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May - June 2026

A Sense of Touch

NYU Abu Dhabi researchers develop novel tactile sensors for minimally invasive surgical instruments

Surgical Recovery

The humble step counter is the best predictor of success

Women's Health

Major study reveals the asynchronous molecular toll of menopause across reproductive organs

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PROJECTS 2026

Prognosis

When the small fixes do the heavy lifting

In this issue we look at seven recently published research reports covering neuroimaging, surgical recovery, primary care informatics, preventive medicine, and women's health – a breadth that reflects the current pace of progress across the medical sciences.

On the technology front, researchers at the University of Illinois have developed a multiplexed MRI framework, MRx, capable of mapping 21 brain biomarkers simultaneously in a single 14-minute scan on standard 3T hardware, with no contrast agents required. Early demonstrations in brain tumour characterisation and multiple sclerosis lesion staging are significant, and the system's compatibility with existing clinical scanners makes translation more plausible than most prototype imaging technologies.

At the other end of the complexity spectrum, a Canadian primary care team achieved a 94-fold increase in family history documentation using a pre-visit questionnaire integrated directly into the EHR. A University of Michigan group demonstrated that embedding a single referral order into Epic was sufficient to funnel 577 prediabetes patients towards community prevention programmes. Ohio State researchers, drawing on nearly 2,000 surgical patients from the NIH's All of Us dataset, found postoperative step count to be a more reliable predictor of complications and readmission than either heart rate variability or patient-reported wellness scores.

In women's health, a drug-target Mendelian randomisation study from King's College London and Oxford offers some reassurance that menopausal hormone therapy does not appear to raise Alzheimer's risk through oestrogen receptor pathways, but does identify a depression signal that warrants further investigation. Separately, researchers at the Barcelona Supercomputing Center have produced the first comprehensive multi-organ atlas of female reproductive ageing, finding that the uterus undergoes a distinct and abrupt molecular transition around age 53, independent of the more gradual decline seen in other reproductive tissues.

And more locally, a team at NYU Abu Dhabi has developed soft microfluidic force sensors that provide real-time tactile feedback to laparoscopic instruments – addressing a fundamental limitation of minimally invasive surgery that has persisted for decades.

Remember to keep your eye on our website – www.MiddleEastHealth.com – for regular healthcare news reports from the region and the world, expert views from leading healthcare practitioners in the region, as well as reports on significant life-science developments.

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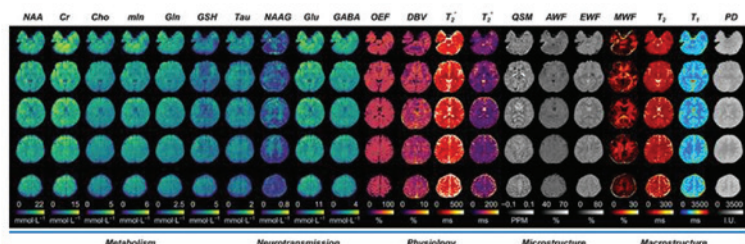
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Update from around the region

Atelerix partners with JH Health to extend non-cryogenic cell preservation into the Middle East

Newcastle-based biotech Atelerix has announced a strategic partnership with Saudi Arabian MedTech firm JH Health Ltd, granting the latter exclusive rights to distribute and deploy Atelerix's hydrogel-based cell and tissue preservation platform across the Middle East.

The agreement, announced on 15 April 2026, represents a significant step in Atelerix's international expansion strategy, which has previously targeted China, Europe, and Africa. The partnership encompasses regional manufacturing investment, regulatory submissions, and new research collaborations.

Addressing the limitations of cold chain logistics

At the core of the agreement is Atelerix's proprietary hydrogel encapsulation technology, which enables the stable storage and transport of sensitive biological samples without recourse to cryopreservation or cold chain infrastructure. The technology works by physically encapsulating cells and tissues within a soft hydrogel matrix that stabilises membrane integrity, permitting storage at ambient temperature for periods of up to two weeks. This approach mitigates the well-documented risks of cryopreservation – including loss of sample viability – while substantially reducing logistical costs.

The clinical and research applications are broad. The partnership will focus initially on enabling the stable transport of patient-derived biological samples for clinical diagnostics and research purposes, with plans to support the development of a new biobank within the region.

Regulatory pathway and manufacturing scale-up

Atelerix will lead the regulatory approval process for its technology with the Saudi Food and Drug Authority, with JH Health providing local operational support. JH



Alastair Carrington, CEO of Atelerix



Mohammed Al Jumah, CEO of JH Health

Health will also furnish financial backing and strategic guidance to facilitate high-volume local manufacturing and to identify further research partnerships aimed at advancing Atelerix's hypothermic preservation technology.

Alastair Carrington, CEO of Atelerix, described the rationale for the partnership: "By partnering with JH Health, we gain access to the deep market expertise and local support needed to establish our operations in the Middle East. Their strategic investment will enable us to build out our local manufacturing capabilities, ensuring we are equipped to deliver the future of biological transport logistics and meet the needs of the rapidly growing life science market in the region."

Access to sovereign investment

Beyond distribution rights and manufacturing support, the partnership is expected to open access to investment opportunities from Saudi sovereign funds, an aspect that could prove significant in underpinning

Atelerix's longer-term capital requirements as it scales internationally.

Mohammed Al Jumah, CEO of JH Health, welcomed the collaboration: "By combining Atelerix's pioneering solutions with our regional expertise, this collaboration enhances access to advanced tools that support biomedical research, accelerate scientific discovery, and strengthen clinical development across the region, ultimately improving healthcare outcomes."

Broader strategic context

The Middle East partnership follows an established model for Atelerix, which has pursued growth through regional partnerships providing local technical expertise and supply chain infrastructure in key markets. The life science and healthcare sector in the Gulf region has seen substantial investment in recent years, driven in part by national diversification strategies, making it a strategically attractive market for enabling technologies in biological sample logistics. MEH



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WHX Tech to co-locate with World Health Expo in Dubai, January 2027

Informa has announced that the next edition of WHX Tech will be held from 27–29 January 2027 at the Dubai World Trade Centre (DWTC), running concurrently with World Health Expo (WHX) as part of a newly formed World Healthcare Week.

The decision to align the two events within the same week marks a strategic consolidation of two distinct but complementary forums – one focused on clinical and systems-level healthcare, the other on the digital technologies increasingly integral to its delivery.

World Healthcare Week: a unified platform

The combined programme will span trade, innovation and cross-sector dialogue across the healthcare ecosystem. The co-location is intended to reduce fragmentation for attendees and exhibitors who would otherwise navigate separate events on separate dates, and to facilitate more substantive engagement between healthcare providers, policymakers, procurement specialists and digital health developers.

WHX Tech will retain its dedicated focus on digital health – convening specialists across artificial intelligence, data infrastructure, interoperability and patient-centred

innovation – while operating within the broader clinical and commercial context that WHX provides. The organisers have stated that each event will preserve its distinct identity and audience focus, even as the shared calendar creates structural opportunity for cross-pollination.

Commercial and clinical rationale

The co-location model reflects a broader trend in large-scale professional events towards integrated formats that offer greater return on attendance. For exhibitors, proximity to a wider and more senior audience reduces the cost and logistical burden of participating in multiple standalone events. For clinicians, health system leaders and policymakers, a single week encompassing both operational healthcare priorities and emerging technology solutions offers a more efficient engagement model.

Lorena Díaz Palle, Event Director at Informa, said: “Bringing WHX Tech into the same week as World Health Expo is about



creating the best possible experience for our global community. We’re making it easier for attendees and exhibitors to maximise their time, access a broader network, and engage with both healthcare and technology in one place. As part of World Healthcare Week, this approach delivers a more connected, efficient and commercially valuable experience for everyone involved.” **MEH**

KFSH performs world-first single-port robotic liver resection from living donors

King Faisal Specialist Hospital & Research Centre (KFSH) in Saudi Arabia has completed the world’s first series of single-port robotic liver resections from living donors, a development that significantly reduces surgical burden whilst maintaining established safety benchmarks in organ transplantation.

Minimising incisions, maximising safety

The procedures were performed through a single incision of no more than 3.5 cm – a marked departure from the multiple incisions required in conventional robotic surgery. Across six donor cases, outcomes included minimal blood loss, no reported complications, low post-operative pain scores, and discharge within two to three days.

Because living donors are otherwise healthy individuals undergoing an elective procedure for another person’s benefit, donor safety is a primary clinical and ethical consideration. The single-port approach directly addresses this by reducing surgical trauma.

Particular benefit for paediatric recipients

The technique is especially relevant where the recipient is a child. Paediatric liver transplantation commonly involves the left lateral segment, which accounts for approximately 20% of total liver volume. This makes it anatomically well suited to single-port access, whilst simultaneously limiting the operative impact on the donor.

Built on extensive robotic experience

Prof. Dieter Broering, Executive Director of the Organ Transplant Centre of Excellence at KFSH, attributed the achievement to a

structured programme of robotic liver surgery built on substantial institutional experience. KFSH has now performed more than 1,600 robotic living donor liver resections – the highest volume recorded globally – underpinned by a model integrating training, simulation, and phased clinical implementation.

Global standing

KFSH ranks first in the Middle East and North Africa and 12th globally among the world’s top 250 Academic Medical Centres in 2026, and features in Newsweek’s World’s Best Hospitals 2026 listings. **MEH**



Ikan Bakar Bujang Gadis by Daun Muda

THE MORE THE UNEXPECTED:

Jakarta, The Halal Capital of Flavour

The first thing you notice about Jakarta isn't the skyline, it's the food. Coconut rice steams in banana leaves, satay sizzles over charcoal, and long tables spill into the night as families gather past midnight. Wander a little further and chandeliers glow over plates where tradition is shaped into art.

For Muslim travelers, there is comfort in knowing that almost every taste is halal, whether found on sidewalks or behind velvet curtains.

