Asia and Singapore Precision Engineering & Technology Association (SPETA), it will feature an extensive product range from upstream to downstream processes in the medtech sectors.

The Southeast Asian market offers a diverse range of business opportunities for potential exhibitors and visitors, making MEDICAL FAIR ASIA 2018 the ideal platform for companies to strengthen and gain a foothold in the Southeast Asian market, network and share best practices.

- For more information:

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+65 6332 9682
www.medicalfair-asia.com MEH

Infectious disease experts share latest developments in HIV treatment at the 2nd HIV Summit in Dubai

More than international and Middle East experts attended the 2nd HIV Summit in the Middle East where they discussed recent updates and developments in HIV in the region. The summit, held in Dubai from 15-16 December, was accredited by the Health Authority of Abu Dhabi and supported by Gilead Sciences – and was entitled 'Today's Choices – Tomorrow's Health'.

Speaking at the summit, Jacques Mokhbat MD, Professor of Medicine, Division of Infectious Diseases, Lebanese American University, School of Medicine, said: "It is very important to spread the message of the importance of the treatment not only to the population at risk or vulnerable population, but also to the decisionmakers, ministers and governments. They need to understand that the treatment works, is effective, preserves life and stops transmission. They need to understand that individuals who are on treatment and responding well will live a normal and healthy life, with a normal lifespan and quality of life. Understanding this will stop the spread of epidemic."

According to the latest data available from the Joint UN Program on HIV and AIDS (UNAIDS) an estimated 36.7 million people globally are living with HIV. Even though new HIV infections have declined by 16% since 2010, 1.8 million became newly infected with HIV in 2016. Today 1 in 3 people living with HIV still do not know their HIV status, so only an estimated 20.9 million were accessing antiretroviral therapy in June 2017 and an estimated one million people died from AIDS-related illnesses in 2016.

On occasion of World AIDS Day, Dr Tedros Adhanom Ghebreyesus, WHO Director-General, issued a statement saying: "Providing the right health services to those who need them, in itself, isn't enough. If we are to achieve equity, to reach universal health coverage and to ensure the right to health for all, we need to work beyond the health system. The broader policy and social environment continues to play a critical role in shaping HIV epidemics and facilitating or hindering effective responses. The principle of 'everybody counts' must be enshrined in policies, laws and practices that span across all relevant sectors, adopting a whole-of-government approach."

In 2016, there were an estimated 230,000 people living with HIV in the Middle East and North Africa, out of which 18,000 were new HIV infections and 11,000 people died of AIDS-related illnesses. Between 2010 and 2016, the number of AIDS-related deaths in the region increased by 19%. When it comes to the treatment coverage, only an estimated 24% of people living with HIV have been receiving treatment, according to UNAIDS.

The experts at the HIV Summit explored the challenges of linkage to care as a key factor in changing the HIV epidemiology and achieving the UNAIDS 90-90-90 goal, particularly focusing on optimising community testing and access to treatment as prerequisites for linkage to care.

Dr Abdullah al Hokail, ID Consultant, King Faisal Specialist Hospital and Research Centre, Riyadh said: "One of the problems we are facing in the Middle East is access to testing, mainly because many people are not aware how serious the problem is. Across the region, there is the avoidance of the topic in the media. But people need to be educated. Testing is very important, and it is a key to linkage to care and viral suppression. People also shy away from the testing as they are afraid of potential consequences. Namely in some countries around the Middle East HIV positive expats might be asked to leave, while locals might lose their jobs. Therefore, in order to improve testing rates these aspects need to be re-evaluated."

The treatment and management of HIV has come a long way, with many of HIV patients now able to look forward to having a normal life expectancy. As such, HIV is now a chronic manageable condition.

The 2nd HIV Summit provided an interactive platform to review the recent clinical data and to share real-world experiences of treating complex patient cases with HIV in Western and Middle-Eastern regions. Infectious disease leaders at the Summit shared insights and best practices that can optimize the treatment outcomes for HIV patients. Experts from UAE, KSA, Kuwait, Oman, Lebanon, UK and Germany had an opportunity to exchange know-how and challenges with some of the world's leading infectious disease specialists.