Coffee that tells a story

And like any good story, it often begins with coffee. Jakarta's coffee culture is as layered as its food. In Glodok's Chinatown, Kopi Es Tak Kie has poured its no-frills brew since 1927. Some come for the sweet iced coffee mixed with condensed milk, but the regulars swear by its black coffee, strong and slightly bitter, the kind that lingers long after the glass is empty. The tiled floor and wooden chairs feel unchanged, and every sip carries the weight of old Jakarta.

Across town in Cipete, South Jakarta, Tuku Coffee sparked the city's modern caffeine wave. Its iced latte with palm sugar became a neighborhood hit that grew into

a national trend, a drink that balances the roast's depth with a subtle sweetness. From heritage brews to contemporary blends, coffee here is never just about caffeine, it is a window into the city's changing tastes.

Street legends that never fade

Every city has dishes that become part of its daily rhythm, and in Jakarta the streets tell that story best. On the crowded lanes of Pasar Baru in Central Jakarta, Bakmi Gang Kelinci has served its springy chicken noodles since 1957. The soy-rich aroma fills a dining room that feels frozen in time, and for many Jakartans it is the taste of homecoming.

A short ride away in Tanah Abang, the air is thick with the coconut fragrance of Nasi Uduk Kebon Kacang. Plates of rice cooked in santan arrive with crispy fried chicken and fiery sambal, best enjoyed shoulder to shoulder with locals in the late-night rush. Both spots prove that some of the city's greatest meals are still found where the streets hum the loudest.

Restaurants and refined tables

Jakarta's dining scene does not just preserve tradition, it reinvents it. Across the city, restaurants are shaping heritage dishes into experiences that feel fresh without losing their roots.

In Senopati, South Jakarta, Daun Muda Soulfood retells Indonesia's culinary stories with spice and fire. Dishes like Manado's rica-rica or Palembang's rusip come plated with a contemporary touch, but the soul remains deeply rooted in the archipelago. For something more elevated, 1945 Restaurant at the Fairmont Senayan reimagines rendang and satay as fine dining artistry. As Jakarta's first halal-certified luxury restaurant, it proves that heritage and refinement can sit comfortably at the same table.

Jakarta's halal dining culture is more than convenience. It is culture made accessible. From the chatter of Chinatown cafés to the hush of silver-spoon dinners, every sip and every dish offers not only sustenance but also a story, waiting to be tasted.

The more dishes you share, the more memories you create. Every flavour is an invitation to the city's soul.

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jakarta



Kopi Es TAK KIE



Tuku Coffee



Bakmi Gang Kelinci

The more meals you gather around, the more connections you make. Every plate brings you closer to the spirit of Jakarta.



Sate Maranggi by 1945 Restaurant



Nasi Uduk Kebon Kacang



NMC Healthcare expands Abu Dhabi footprint with new Al Riyadh City clinic

NMC Healthcare Group has announced the opening of a new outpatient clinic in Al Riyadh City, Abu Dhabi, extending the group's network of primary and specialist care facilities across the emirate.

A broad clinical offering under one roof

The new facility spans approximately 1,600 square metres across two floors and has been designed with patient flow and accessibility in mind. The clinic offers consultations across seven clinical disciplines: family medicine, dermatology, internal medicine, obstetrics and gynaecology, paediatrics, psychiatry, and radiology. An in-house pharmacy has been integrated into the facility, allowing patients to dispense prescriptions on-site without requiring a separate visit to an external provider.

The clinic has received Thiqa Insurance approval, meaning UAE nationals enrolled in the scheme can access the full range of services under their existing coverage – a consideration of practical significance for a predominantly residential community such as Al Riyadh City.

Serving a growing residential community

Al Riyadh City is a family-oriented resi-

dential district in Abu Dhabi, and the clinic has been positioned explicitly to serve that demographic. David Hadley, Chief Executive Officer of NMC Healthcare, commented: “Our new clinic offers families a comprehensive range of healthcare services, ensuring fast, convenient access to exceptional medical care in their own neighbourhood.”

The inclusion of psychiatric services alongside more conventional primary and secondary care disciplines is notable, reflecting a broader shift within the UAE's private healthcare sector towards integrating mental health provision into community-based clinical settings rather than confining it to specialist hospital environments.

Strategic context and national alignment

The opening forms part of NMC Healthcare's stated strategy to consolidate its presence in key residential and growth areas across the UAE. The group describes itself

as a leading integrated private healthcare provider in the country, and this latest facility continues a pattern of targeted geographic expansion into communities that may previously have had limited access to co-located specialist services.

NMC has framed the clinic's opening within the context of the UAE's national healthcare vision, which emphasises the development of resilient, accessible healthcare infrastructure and encourages innovation within the sector. The provision of multi-specialty outpatient care at community level – rather than directing all non-emergency cases to larger hospital settings – is consistent with the model of care increasingly favoured by health authorities seeking to reduce unnecessary tertiary referrals.

The facility is now open to patients. As Hadley noted, the clinic is “part of our broader mission to deliver personalised, high-quality healthcare to communities across the UAE.” **MEH**



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¹WHO. Medication Without Harm. 2022.[cited 25th April 2024]. Available from: Medication Without Harm (who.int)

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DHCC's C37 and Sir Ganga Ram Hospital sign vascular care partnership for the UAE

C37, the UAE's first private medical workspace operated by Dubai Healthcare City (DHCC), has formalised a strategic partnership with the Institute of Vascular & Endovascular Sciences (IVES) at Sir Ganga Ram Hospital in New Delhi, India. The agreement, facilitated by healthcare advisory firm Surge Growth Partners, is aimed at broadening access to specialist vascular and endovascular surgical care within the UAE.

Under the terms of the collaboration, a select cohort of consultant vascular and endovascular surgeons from IVES will practise at C37, delivering clinical services across a range of complex conditions. Areas of expertise include arterial and venous disease, advanced endovascular procedures, diabetic foot and limb salvage, carotid artery disease, and dialysis access management.

Clinical scope and knowledge exchange

The partnership is structured to support bilateral knowledge exchange alongside direct patient care, allowing international clinical expertise to be deployed within a regulated UAE clinical environment. Dr Mohamed Elbaz, Medical Director and

Head of Operations at C37, noted that the workspace is “designed to support both local and visiting doctors,” positioning C37 as a conduit for attracting specialist international talent to meet growing demand for advanced healthcare services in the region.

An institutional perspective

Sir Ganga Ram Hospital, one of India's longest-established quaternary care institutions, views the agreement as a potential foundation for broader engagement. Dr Ajay Swaroop, Chairman of the Board of Management, expressed hope that the collaboration would “expand into a bigger relationship to provide tertiary healthcare services in UAE from various other departments” of the hospital.

Structuring the collaboration

Surge Growth Partners played a central coordinating role in bringing the two institutions together. Vivek Shukla, the firm's Founder and Managing Partner, described the partnership as structured to function “clinically, operationally, and within the UAE healthcare framework,” emphasising the practical rather than aspirational nature of the arrangement.

DHCC, established in 2002, is the region's largest healthcare ecosystem and operates as a free zone under the governance of Dubai Healthcare City Authority, a Dubai Government entity. It supports business set-up across medical care, wellness, and academic and research sectors. **MEH**



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Update from around the globe



WHO

UN staff with hospital director beside the ruins of the Al-Shifa Hospital in Gaza, April 2024

WHO, ICRC and MSF issue joint call to protect healthcare in armed conflict

Ten years on from the unanimous adoption of UN Security Council Resolution 2286, the heads of the World Health Organization (WHO), the International Committee of the Red Cross (ICRC) and Médecins Sans Frontières (MSF) have issued a stark joint statement: the resolution has failed in its core objectives, and the protection of healthcare in conflict zones has deteriorated rather than improved.

A decade of broken commitments

Resolution 2286, adopted in May 2016, obliged all parties to armed conflict to respect and protect medical personnel, facilities, and transport under international humanitarian law (IHL). The tenth anniversary of its adoption has prompted not a commemoration but an urgent call to account. “Today, we mark not an achievement – we mark a failure,” the three organisations stated in their joint declaration, published 4 May 2026 in Geneva.

The statement describes an unrelenting pattern of harm: hospitals reduced to rubble, ambulances obstructed or delayed, and medical staff and patients killed or injured in direct and indirect attacks. The clinical consequences are severe – patients dying of otherwise treatable conditions, women delivering without

adequate obstetric care, and entire populations losing access to essential services.

IHL obligations and the failure of political will

The three organisations are explicit that the legal framework itself is not the problem. IHL already requires states not only to abide by the rules protecting healthcare, but also to use all available influence to ensure other states and parties to conflict do the same. The failure, they argue, is one of implementation and political will.

The statement also references World Health Assembly Resolution 65.20, adopted in 2012, which established systematic WHO documentation of attacks on healthcare. The organisations call for stronger and more transparent reporting mechanisms to build an evidence base capable of informing prevention, guiding responses, and supporting accountability processes.

Seven concrete measures demanded of states

The joint call sets out seven specific actions demanded of states. These include translating existing commitments into concrete implementation of Resolution 2286; integrating healthcare protection

into military doctrine, rules of engagement, and operational guidance; reviewing and strengthening domestic legislation; and allocating adequate financial and technical resources to protective measures.

States are also urged to use their influence over parties to conflict – including those they support in any form – to ensure compliance with IHL. Additionally, the statement calls for swift, transparent, and impartial investigations into attacks on healthcare facilities and personnel, and for regular public reporting on the implementation of Resolution 2286, including documentation of progress, challenges, and lessons learned.

An appeal to world leaders

The three organisations, drawing on their combined presence across the world’s most active conflict settings, describe the targeting or incidental destruction of healthcare infrastructure as not merely a humanitarian crisis but, in their words, “a crisis of humanity.”

The joint statement concludes with a direct appeal to heads of state: “We urge world leaders to act and show the needed political leadership to end this violence. Health care must never be a casualty of war.” 

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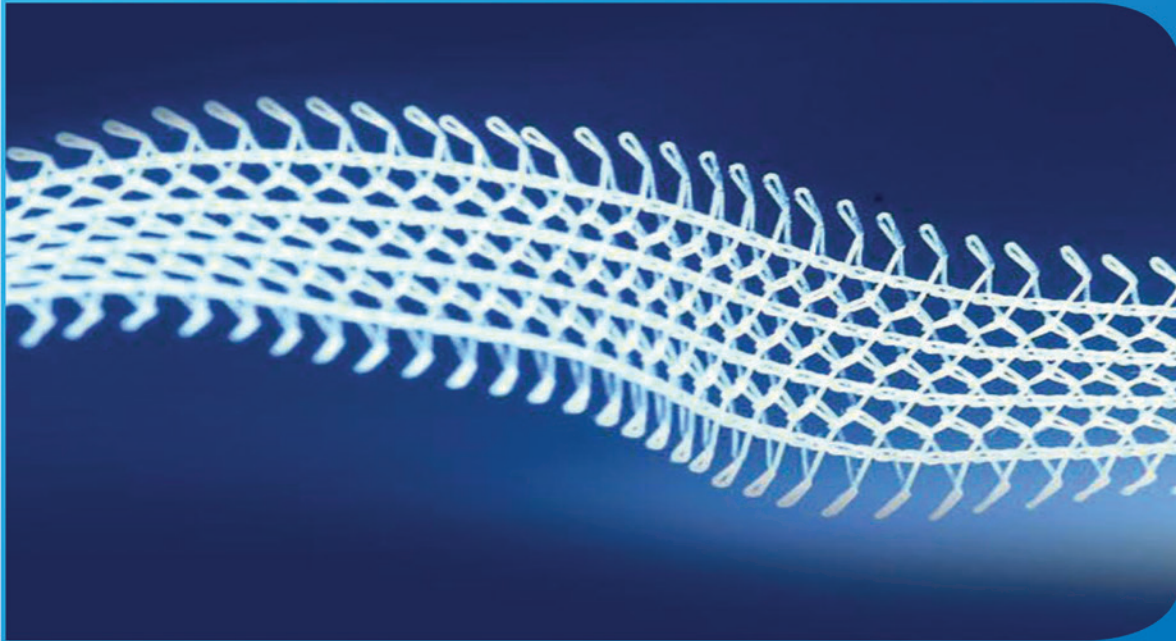
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Global hepatitis efforts show progress but 2030 targets remain at risk

Global efforts to eliminate viral hepatitis are producing measurable results, yet the disease continues to exact a heavy toll, with 1.34 million deaths recorded in 2024 alone. The findings come from the 2026 *Global Hepatitis Report* < <https://shorturl.at/b8Cq7> >, released by the World Health Organization (WHO) at the World Hepatitis Summit in Bangkok.

Gains recorded, but transmission persists

The report documents meaningful progress since 2015. New hepatitis B infections have declined by 32%, and hepatitis C-related deaths have fallen by 12% globally. Hepatitis B prevalence among children under five has dropped to 0.6%, with 85 countries already meeting or exceeding the 2030 target of below 0.1%. These gains reflect a decade of coordinated national and international action following the adoption of WHO

elimination targets by Member States at the World Health Assembly in 2016.

Nevertheless, transmission continues at scale. More than 4,900 new infections are recorded every day – approximately 1.8 million per year – and an estimated 287 million people were living with chronic hepatitis B or C infection in 2024.

Treatment gaps undermine progress

Coverage of prevention and treatment remains deeply uneven. Fewer than 5% of the 240 million people with chronic hepatitis B in 2024 were receiving treatment, and only 20% of those with hepatitis C have been treated since 2015, despite the availability of a 12-week regimen with a cure rate of approximately 95%. People who inject drugs accounted for 44% of new hepatitis C infections, underscoring the importance of harm reduction services.

The WHO African Region bore a disproportionate burden, accounting for 68% of new hepatitis B infections in 2024, yet only 17% of newborns in the region received the hepatitis B birth-dose vaccine.

Accelerated action required

“Around the world, countries are showing that eliminating hepatitis is not a pipe-dream, it’s possible with sustained political commitment, backed by reliable domestic financing,” said WHO Director-General Dr Tedros Adhanom Ghebreyesus, adding that progress remains “too slow and uneven.”

The report calls for expanded birth-dose vaccination, scaled-up antiviral treatment – particularly in the African and Western Pacific regions – and stronger integration of hepatitis services into primary care. Effective tools exist; the challenge is now one of equitable implementation. WHO

Largest-ever childhood vaccination catch-up reaches 18 million children across 36 countries

A landmark multi-year immunisation initiative has delivered more than 100 million vaccine doses to an estimated 18.3 million children in 36 countries, addressing a significant backslide in childhood vaccination coverage driven by the COVID-19 pandemic.

The Big Catch-Up (BCU), a coordinated effort led by Gavi, the Vaccine Alliance, the World Health Organization (WHO), and UNICEF, concluded in March 2026 after operating across Africa and Asia since its launch during World Immunization Week in 2023. The initiative is forecast to meet its target of reaching at least 21 million un- and under-immunised children, though final data remain under compilation.

Zero-dose children at the centre

Of particular note, an estimated 12.3 million of the children reached were “zero-dose” – meaning they had not previously received any vaccination at all. A further 15 million had never received a measles vaccine, and 23 million doses of inactivated polio vaccine (IPV) were administered to un- or under-vaccinated children, in support of global polio eradication efforts.

The 36 participating countries currently account for 60% of all zero-dose children worldwide. Crucially, the BCU was the first initiative to systematically use routine immunisation infrastructure to reach children aged one to five who had missed vaccinations in infancy – a group chronically overlooked by previous catch-up campaigns.

Twelve countries – including Ethiopia, Nigeria, Pakistan, and Somalia – reported reaching more than 60% of all zero-dose children under five who had previously missed their first dose of diphtheria-tetanus-pertussis vaccine (DTP1). Ethiopia alone reached more than 2.5 million previously zero-dose children with DTP1, alongside nearly 5 million doses of IPV and more than 4 million doses of measles vaccine.

Systemic gains beyond dose delivery

Beyond vaccination counts, the BCU catalysed lasting improvements to health infrastructure in participating countries. These included updates to age-eligibility policies, training of health workers to identify and vaccinate missed children as part of routine



care, and enhanced community engagement strategies. Screening and monitoring systems were established to better track coverage rates in older children.

“As the largest ever international effort to reach missed children with life-saving vaccines, the Big Catch-Up shows what is possible when governments, partners and communities work together to protect the most vulnerable in society,” said Dr Sania Nishtar, CEO of Gavi, the Vaccine Alliance.

Ongoing challenges in routine immunisation

Despite the progress, the agencies are unambiguous that catch-up campaigns are a contingency measure rather than a substitute for robust routine immunisation. In 2024, an estimated 14.3 million infants globally failed to receive a single vaccine through routine programmes – a figure ►



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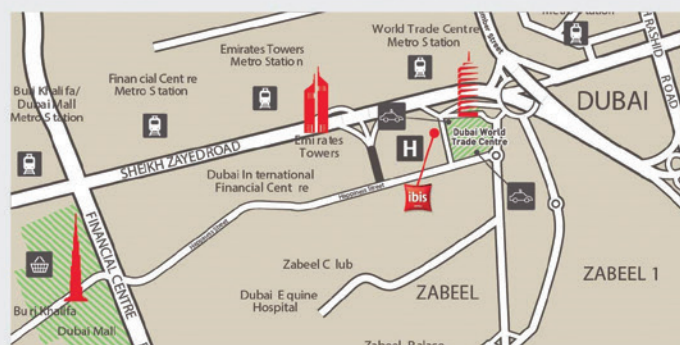


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that underscores the scale of the underlying challenge.

Measles serves as a salient indicator of the consequences of persistent immunisation gaps. Approximately 11 million cases were recorded globally in 2024, with the number of countries experiencing large outbreaks having nearly tripled since 2021. This resurgence is attributed

to chronic failures in routine measles vaccination, compounded by declining vaccine confidence in some previously high-coverage settings.

“The gains made through the Big Catch-Up must be sustained through investment in strong, reliable immunisation systems, especially at a time where measles is resurging,” said UNICEF Executive

Director Catherine Russell.

Sustaining progress will require increased domestic investment in immunisation programmes and continued commitment from international donors, particularly as rising birth cohorts, conflict, displacement, and funding pressures continue to strain health systems across the most vulnerable regions. **MEH**

Practising today for tomorrow's emergencies: WHO simulation tests global pandemic response



WHO

WHO AFRO
Regional Director's
visit to the mpox
treatment centre in
Bujumbura, Burundi,
in March 2026.

The World Health Organization (WHO) has concluded Exercise Polaris II, a two-day high-level pandemic simulation that brought together 26 countries and territories, more than 600 health emergency specialists, and over 25 partner organisations. Held on 22 and 23 April 2026, the exercise was built around a fictional novel bacterium spreading globally, and was designed to stress-test national and international preparedness structures under conditions as close to real-world response as possible.

The exercise follows Polaris I, conducted in April 2025, which used a fictional viral pathogen as its scenario. Both exercises required participating countries to activate their emergency coordination structures, manage information flows across borders, align policy responses, and surge their health workforces – all simultaneously and under time pressure.

Frameworks put to the test

Polaris II served as a practical trial for two key WHO frameworks: the Global Health Emergency Corps (GHEC) framework, published in June 2025, and the National health emergency alert and response framework, published in October 2025. The GHEC framework provides guidance on strengthening health workforces for emergency response based on the principles of sovereignty, equity, and solidarity, and is intended to support information exchange and facilitate the deployment of regional and global personnel when national capacity is overwhelmed. The National framework outlines the coordination systems, key functions, and actions required at local, sub-national, and

national levels during a health emergency.