Dr Jacques Mokhbat, Professor of Medicine, Division of Infectious Diseases, Lebanese American University, School of Medicine. "It is very important to spread the message of the importance of the treatment not only to the population at risk or vulnerable population, but also to the decisionmakers, ministers and governments. They need to understand that the treatment works, is effective, preserves life and stops transmission."

Dr Samer El-Ali, Medical Director, Gilead Sciences Eastern Europe and Middle East said: "For the second consecutive year, HIV Summit gathered leading infectious disease experts committed to the exchange of know-how and best practices focused on HIV management. Our ambition is to provide healthcare community in the Middle East a platform for continuous education on the effective HIV treatment, which leads to the better support for the people affected by HIV across the region."

By creating a continuous medical education platform that empowers local, regional and international infectious disease experts to connect and exchange ideas, Gilead Sciences reaffirms its commitment to educational efforts for healthcare professionals in the field of HIV. MEH

DiaSpect haemoglobin analyser now has smartphone app

EKF Diagnostics, the global in vitro diagnostics company, has introduced POC Connect – a data management smartphone application for its DiaSpect Tm haemoglobin analyzer. DiaSpect Tm is the only reagent-free haemoglobin analyzer with mobile connectivity. Lightweight and palm-sized, the DiaSpect Tm analyzer delivers laboratory quality haemoglobin results within 2 seconds at the point-of-care (POC). Now with the availability of POC Connect, this makes it ideal for mobile health checks and anaemia screening in a range of locations, environments and climatic conditions.

The new POC Connect mobile app is the world's first mobile data management solution for a reagent-free haemoglobin testing device. It is a simple android application that enables the storage, access and transmission of haemoglobin results directly from the DiaSpect Tm analyzer to a smartphone via Bluetooth technology. DiaSpect Tm can be purchased with integrated Bluetooth, meaning there is no need to purchase an additional external Bluetooth dongle.

This new POC solution will prove useful in countries with challenging environmental and geographical conditions where remote haemoglobin testing and access to internet can be difficult. All that is needed is an android phone and DiaSpect Tm device to record haemoglobin results with dates and times and then add unique identifiers, such as Patient ID, User ID, QC information, Cuvette LOT numbers, and comments. Data is synched and stored on the smartphone in a history list for easy access. Data can then be transferred at any time as a protected CSV file and added to a central database or lab information system (LIS) as required.

Hand held and portable, DiaSpect Tm is ideal for POCT not only due to its unmatched measurement speed, but also through its extensive battery life of 40 days continuous use, and up to 10,000 tests, without need for a recharge. Additionally, its reagent-free microcuvettes have up to 2.5 years shelf life, even after opening, and are unaffected by temperature or humidity. These disposable cuvettes can be stored from 0 to 50°C, meaning temperature controlled storage is not necessary – short term storage is even possible at 30°C to 70°C for 24 hours. This makes the device highly suited for testing in remote and/or hot and humid environmental conditions, or sites with low test volumes.

DiaSpect Tm is easy to use, requiring minimal training, as the user simply collects a capillary or venous blood sample of <10 µL in the microcuvette before inserting straight into the analyzer. Also making it perfect for POCT use in all locations, DiaSpect Tm is factory calibrated against the HiCN reference method in accordance with ICSH. No re-calibration or maintenance is needed, and it undertakes an automatic self-check between every measurement.

- For more information, visit: *www.ekfdiagnostics.com*
- Download the POC Connect app from the Google Play store MEH

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- Further information can be found at: *www.multivac.com* MEH

Konica Minolta introduces HD, wireless, portable DR system

An extremely high-definition wireless portable DR system, the AeroDR HD from Konica Minolta is the new flagship model AeroDR series that is ideal for use in a wider range of environments, including at the patient's bedside, in ICUs, emergency departments and operating rooms as well as radiography rooms.