The simulation also explored the integration of AI-enabled tools to support workforce organisation and planning – an area of growing interest as health systems look to improve the speed and accuracy of surge capacity decisions.

“By simulating the spread of a dangerous pathogen under real-life conditions, Exercise Polaris II helped us turn existing plans into action. It is not enough to have plans on paper – what matters is how they perform in practice,” said Edenilo Baltazar Barreira Filho, Director of the Public Health Emergencies Department, Ministry of Health, Brazil.

A growing coalition of responders

The exercise drew participation from all six WHO regions, with countries including Bangladesh, Brazil, Colombia, Egypt, Ghana, India, Indonesia, Kenya, the Philippines, and Rwanda, among others. It also provided an opportunity to coordinate technical expertise and surge support across more than 25 national, regional, and global health agencies, including Africa CDC, the International Federation of Red Cross and Red Crescent Societies, Médecins Sans Frontières, the Robert Koch Institute, UK-Med, UNICEF, the Global Outbreak Alert and Response Network, and the Emergency Medical Teams initiative.

A notable feature of this second edition was engagement through newly established networks, including the recently launched Health Emergency Leaders Network for Africa and the Eastern Mediterranean.

Continuous investment, not periodic effort

WHO Director-General Dr Tedros Adhanom

Ghebreyesus emphasised the broader purpose the exercise serves. “Exercise Polaris II showed what is possible when we act together. It demonstrated that global cooperation is not optional – it is essential,” he said. “This is the purpose of the Global Health Emergency Corps: coordination across the emergency workforce, building trust, strengthening connections, and working as one across borders.”

Dr Chikwe Ihekweazu, Executive Director of WHO's Health Emergencies Programme, echoed this framing: “Exercise Polaris II showed what it looks like when countries are prepared and ready to act together. This reflects the spirit of the Global Health Emergency Corps: a well-organised, trained, coordinated and connected emergency workforce ready to respond wherever and whenever it is needed.”

Exercise Polaris II forms part of HorizonX, WHO's multi-year simulation exercise programme, which aims to make emergency preparedness a continuous process rather than an intermittent undertaking. The programme puts global health security frameworks into practice under realistic conditions, with the goal of ensuring that coordination mechanisms function reliably when a genuine crisis demands them. **MEH**

For more information, visit:

- Polaris I (April 2025): <https://www.who.int/news/item/04-04-2025-who-brings-countries-together-to-test-collective-pandemic-response>
- Global Health Emergency Corps framework: <https://www.who.int/publications/item/9789240109445>
- National health emergency alert and response framework: <https://www.who.int/publications/item/9789240113893>

WHO prequalifies first antimalarial treatment formulated for newborns and young infants

The World Health Organization (WHO) has prequalified the first antimalarial treatment developed specifically for newborns and young infants, marking a clinically significant step in addressing one of the most neglected patient groups in malaria care. The announcement was made on 24 April 2026, ahead of World Malaria Day.

The newly prequalified medicine, artemether-lumefantrine, has been formulated for infants weighing between two and five kilograms. Prior to this approval, clinicians managing malaria in neonates and very young infants had no choice but to administer formulations designed for older children – an approach associated with increased risk of dosing errors, adverse effects, and toxicity. WHO prequalification confirms that the medicine meets international standards of quality, safety, and efficacy, and opens the pathway to public sector procurement.

A persistent treatment gap

The scale of the problem is considerable. Approximately 30 million babies are born each year in malaria-endemic regions of Africa, yet until now no purpose-built antimalarial treatment existed for the youngest among them.

WHO Director-General Dr Tedros Adhanom Ghebreyesus described the prequalification as part of a broader shift in malaria control: “New vaccines, diagnostic tests, next-generation mosquito nets and effective medicines, including those adapted for the youngest, are helping to turn the tide.”

New rapid diagnostic tests address emerging resistance

Alongside the treatment prequalification, WHO announced on 14 April 2026 the prequalification of three new rapid diagnostic tests (RDTs) designed to counter a growing diagnostic challenge. Standard RDTs for *Plasmodium falciparum* detect the parasite protein HRP2. However, surveys across 46 countries have identified strains that have lost the *pf-hrp2* gene responsible for producing this protein, rendering them undetectable by HRP2-based tests. In parts of the Horn of Africa, up to 80% of cases have been missed as a result, leading to delayed treatment, disease progression, and death.

The three newly prequalified tests instead target pf-LDH, a different parasite protein that cannot be readily shed, providing a reliable diagnostic alternative in

affected regions. WHO now recommends that countries transition to pf-LDH-based RDTs when more than 5% of cases are being missed owing to *pf-hrp2* deletions.

Global burden and stalling progress

The announcements coincide with the launch of WHO's 2026 World Malaria Day campaign. The backdrop is sobering: the *World Malaria Report 2025* < <https://shorturl.at/bMf5C> > estimates 282 million cases and 610,000 deaths globally in 2024, an increase on the preceding year. While 47 countries have now been certified malaria-free and 37 reported fewer than 1,000 cases in 2024, overall progress has stalled. Drug resistance, insecticide resistance, diagnostic failure, and reductions in international development funding are cited as principal threats to hard-won gains.

Nevertheless, since 2000 an estimated 2.3 billion infections have been prevented and 14 million lives saved. Twenty-five countries are currently rolling out malaria vaccines, and next-generation insecticide-treated nets now account for 84% of all new nets distributed – evidence that co-ordinated investment and innovation can produce measurable results. MEH

WHO designates global network of biomanufacturing training centres

The World Health Organization (WHO) has formally designated a network of regional training centres for biomanufacturing spanning all six of its global regions, in a significant step towards building the skilled workforce required to produce vaccines, biotherapeutics, and other biological products at a regional level.

The designations, announced on 29 April 2026, follow a rigorous two-stage selection process and form part of the WHO Biomanufacturing Workforce Training Initiative, established in 2023 to address persistent skills gaps across the biomanufacturing value chain and enable countries to translate technological capacity into sustainable local production.

Addressing workforce gaps across the value chain

The initiative takes a comprehensive end-to-end approach to workforce capacity-building, encompassing upstream and downstream bioprocessing, quality manage-

ment systems, good manufacturing practices, regulatory science, technology transfer readiness, and clinical development.

Dr Yukiko Nakatani, WHO Assistant Director-General for Health Systems, Access and Data, described the strategic intent: “Building a skilled biomanufacturing workforce is fundamental to advancing equitable access to health products and strengthening global health security. By designating regional training centres across all WHO regions, we are investing in people and systems that enable countries not only to produce quality-assured essential health technologies, but to sustain and scale them.”

The designated institutions

The centres will deliver hands-on, context-specific training aligned with regional priorities, regulatory environments, and languages. Selected institutions include Institut Pasteur de Dakar and the Council for Scientific and Industrial Research (South

Africa) for the African Region; Fiocruz in Brazil for the Americas; the Translational Health Science and Technology Institute in India for South-East Asia; the National Institute for Bioprocessing Research and Training in Ireland for Europe; the Egyptian Drug Authority's Center for Continuing Professional Development for the Eastern Mediterranean; and Peking University for the Western Pacific.

Health security and preparedness

The network directly supports World Health Assembly resolution WHA74.6 on strengthening local production of medicines and health technologies. By establishing geographically distributed training infrastructure, WHO aims to reduce longstanding inequities in access to health products and bolster countries' capacity to respond to future public health emergencies – ensuring that expertise in producing critical biological products is not concentrated solely in high-income settings. MEH



the laboratory

Medical research news from around the world

AI reads cancer tissue like a crystal ball – predicting tumour futures from a single slide

A new agentic artificial intelligence system developed at the University of Cologne can autonomously generate and test biological hypotheses from routine cancer pathology slides – without any additional model training. Published in *Nature Medicine*, the SPARK system was validated across more than 5,400 patients and five tumour types, and may fundamentally shift pathology from a descriptive discipline into a predictive science.

Cancer pathologists have long worked with the same fundamental tools: stained tissue sections examined under the microscope, interpreted through years of training and experience. Artificial intelligence has steadily encroached on this territory, automating tissue segmentation and cell classification with impressive accuracy. But a team at University Hospital Cologne believes those existing approaches are still thinking too small.

Their new system – SPARK, the System of Pathology Agents for Research and Knowledge – does not merely automate what pathologists already do. It reasons, hypothesises, writes its own analytical code, and extracts biological meaning from tissue images that no human eye could previously discern.

“SPARK helps to refine diagnoses, stratify patients more reliably, and make more precise treatment decisions,” said Dr Yuri Tolkach, Senior Physician at the Institute of Pathology at University Hospital Cologne. “Particularly in the field of personalised oncology, there is an opportunity to tailor treatments more closely to the individual biological characteristics of a tumour, thereby improving treatment outcomes.”

The study was published in *Nature Medicine* on 29 April 2026.

How SPARK works

SPARK functions as a coordinated network of specialised AI agents – a digital pathology “brain.” It takes routine haematoxylin and eosin (H&E)-stained whole-slide images as input, performs quality control and tissue segmentation, and identifies seven major cell types across tumour and stromal compartments. From there, it autonomously generates biological hypoth-

eses, refines them, translates them into executable Python code, and tests them across large patient cohorts – all without retraining any underlying models.

Language serves as the universal interface throughout. Biological ideas are articulated in natural language, passed between agents, reviewed for plausibility, and converted into computable image parameters. Across two primary use cases, the system generated 618 unique hypotheses and successfully implemented 99.2% of them as executable code. After quality filtering and removal of redundant parameters, 1,115 non-correlated analytical parameters remained for downstream analysis.

Predicting what scans cannot show

Results across 18 independent patient cohorts and five cancer types – lung adenocarcinoma, lung squamous cell carcinoma, colorectal cancer, breast cancer, and oropharyngeal squamous cell carcinoma – were compelling. SPARK parameters correlated significantly with histological grade, tumour stage, oestrogen receptor status, microsatellite instability (MSI), PD-L1 expression, and HPV status.

Predictive modelling using lightweight XGBoost classifiers achieved clinically meaningful accuracy. MSI status in colorectal cancer reached an area under the receiver operating curve (AUROC) of up to 0.933 in independent test cohorts – comparable to or exceeding current commercial tools. PD-L1 status in lung adenocarcinoma was predicted across multiple clinical cut-offs, capturing what the authors describe as a broader immune-evasion signature with direct implications for immunotherapy selection.

SPARK also demonstrated something rather striking: the ability to infer tumour evolutionary trajectories from static tissue images. By treating high-risk morphological features as spatial field effects within tumours, the system reconstructed temporal sequences of cellular events linked to increasing aggressiveness – essentially reading a disease timeline from a single slide. More than 70% of identified aggressiveness features appeared to be late evolutionary events, consistent with prevailing models of tumour progression.

Open to clinicians, open to science

A dedicated interactive module allows clinicians and researchers to submit hypotheses in plain free-text, with no programming knowledge required. In a human evaluation exercise, five pathologists and one medical student contributed their own ideas, with each producing at least some parameters of independent prognostic value.

The authors are candid about limitations. All cohorts were retrospective surgical resections, and prospective validation in biopsy material and treatment-response cohorts remains essential. Total development cost was approximately 4,000, using OpenAI o1 for idea generation and Anthropic Claude 3.5 Sonnet for parameter coding. All code and results have been made openly available.

Professor Dr Reinhard Büttner, Director of the Institute of General Pathology at Cologne, summarised the ambition: “With SPARK, we aim to transform pathology from a primarily descriptive discipline into a data-driven, predictive science – and thereby make a significant contribution to precision medicine in oncology.” 

Journal reference:

Trost, F., Zhang, B., Aring, I., et al. (2026). An agentic framework for autonomous scientific discovery in cancer pathology. *Nature Medicine*. <https://doi.org/10.1038/s41591-026-04357-y>



Scientists crack the molecular secret of how blood clots

In a landmark study published in *Science Advances*, researchers at the University of Leeds have for the first time resolved the high-resolution structure of a key platelet protein in its inactive state, revealing the precise molecular process that keeps blood clotting under tight control – and why inherited mutations can fatally throw that balance off.

When you nick your finger, a cascade of molecular events springs into action within seconds. Platelets rush to the wound, aggregate, and compact a fibrous network into a plug that seals the breach. Central to this process is a motor protein called nonmuscle myosin 2A (NM2A) – but until now, scientists had only a partial picture of how it stays dormant until it is needed. A new study from the University of Leeds, published in *Science Advances* on 17 April 2026, changes that fundamentally.

Using cryo-electron microscopy (cryo-EM) housed in the University's Astbury Biostructure Laboratory, the team resolved the shutdown structure of human NM2A to a global resolution of 3.0 ångströms in the head region and 6.3 ångströms for the full-length molecule. This is the first time a high-resolution structure of NM2A in its dephosphorylated, inactive – or “10S” – state has been achieved.

A protein that folds itself into silence

Myosins are molecular motors that power an enormous range of cellular functions, from muscle contraction to cell division. NM2A is the sole class 2 myosin isoform found in platelets, making it indispensable for clot formation. When platelets are quiescent, NM2A must remain switched off; premature activation would be disastrous.

The shutdown mechanism, it turns out, is elegantly self-contained. In its

inactive state, the protein's long coiled-coil tail wraps back around its own motor domains – the “heads” – preventing them from binding to actin or assembling into filaments. The authors describe this as the interacting heads motif (IHM). As the paper's abstract states, the structure reveals “specific ionic interactions that explain why the path of the coiled coil and the shutdown mechanism for NM2A differ from those of β -cardiac myosin.”

Postdoctoral researcher Glenn Carrington explained the significance: “What's exciting is that we can now explain, in structural detail, how this molecule folds in on itself to stay inactive – and how a simple chemical change flips it back on.”

Flipping the switch: phosphorylation as the trigger

That chemical change is phosphorylation. Activation of NM2A is initiated when the enzyme myosin light chain kinase (MLCK) adds a phosphate group to serine-19 (Ser19) on the regulatory light chain (RLC). The Leeds team's structural data reveal that this site is exposed on the surface of a region they term the “mortar” – where the two RLCs interface – making it accessible to MLCK.

Crucially, the researchers found that MLCK can access Ser19 on the free head RLC (the mortar) with far fewer steric clashes than on the blocked head RLC (the latch). This asymmetry suggests a sequential activation model: the mortar is phosphorylated first, destabilising the RLC–RLC interface and increasing the mobility of the tail segments. This progressively exposes the latch region, allowing

MLCK to phosphorylate the second Ser19, ultimately releasing the entire molecule into its active, filament-forming state.

Disease mutations mapped onto the structure

The high resolution of the structure has immediate clinical relevance. More than 200 autosomal dominant missense mutations in *MYH9* – the gene encoding the NM2A heavy chain – are known to cause a spectrum of disorders including bleeding disorders, kidney abnormalities, and hearing loss. Many of these mutations cluster precisely in the regions the Leeds team has now visualised in atomic detail.

Professor Michelle Peckham, the study's corresponding author, put it succinctly: “By understanding how this molecule is normally kept under control, we can begin to see how genetic mutations push it out of balance and lead to disease.”

The structural data show that mutations in the groove where the coiled-coil segment 2 docks against the motor domain are particularly likely to destabilise the shutdown state, causing premature NM2A activation and impaired platelet function – a plausible mechanism for the bleeding phenotypes seen in *MYH9*-related disease.

The full-length and head-region structures have been deposited in the Protein Data Bank (PDB IDs 9SYU and 9SZR respectively), making them available to the wider research community for further interrogation. 

Journal reference:

Casas-Mao, D., Carrington, G., Peckham, M., et al. (2026). Cryo-EM structure of shutdown human nonmuscle myosin 2A. *Science Advances*, 12(16), eaed1858. <https://doi.org/10.1126/sciadv.aed1858>



New platform captures cellular gene readouts without sacrificing the cell

A new platform called NTVE – non-destructive transcriptomics via vesicular export – allows researchers to repeatedly sample gene expression from living cells without destroying them, opening doors to longitudinal studies of stem cell development and disease. The work, published in *Nature Communications* on 25 April 2026, could transform how scientists monitor cell therapies and organoid research.

For decades, transcriptomics – the comprehensive profiling of which genes a cell is actively expressing – has required one uncomfortable compromise: you must kill the cell to read it. Lysis destroys the sample, meaning each measurement is a one-way door. Longitudinal analysis of the same living cell population has remained largely out of reach, limited to laborious techniques such as nanostraw aspiration that work only in small numbers of robust cells and cannot easily scale.

A team led by Prof. Gil Westmeyer, Professor of Neurobiological Engineering at the Technical University of Munich (TUM), has now found an elegant way around this constraint. Their new platform, NTVE (non-destructive transcriptomics by vesicular export), exploits engineered virus-like particles (VLPs) to shuttle messenger RNA out of living cells and into the surrounding culture medium, where it can be collected and sequenced – leaving the cells intact and available for further sampling.

How the cellular postbox works

The key to NTVE lies in repurposing HIV-1 Gag, a viral protein that naturally drives membrane budding to form new viral particles. The team engineered an inducible version of this budding machinery, activating it with doxycycline, and fused it to the first two RNA recognition motifs (RRM1 and RRM2) of the poly(A)-binding protein PABPC1. These domains act like molecular postmen, collecting polyadenylated messenger RNAs from inside the cell and packaging

them into outgoing vesicles, roughly 65 nm in radius, which bud off the plasma membrane and accumulate in the culture supernatant.

The exported RNA is then extracted and analysed by standard next-generation sequencing workflows. Critically, the concordance with conventional lysate-based RNA-seq is high – a Pearson correlation of 0.95 – and the method detects over 14,500 genes also found in matched cell lysates, with an intersection-over-union of 90.4%. As the authors note in the paper, “NTVE captures transcriptome changes in response to genetic and chemical perturbations within the same cells over time using standard sequencing workflows.”

Same cells, different days

Because the cells are left unharmed, the same population can be sampled repeatedly over days or weeks. The team demonstrated this across several demanding biological contexts. In primary murine cortical neurons, delivered via adeno-associated virus (AAV), NTVE correctly identified upregulation of CREB pathway genes – including *Bdnf*, *Crh*, and *Sik1* – following stimulation with forskolin. In human induced pluripotent stem cells (hiPSCs), the system tracked trilineage differentiation into ectoderm, mesoderm, and endoderm through daily transcriptomic snapshots, revealing lineage-specific marker dynamics that endpoint flow cytometry alone could not fully resolve.

Perhaps most strikingly, NTVE monitored hiPSC differentiation into contracting cardiomyocytes over nine days, capturing the progressive enrichment of cardiac marker genes – including *MYL6*, *MYL3*,

and *ACTC1* – whose upregulation coincided precisely with the onset of visible cellular contraction on day six.

Prof. Westmeyer emphasised the clinical potential: “This method provides biomedical research with a powerful new tool. We will gain day-by-day insights into the maturation and functionality of stem cells. This could make future cell therapies more precise and effective.”

Beyond reading – also writing

NTVE’s capabilities extend beyond transcriptomic readout. The platform can be pseudotyped with glycoproteins to target specific recipient cells, enabling engineered cell-to-cell communication. The team demonstrated delivery of a recombinase-encoding mRNA and, separately, a CRISPR prime editor packaged as a ribonucleoprotein complex – both successfully activating fluorescent reporter switches in co-cultured recipient cells.

First author Niklas Armbrust and co-corresponding author Dr Jeffery Truong noted that “NTVE can potentially be used for long-term analysis of organoids as well as for further research into tumours and their intercellular communication.”