With a sensor panel sampling pitch (pixel size) of only 100 µm, the AeroDR HD detector delivers outstanding resolution which is among the highest in the world. For example, this allows orthopedists to capture far clearer images of fine structures such as the trabecular bone even when enlarged, thus contributing to enhanced diagnostic accuracy.

Moreover, because of its high DQE, the AeroDR HD can reduce dose by 62% compared to CR.

The AeroDR HD is also characterized by enhanced durability in terms of load and bending resistance. The detector can operate 100% wireless and is compatible with any existing X-ray room. Needless to say, a retrofit solution is an excellent economic alternative to digitize an X-ray room instead of purchasing a complete new room.

● For more information, visit: *www.konicaminolta.eu/healthcare* MEH

Timesco's reusable laryngoscopes and preloaded single-use handles are best choice

Timesco Healthcare, England, has been at the forefront of laryngoscopes design, manufacture and innovative developments in intubation for over five decades.

Complete ranges of reusable "Optima", "Sirius" laryngoscopes systems covering from neonate to adult intubation, as well as specialist, Robert Shaw, Seward, and difficult intubation "Eclipse" tilting tip blades are available.

Timesco's range of laryngoscopes has been further upgraded by addition of LED light for the reusable and single-use handles.

Timesco manufactures the world's number one single use disposable fibre optic laryngoscopes system "Callisto", which is complemented with Callisto single use and Optima reusable LED handles.

The single-use Callisto range has been expanded with the addition of Callisto Flare LED single-use dry cell and preloaded handles which are supplied complete with batteries. The Callisto Flare LED handles are available individually and also paired with the Callisto blades as handle and blade packs, ready to use.

Timesco is an ISO, FDA, CE and SFDA registered company.

- For more information, visit: *www.timesco.com* MEH

On the pulse

Capsa Healthcare introduces advanced point-of-care computing cart

The new M38e from Capsa Healthcare is an evolution of the most proven point-of-care computing cart in healthcare. With updated features that provide superior ergonomics, enhanced ease of use, and expanded storage flexibility, the M38e maximizes clinical efficiency and elevates the performance of your health IT program.

Capsa Healthcare is a leading developer of point-of-care computing workstations that improve the efficiency of clinical providers in hospitals throughout the world. We understand the delivery of healthcare cannot wait. Caregivers need assurance that the right products, the right technology, and the right support they need will always be there. That's why Capsa Healthcare products are designed with caregivers in mind, to help them meet the demands of care seamlessly and efficiently.

• For more information, visit: *www.capsahealthcare.com* MEH

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or *customerservice@sunvitd3.co.uk* MEH

The closest thing to a new form of life

Some 3.5 billion years ago, life on Earth evolved to have just four "letters" in its genetic code. These letters are the DNA bases G, C, A and T – and they spell out the instructions for making proteins in every organism on Earth.

But scientists in a lab at The Scripps Research Institute (TSRI) have been working on something new. They've designed a bacterium with two unnatural bases, called X and Y, which could someday help them produce new molecules for medical therapies.

In a study published in the journal *Nature* (29 November 2017), the researchers announced that their "semi-synthetic" strain of *E. coli* is the first to both contain the unnatural bases in its DNA and use the bases to instruct cells to make a new protein.