The authors acknowledge current limitations: NTVE cannot export nuclear-localised transcripts, and individual exported transcripts cannot yet be assigned to single cells. Nevertheless, the repeated-measures design it enables opens analytical strategies – including predictive modelling of cell state trajectories – that endpoint sampling simply cannot offer. MEH

Reference:

Armbrust, N., Grosshauser, M., Geilenkeuser, J., et al. (2026). Non-destructive transcriptomics via vesicular export. *Nature Communications*, 17, 3812. <https://doi.org/10.1038/s41467-026-72072-w>

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Silicone ‘bristles’ make hospital surfaces shed protein – and the pathogens that ride on them

A coating made from tiny, flexible chains of polydimethylsiloxane causes dried protein residues to peel themselves away from surfaces – a finding published in *Chemical Engineering Journal* that could offer hospitals a passive, chemical-free alternative to disinfectants in the fight against healthcare-associated infections.

Healthcare-associated infections (HAIs) remain a stubborn burden on health systems worldwide. In Canada alone, 7.9% of hospital patients acquire an infection during their stay – rising to 30% among those chronically in contact with indwelling catheters and other invasive devices. A central mechanism driving this toll is the rapid adsorption of proteins from body fluids onto environmental surfaces and equipment, creating a sticky biological scaffold that bacteria exploit to colonise and form biofilms.

Now, engineers at the University of Toronto believe they have found a way to deny pathogens that foothold – not with chemicals, but with physics.

How the coating works

The key material is polydimethylsiloxane (PDMS), a silicone polymer already familiar to clinicians through its use in contact lenses and implants. Most people encounter PDMS in its cross-linked, solid form – silicone rubber. What the Toronto team has done differently is to graft individual PDMS chains directly onto a surface so that they stand upright like bristles on a brush, rather than forming an interconnected solid mass.

Because these chains are not tethered to one another, they can bend and sway freely. The result is what the researchers call a “liquidlike” surface – one that is molecularly mobile even though it appears solid. “Instead of having interconnected, solidified chains, it’s instead covered in long chains of PDMS that stick out from the surface, like the bristles on a brush,” explains Mehdi Sadeghi, PhD student and lead author of the study.

This mobility appears to be the critical factor. Proteins arriving at the surface – the first event in the chain leading to biofilm formation – struggle to achieve stable adhesion because the surface beneath them is constantly in motion at the nanoscale.

The coffee ring that wasn’t

To test their coating, the team used bovine serum albumin (BSA) dissolved in phosphate-buffered saline as a proxy for the proteins found in blood, urine, nasal mucus, and synovial fluid. When a droplet of protein solution dries on most surfaces, capillary flow carries solutes to the contact line, leaving a characteristic ring of deposited protein – the so-called coffee ring effect. The researchers allowed BSA droplets of varying concentrations to dry on PDMS brush-coated wafers and compared the results with PDMS rubber, perfluorinated polymer brushes, and fluorinated self-assembled monolayers.

At protein concentrations of 2% or above – a threshold met by blood, serum, and several other body fluids – the dried residue on PDMS brushes did not merely resist removal; it detached spontaneously. Cracks propagated along the brush–protein interface as the residue contracted during drying, lifting it entirely away from the surface. The authors describe this as “auto-delamination.” Scanning electron microscopy confirmed that no protein remained on the surface after the event, and the surface’s water contact angle was unchanged after five consecutive drying and rinsing cycles, demonstrating that the coating was not progressively fouled.

At lower concentrations, full auto-delamination did not occur, but the team found that “a small puff of air was able to dislodge the

residue,” as the authors note – a striking contrast to the firmly adhered rings left on uncoated silicon wafers.

Beyond Teflon

Importantly, PDMS brushes outperformed perfluorinated coatings – the family that includes Teflon – in protein repellency. This matters clinically, because per- and polyfluoroalkyl substances (PFAS) carry known toxicity concerns and are subject to increasing regulatory pressure. “The microbes that carry them typically release a sticky layer of proteins that enable their attachment to a surface. If you can stop those proteins from sticking, you can stop the disease from spreading,” says lead investigator Professor Kevin Golovin.

The team’s cytotoxicity testing, performed on MDCK cells, found that neither capped nor uncapped PDMS brush coatings would be classified as cytotoxic under ISO standards, with more than 70% of cells remaining viable after 24 hours of leachate exposure.

“Right now, the simplest way to keep a surface clean and free of disease-causing microbes is to wash it with disinfectants like bleach,” says Golovin. “But of course, it’s not great for the humans that work in these environments to be constantly exposed to these toxic products.”

The coating process is described as scalable, with the researchers already in dialogue with medical device manufacturers. Next steps include testing against real bacterial adhesive proteins rather than BSA alone, and validating durability across clinically relevant stresses – autoclaving, flexure, and repeated disinfection. MEH

Journal reference:

Sadeghi, M., Feizabadi, L., Zheng, E. E., et al. (2026). Liquidlike polydimethylsiloxane polymer brushes spontaneously delaminate drying protein-laden droplets. *Chemical Engineering Journal*, 531, 173417. <https://doi.org/10.1016/j.cej.2026.173417>

Innovating care. Transforming lives.



NYU Abu Dhabi researchers develop microfluidic sensors that provide tactile feedback in minimally invasive surgery

Minimally invasive surgery has transformed patient recovery, but it has robbed surgeons of a fundamental sense: touch. Now, researchers at NYU Abu Dhabi have developed soft, flexible microfluidic force sensors that restore real-time tactile feedback during keyhole procedures, according to a study published in *Microsystems & Nanoengineering*. The work could mark a turning point in the design of smarter, safer surgical instruments.

Laparoscopic surgery offers patients faster recovery, less post-operative pain, and reduced risk of infection compared with open procedures. Yet the long, rigid instruments threaded through small incisions impose a significant clinical trade-off: surgeons lose the ability to feel the resistance and texture of the tissue they are manipulating. Grip too firmly, and delicate structures tear; grip too lightly, and control is lost. For decades, this sensory deficit has been one of minimally invasive surgery's most stubborn limitations.

Tactile sensing is far from a niche engineering concern. In robotics, wearable electronics, and medical instrumentation, the ability to perceive and respond to physical interactions with the environment underpins feedback control, object manipulation, and real-time decision-making. In surgery, the stakes are particularly high. Conventional force sensors have traditionally relied on rigid solid-state technologies – including Micro-Electro-Mechanical Systems (MEMS) – which offer excellent sensitivity and compact form factors but are fundamentally ill-suited to the compliant, curved, and dynamic surfaces of surgical instruments. Their mechanical rigidity creates a mismatch that can compromise both performance and safety.

A team led by Associate Professor Mohammad A. Qasaimeh at NYU Abu Dhabi's Engineering Division has now developed a practical solution. Their multichannel soft microfluidic force sensors – fabricated from polydimethylsiloxane (PDMS) and filled with Galinstan, a biocompatible eutectic

liquid metal alloy of gallium, indium, and tin – can measure forces ranging from the gentlest tissue contact to forceful grasping, all in real time. The findings were published in *Microsystems & Nanoengineering* on 20 April 2026.

“Minimally invasive surgery benefits patients, but it also removes a key human capability: the surgeon's sense of touch,” said Qasaimeh. “In this work, we developed soft sensors that can capture a wide range of forces while remaining easy to integrate with existing tools, moving us closer to smarter and safer surgical instruments.”

How the sensors work

The sensing mechanism is elegantly straightforward. When a normal force is applied to the PDMS structure, the elastomer deforms, compressing the Galinstan-filled microchannels embedded within it. This reduces the channel's cross-sectional area, increasing its electrical resistance in a measurable, calibrated way. The greater the force, the greater the resistance change – a relationship that can be precisely quantified using the standard resistivity equation governing the electrical behaviour of the liquid metal within the channel.

Galinstan was selected as the active sensing element for good reason. At room temperature it exhibits a dynamic viscosity of approximately 2.4 mPa·s, high electrical conductivity, low melting temperature, non-toxicity, and ultralow vapour pressure. Unlike mercury, it is safe for biomedical applications. Combined with PDMS – chosen for its high elasticity, tunable stiffness, op-

tical transparency, and biocompatibility – the two materials form a robust platform for soft, stretchable force sensing.

The team systematically evaluated how key design parameters affect sensitivity and working range, using both finite element analysis (FEA) simulations in COMSOL Multiphysics and experimental validation. Among the variables assessed were microchannel cross-sectional geometry, vertical depth of the microchannel within the sensor, sensor thickness, and the stiffness of the PDMS elastomer – controlled by varying the base-to-crosslinker mixing ratio and curing duration.

Among the geometries tested – including spiral, flower-inspired, and strain gauge-inspired layouts – an inverted stepped-triangle microchannel cross-section consistently delivered the highest sensitivity. Thinner sensors and softer PDMS formulations also enhanced responsiveness, consistent with Hooke's law of elasticity. Shallower microchannels, positioned closer to the sensor surface, were more prone to force-induced deformation and therefore more sensitive to applied loads.

Crucially, the entire fabrication process requires no cleanroom. Mould designs were produced using desktop digital light processing (DLP) 3D printing with PlasCLEAR resin, followed by PDMS casting and Galinstan injection via vacuum-assisted filling. By incorporating injection inlets and electrical terminal channels directly into the mould design, the team eliminated common manual post-processing steps, improving yield and simplifying assembly. The

result is a reproducible, low-cost fabrication protocol accessible to standard research laboratories – an important consideration for eventual clinical translation and the prototyping of single-use disposable sensors.

Multichannel designs extend sensing range

A particularly significant contribution of the study is the development of multichannel sensor architectures that extend the dynamic range of force detection within a single compact device. Two principal approaches were explored.

The first involved multilayer designs, in which two spiral microchannels were positioned at different vertical depths within a stacked PDMS structure. The upper microchannel, closer to the surface, experienced greater deformation under load and provided higher sensitivity at low forces; the lower microchannel, further from the surface, underwent less deformation and offered an extended linear working range at higher forces. The two channels thus operated in complementary fashion, together spanning a broader force range than either could achieve alone.

The second approach used coplanar multichannel configurations, embedding multiple microchannels with different geometries or cross-sectional dimensions within a single PDMS layer. Flower-inspired designs incorporated two concentric microchannels arranged in petal-like patterns, whilst strain gauge-inspired designs placed two serpentine microchannels side by side with differing aspect ratios. In both cases, the channels exhibited distinct force-response profiles, enabling dual-range sensing without the additional fabrication complexity of multilayer bonding.

First author Wael Othman, formerly a postdoctoral associate at NYU Abu Dhabi and now Assistant Professor at Khalifa University, described the rationale: “Our goal was to create sensors that are both sensitive and practical for real surgical environments. This design allows us to measure both gentle and strong forces within the same small device, and to place sensors where they are most useful on surgical tools.”



NYU Abu Dhabi researcher Associate Professor Mohammad A. Qasaimeh (right) and Wael Othman, formerly a postdoctoral associate at NYU Abu Dhabi and now Assistant Professor at Khalifa University, have developed smart soft sensors to restore surgeons' sense of touch in minimally invasive procedures.

A dual-sensor system for the operating theatre

To demonstrate clinical applicability, the researchers integrated two single-channel sensors onto a standard laparoscopic grasper. A teeth-patterned strain gauge sensor – designed to mimic the gripping surface of a conventional metallic grasper jaw, and incorporating the inverted stepped-triangle microchannel geometry identified as the most sensitive – was mounted on one jaw to capture tissue contact forces. A spiral sensor was placed on the thumb ring of the handle to measure the actuation force applied by the surgeon during jaw manipulation.

The choice of sensor placement also has practical implications for sterilisation and ease of use. Mounting the handle sensor off the jaw keeps the instrument tip unobstructed and easier to sterilise, whilst jaw-mounted sensors provide more direct measurement of tool-tissue interaction forces – a flexibility the authors highlight as an advantage of the platform's modular design.

During testing with cylindrical PDMS tissue phantoms, the jaw sensor reliably captured grasp-and-release force cycles in real time, whilst the handle sensor simultaneously tracked the surgeon's thumb actuation forces. Fabrication reproducibility was strong, with output signal variation across identically produced sensors remaining within $\pm 5\%$. Dynamic response testing demonstrated a response time of 65 ms and a recovery time of 80 ms – performance characteristics consistent with the demands of real surgical manipulation.

The authors note that this dual-sensor configuration “establishes a multimodal tac-

tile feedback system that effectively restores a sense of ‘touch’ in MIS tools, facilitating safer and more informed tissue manipulation.” Previous work by the same group has validated a strong correlation between forces measured at the handle and those applied at the jaws, meaning that even the off-jaw handle sensor can be used to reconstruct tissue contact forces during grasping events.

Limitations and future directions

Long-term storage testing over 16 months highlighted one area requiring attention: gradual stiffening of the PDMS due to natural ageing increased sensor stiffness and altered the force-response signal over time. The authors recommend routine calibration for sensors intended for extended use – a practical consideration that will need to be addressed in any pathway towards clinical deployment.

Future work will focus on improving simulation accuracy through nonlinear PDMS material models and mesh refinement near the microchannel-substrate interface. The team also intends to integrate the sensors with wireless microcontrollers for portable, real-time data acquisition, and to explore multimodal sensing of shear stresses, torque, and bending.

The broader implications extend well beyond laparoscopy. As the authors conclude, the platform “provides a foundation for developing next-generation soft sensors for biomedical instrumentation, soft robotics, and human-machine interfaces” – with potential applications in surgical training, robotic automation, and intraoperative decision support. MEH

Reference:

Othman, W., Qasaimeh, M. A., et al. (2026). Multichannel soft microfluidic force sensors: design, characterization, and application in laparoscopy. *Microsystems & Nanoengineering*, 12, 138. <https://doi.org/10.1038/s41378-026-01263-8>

New robotic-assisted technology enhances precision lung surgery

At the world-renowned Harefield Hospital, part of Guy's and St Thomas' NHS Foundation Trust, lung cancer patients can now benefit from innovative robotic-assisted thoracic surgery (RATS). Using Intuitive's da Vinci 5 (dV5) robotic surgical platform, the hospital's expert thoracic surgeons can perform minimally invasive complex lung procedures with enhanced precision.

Robotic-assisted thoracic surgery

The dV5 is the most sophisticated generation of Intuitive's da Vinci surgical systems, enabling advanced thoracic surgery through small incisions. At Harefield, surgeons can perform procedures through just 3-5 incisions measuring 8-12mm using the robotic platform.

Surgeons access the thoracic cavity using small surgical instruments and a 3D camera that provides a magnified, high-definition view of the chest cavity. The robotic instruments replicate the surgeon's hand movements in real time from a console.

Advanced technology for precision surgery

Compared with previous da Vinci models, the dV5 has significant technological and sensing advancements, including 10,000 times greater computing power. Its innovative Force Feedback technology enables surgeons to sense tissue resistance during procedures, supporting more refined control during complex surgery and helping to reduce tissue trauma.

The system also features enhanced 3D visualisation and wristed instruments that provide exceptional dexterity within the chest cavity, enabling highly precise dissection around delicate lung structures and supporting improved patient outcomes.

"The dV5 is currently the most innovative technology available for robotic surgery and, at Harefield Hospital, we're the first thoracic unit in the country to have it," says Mr Nizar Asadi, consultant thoracic surgeon.



Benefits to patients

Advancements in robotic technology associated with the dV5 may offer several benefits compared with non-robotic and open surgery, including reduced post-operative pain and scarring, less bleeding, lower risk of infection, and shorter hospital stays. It can also provide a minimally invasive option for some higher-risk surgical patients.

"The dV5 has numerous benefits for our lung cancer patients undergoing thoracic surgery," explains Miss Emma Beddow, consultant thoracic surgeon. "The arrival of the dV5 at Harefield further strengthens our reputation as one of the UK's leading thoracic centres and reflects our commitment to managing the most complex lung cancer cases with excellent results."

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M42's Danat Al Emarat introduces advanced keyhole surgery to treat spina bifida before birth

Landmark procedure strengthens the UAE's position in advanced fetal care and complex prenatal interventions

Danat Al Emarat Women and Children's Hospital, part of the M42 group, has successfully performed a minimally invasive fetoscopic keyhole repair for spina bifida, the first procedure of its kind at the hospital. Unlike traditional open fetal surgery used in similar cases, this advanced in utero intervention was completed using a minimally invasive approach.

This achievement marks a significant advancement in maternal and fetal care in the UAE, expanding in-country capability to manage complex prenatal conditions and reducing the need for families to seek treatment abroad.

Spina bifida is a congenital condition in which a baby's spine and spinal cord do not close properly during early pregnancy. It affects approximately 1 in every 1,000 pregnancies globally and, in severe cases, can lead to lifelong disability, including paralysis and neurological complications. Evidence shows that repairing the defect before birth improves mobility and reduces the need for postnatal surgery to treat hydrocephalus, a serious condition caused by fluid buildup in the brain.

Previously, these procedures were performed through open uterine surgery, requiring a larger abdominal incision. While effective, the technique involves more extensive maternal recovery and careful management of future pregnancies. The introduction of the fetoscopic approach at Danat Al Emarat represents a major step forward in prenatal intervention. Performed through small keyhole incisions using specialized in-



struments and high-definition imaging, the technique reduces surgical impact on the mother, supports faster recovery, and preserves uterine integrity while maintaining intended fetal outcomes.

Dr. Summia Zaher, CEO of Danat Al Emarat Hospital, said: "Introducing fetoscopic fetal surgery to the UAE means families facing complex diagnoses can access advanced care at a critical moment, without the added burden of travelling abroad. It also enables greater continuity of care, with patients supported by the same specialised teams before, during and after treatment."

The complex five-hour procedure was carried out by Dr. Ghalia Almahri, Consultant and Department Head of Fetal Medicine at Danat Al Emarat, alongside a multidisciplinary team of maternal-fetal medicine specialists, paediatric neurosurgeons, anaesthesiologists and neonatal experts.

Dr. Ghalia Almahri said: "Fetal inter-

vention can change the course of a child's life before birth. The ability to perform this repair fetoscopically reflects how far specialized care has advanced in the UAE, enabling less invasive treatment for complex conditions. It sets a new benchmark for fetal surgery and the outcomes we can achieve."

Available in only a limited number of highly specialized centres worldwide, minimally invasive fetal spinal repair represents the forefront of maternal and fetal surgery. Its introduction at Danat Al Emarat reflects M42's commitment to combining advanced clinical expertise, technology and multidisciplinary care to deliver complex interventions locally.

This milestone also aligns with the UAE's Year of the Family, reinforcing ongoing investment in specialized care that supports families from diagnosis through delivery.

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The humble step counter beats heart monitors and wellness scores as the best predictor of surgical recovery

A landmark study drawing on nearly 2,000 surgical patients from the NIH's All of Us Research Programme has quantified what clinicians have long suspected: postoperative step count, measured by a consumer wearable, is a robust, independent predictor of hospital length of stay, complications, and readmission. Published in the *Journal of the American College of Surgeons* on 6 May 2026, the findings challenge the clinical value of heart rate variability monitoring and patient self-reported wellness scores as postoperative recovery tools.

Walk enough steps after your operation and, according to a compelling new study, you are measurably less likely to suffer a complication, be readmitted to hospital, or spend longer than necessary in a hospital bed. The research, led by investigators at The Ohio State University Wexner Medical Center, puts precise numbers on the benefits of postoperative mobility for the first time – and the signal is striking. Each additional 1,000 steps per day taken in the postoperative period was independently associated with an 18% reduction in the odds of complications, a 16% reduction in readmission risk, and a 6% shortening of hospital stay.