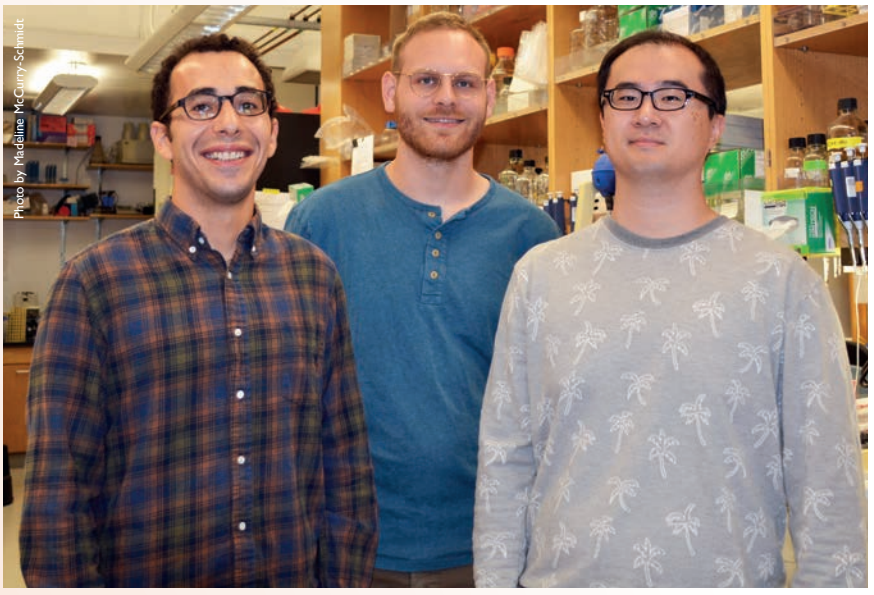
"I would not call this a new lifeform – but it's the closest thing anyone has ever made," said TSRI Professor Floyd Romesberg, Ph.D., who led the study. "This is the first time ever a cell has translated a protein using something other than G, C, A or T."

The new research builds on the Romesberg Lab's previous efforts to expand the limited "alphabet" of natural DNA. Until now all organisms use have used only the four DNA bases to code for 20 amino acids. With the addition of X and Y, an organism could code for up to 152 new amino acids. The researchers hope these amino acids could become building blocks for new medicines.

Synthorx, founded on research from the Romesberg Lab, is leading the effort to develop protein therapeutics based on X and Y.

Romesberg and his team worked toward this breakthrough for 20 years. Their research took a huge step forward in 2014, when the team announced the creation of a semi-synthetic organism that could copy X and Y in its DNA. Earlier this year, the researchers also found that they could get bacteria to stably store the information and pass on the unnatural bases to daughter cells as they divide.

But just storing these bases isn't enough.



Study authors included TSRI's Aaron W. Feldman Emil Fischer and first author Yorke Zhang

To really be useful, these bases need to be "read", or transcribed, into RNA molecules and translated into proteins.

Romesberg and his colleagues achieved these important steps by embedding their unnatural bases in genes that also contained A, C, G and T. They found that within the semi-synthetic organism these genes could be successfully transcribed into RNA molecules also containing the unnatural bases, and that the cells could use these RNA molecules at their ribosomes to direct the incorporation of unnatural amino acids into proteins.

The protein produced in this process was a variant of green fluorescent protein (GFP), a naturally glowing marker often used in genetic experiments, which contained different unnatural amino acids incorporated at a selected site.

"This was the smallest possible change we could make to the way life works – but it is the first ever," said Romesberg.

Hydrogen bonds

The study is also the first to show that hydrogen bonds – thought to be crucial to the DNA-decoding process – may not be as important as scientists thought. "It would be very easy to say complementary hydrogen bonds are what define DNA and RNA," said Romesberg. "But we've found that forces other than hydrogen bonding can productively participate in every step of information storage and retrieval."

The scientists designed part of X and Y to be hydrophobic – so that they only pair with each other and repel the usual hydrogen bonding natural bases, which keeps X and Y from accidentally pairing with A, T, C or G.

It turns out that a lack of complementary hydrogen bonds doesn't really bother cells. As the scientists found, X and Y were successfully transcribed and translated anyway.

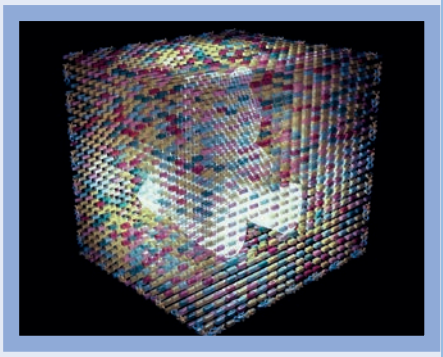
"What is remarkable about our findings is not just the fact that the cells are able to transcribe and translate these hydrophobic unnatural bases, but that they do so very efficiently," said TSRI Graduate Student Yorke Zhang, first author of the study. "We were able to achieve purities of desired amino acid incorporation above 98%, which demonstrates how seamlessly our synthetic bases can be integrated into the natural processes for encoding and decoding genetic information."

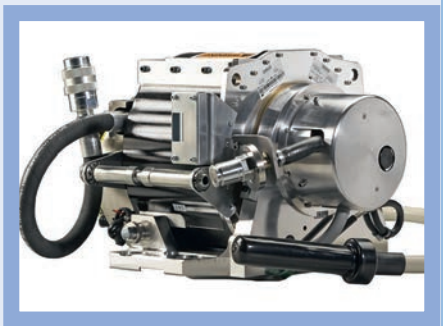
• **doi**: 10.1038/nature24659 MEH

Agenda

Selected schedule of regional medical meetings, conferences and exhibitions

Event	Date / City	Contact
January 2018		
Emirates Rhinology and Otology	17-19 January 2018 Dubai, UAE	*www.emiratesrhinologyandotology.ae*
Arab Health Exhibition	29 January – 1 February 2018 Dubai, UAE	*www.arabhealthonline.com*
February 2018		
Transcatheter Solutions	15-17 February 2018 Dubai, UAE	*www.4tsconference.com*
Pan ARAB Rheumatology Congress – ARLAR 2018	23-25 February 2018 Muscat, Oman	*http://arlar.org*
March 2018		
EDEC (Emirates Diabetes Society)	1-3 March 2018 Dubai, UAE	*www.edec-uae.com*
2nd Annual Dubai International Musculoskeletal Medicine Congress	9-10 March 2018 Dubai, UAE	*www.dimmc.com*
Abu Dhabi Annual Intl Conference on Vitamin D Deficiency & Human Health	15-16 March 2018 Abu Dhabi, UAE	*www.UAEVitaminDCongress.com*
IGDC (International Growth & Development)	15-17 March 2018 Dubai, UAE	*www.igdconference.com*
5th Evolving Practice of Ophthalmology Middle East Conference (EPOMEC 2018)	15-17 March 2018 Dubai, UAE	*www.epomec.ae*
GCC eHealth Workforce Development Conference	27-29 March 2018 Abu Dhabi	*www.gccehealth.org*





Agenda

Selected schedule of regional medical meetings, conferences and exhibitions

Event	Date / City	Contact
April 2018		
3rd Masterclass Gastroenterology, Hepatology & Related Diseases Conference	5-6 April 2018 Abu Dhabi, UAE	*http://menaconference.com/events/3mcga*
Arab International Men's Health Congress	12-14 April 2018 Dubai, UAE	*www.arabinternationalmenshealth.com*
3rd International Conference on Molecular Medicine and Diagnostics	19-20 April 2018 Dubai, UAE	*https://molecularmedicine.conferenceseries.com*
24th World Nurse Practitioners & Healthcare Congress	23-25 April 2018 Dubai, UAE	*https://nursepractitioner.nursingconference.com/middleeast*
July 2018		
29th International Conference on Public Mental Health & Neurosciences	16-18 July 2018 Dubai, UAE	*https://mental-health.neurologyconference.com*
22nd World Nutrition and Pediatrics Healthcare Conference	16-18 July 2018 Dubai, UAE	*https://nutrition.pediatricsconferences.com*
August 2018		
Middle East Obesity, Bariatric Surgery and Endocrinology Congress	6-7 August 2017 Abu Dhabi, UAE	*https://obesity-middleeast.conferenceseries.com*
28th International Conference on Cardiology and Healthcare	9-11 August 2017 Abu Dhabi, UAE	*https://healthcare.cardiologymeeting.com*
9th International Conference on Food Safety and Health	30-131 August 2018 Dubai, UAE	*https://foodsafety.nutritionalconference.com*

List your conference:
If you have upcoming conference/exhibition details which you would like to list in the agenda, please email the details to the editor: *editor@MiddleEastHealthMag.com*

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