The investigators used data from the NIH's All of Us Research Programme – a large, richly characterised cohort that links electronic health records (EHRs) with voluntary Fitbit wearable data – to identify 1,965 adult patients who underwent inpatient surgery and had at least 30 days of preoperative and postoperative wearable coverage. That stringent inclusion criterion, applied from an initial pool of 66,345 surgical patients, produced a cohort with sufficient data to examine not only postoperative step counts but also changes in heart rate variability (HRV) and self-reported wellness, measured us-

ing the validated SPADE composite score (which captures fatigue, pain, anxiety, depression, and sleep disruption).

Step counts outperform every other metric tested

The headline finding is unambiguous. On multivariable analysis – adjusted for age, sex, surgical risk category, BMI, Charlson Comorbidity Index, and neighbourhood deprivation index – postoperative change in daily steps was the only wearable-derived metric consistently associated with every primary outcome. Specifically, each incremental 1,000-step increase per day relative to preoperative baseline was associated with a reduced length of stay (incidence rate ratio 0.94, 95% CI 0.90–0.99) and lower odds of both 30-day (adjusted OR 0.83, 95% CI 0.69–1.00) and 90-day (adjusted OR 0.82, 95% CI 0.70–0.96) complications. The same pattern held for readmission: 30-day readmission odds fell by 15% (aOR 0.85, 95% CI 0.76–0.96) and 90-day readmission odds by 16% (aOR 0.84, 95% CI 0.75–0.94) per additional 1,000 postoperative steps per day.

The clinical magnitude of those effects becomes clearer in the scenario analyses. A swing from –1,000 to +1,000 steps per day relative to preoperative baseline trans-



Senior author Timothy M. Pawlik, MD, PhD, professor and chair of surgery at Ohio State University Wexner Medical Centre.

lated to a reduction in mean length of stay from 2.60 days to 1.92 days – a difference of roughly 0.68 days, or 35.5%. The effect was most pronounced in high-risk surgical procedures (23.5% reduction) and was meaningful even in low-risk cases (17.5% reduction).

Senior author Timothy M. Pawlik, professor and chair of surgery at Ohio State, framed the finding in practical terms. “We tell patients that they need to get up and walk after an operation, but we don’t have a good sense of how much they’re actually

moving,” he said. “Wearables give us an objective, continuous readout. Instead of asking how you feel, we can see that you’re up and moving, which is a very actionable signal of how your recovery is progressing.”

Heart rate variability and wellness scores fall short

By contrast, neither postoperative changes in HRV nor the SPADE self-reported wellness composite reached statistical significance for any of the primary outcomes. Changes in HRV – operationalised from wrist photoplethysmography-derived SDANN values – showed no association with length of stay (IRR 1.55, 95% CI 0.93–2.61, $p = 0.275$), 30-day complications ($p = 0.61$), or 90-day readmission ($p = 0.75$). SPADE scores likewise failed to independently predict any postoperative outcome in fully adjusted models.

The authors are careful to contextualise the HRV null result. “HRV demonstrates a modest association with complications and readmissions, consistent with the concept that preserved parasympathetic (vagal) tone confers resilience to surgical stress,” they write in the paper’s Discussion section. The lack of statistical significance may partly reflect methodological limitations inherent to consumer-grade wrist photoplethysmography, which is noisier and less accurate than electrocardiography-derived RR-interval measurements, particularly in free-living postoperative settings where motion artefact, opioid use, neuraxial anaesthesia, and atrial fibrillation can all distort the signal.

The authors’ view is that HRV retains clinical relevance – but at a different point in the surgical pathway. “HRV appears most useful as a preoperative triage tool to identify patients who might benefit from prehabilitation (e.g., HRV-biofeedback or breathing interventions) rather than as a standalone postoperative monitoring target,” they note.

The failure of SPADE to predict outcomes is arguably the more provocative finding for those invested in patient-re-

ported outcome measures. Self-reported wellness, the authors suggest, may be systematically confounded by pain, medication effects, environmental stressors, and social-desirability bias in ways that decouple subjective experience from objective physiological recovery. That does not render PROMs useless – “in a multimodal framework, PROMs may still add context, such as capturing pain interference, sleep quality, or mood, that can guide targeted symptom relief,” the authors acknowledge – but it does argue against relying on them as a primary signal for discharge decision-making.

From wrist to ward: what this means for clinical practice

Pawlik acknowledges the chicken-and-egg complexity of the relationship between mobility and recovery. “People who feel better are naturally more likely to be up and around,” he said. “However, the signal is so strong that it suggests step count is not just a marker of wellness, but a key component of it. Seeing a patient’s step count drop can be an early indicator to intervene, perhaps by involving physical therapy or checking in more frequently.”

That interpretive nuance matters. The study’s observational design cannot establish causation, and the authors are candid about the risk of confounding by indication: sicker patients may simply walk less, and some procedures mandated reduced early mobility. Rehabilitation status was unavailable in the All of Us dataset, meaning patients enrolled in formal postoperative physiotherapy programmes could not be distinguished from those without structured support.

Despite those caveats, the practical implications are considerable. The findings align with, and extend, a prior All of Us analysis in which preoperative step counts above 7,500 per day were associated with a 51% reduction in postoperative complication risk. The current study adds postoperative data and specifies which complications were most sensitive

We tell patients that they need to get up and walk after an operation, but we don't have a good sense of how much they're actually moving.

to activity level – respiratory events and venous thromboembolic complications showed the strongest associations, reinforcing well-established mechanistic links between immobility, pulmonary stasis, and thrombogenesis.

The authors argue that these findings support integrating wearable step-count data into Enhanced Recovery After Surgery (ERAS) pathways as dynamic, patient-specific targets rather than generic milestones. “If a patient’s goal is 8,000 steps before surgery and 6,000 on postoperative day three, they can see if they’re hitting those targets,” Pawlik said. “It gives them a concrete goal and gives us objective data to help decide if they’re ready for discharge or if they need more support at home.”

The authors envision a two-phase wearable integration strategy: preoperative HRV-informed risk stratification to identify patients who might benefit from prehabilitation, followed by postoperative step-guided recovery management with trend-based alerts to trigger earlier clinical review when activity falters. “Future trials should test whether step-target interventions and HRV-based prehabilitation improve outcomes across surgical risk strata,” they conclude.

For a healthcare system still grappling with avoidable readmissions and prolonged hospital stays, the message is simple: the number of steps your patient takes after surgery may tell you more about their recovery than anything they – or their autonomic nervous system – are able to report. MEH

Reference:

Elemosho, A., Chatzipanagiotou, O. P., Angez, M., et al. (2026). Association of perioperative steps and heart rate variability from wearable devices with surgical outcomes. *Journal of the American College of Surgeons*. <https://doi.org/10.1097/XCS.0000000000001857>

HRT and the brain: new genetic study clears Alzheimer's fears but raises depression flag

A landmark drug-target Mendelian randomisation study published in *npj Women's Health* has used genetic proxies to cut through decades of conflicting observational data on menopausal hormone therapy. The findings offer some reassurance on dementia risk – but sound a cautionary note about depression that clinicians and patients will need to weigh carefully.

For years, women approaching the menopause and their doctors have faced an uncomfortable paradox: the therapy most commonly used to ease menopausal symptoms sits at the centre of a scientific controversy that shows no sign of resolving itself. Does menopausal hormone therapy (MHT) protect the ageing brain, harm it, or do nothing at all? A new study led by researchers at King's College London and the University of Oxford has taken an ingenious approach to cutting through the noise – and the results are both reassuring and thought-provoking in equal measure.

The research, published in *npj Women's Health*, deployed a technique called drug-target Mendelian randomisation (MR) to sidestep the confounding and reverse causation that have long plagued observational studies of MHT. Rather than following women through their hormonal choices and health outcomes, the team used genetic variants as stand-ins for the drug itself – effectively asking what happens to the brain when the molecular targets of MHT are perturbed, independent of lifestyle, socioeconomic factors, or clinical indication.

How genetics can mimic a drug trial

MHT works primarily by binding to two oestrogen receptors, ER α and ER β , encoded by the genes *ESR1* and *ESR2* respectively. The researchers identified naturally occurring single-nucleotide polymorphisms (SNPs) within these genes that influence downstream biomarkers known to reflect oestrogen receptor activity – bone mineral density and sex

hormone-binding globulin (SHBG) levels for ER α , and haemoglobin levels for ER β .

These SNPs were then used as instrumental variables in two-sample MR analyses, drawing on genome-wide association study (GWAS) data from tens of thousands of participants. Because genetic variants are assigned at conception and cannot be influenced by later environmental factors, this approach largely avoids the confounding that makes observational studies so difficult to interpret.

The outcomes of interest were chosen with care: Alzheimer's disease (AD), cortical grey matter volume, hippocampal volume, white matter hyperintensity (WMH) volume, depression, and anxiety – all conditions with a marked female preponderance and all plausibly linked to oestrogen biology.

No smoking gun for Alzheimer's

Perhaps the most clinically significant finding is what the study did not find. Genetically proxied perturbation of either ER α or ER β showed no statistically significant association with Alzheimer's disease risk or with any of the brain structural measures examined – cortical grey matter volume, hippocampal volume, or white matter hyperintensities.

This stands in notable contrast to the Women's Health Initiative Memory Study (WHIMS), which reported a roughly doubled risk of dementia in postmenopausal women aged 65 and over who received oral conjugated equine oestrogen combined with progesterone. The authors acknowl-

edge this discrepancy but offer a plausible explanation rooted in the so-called critical window hypothesis, which proposes that the neurological benefits of MHT depend heavily on when it is initiated relative to the onset of menopause.

As the authors write, "MR estimates can provide insights into lifelong effects of genetic variants, they do not equate to the impacts of pharmacological interventions initiated at specific times." In other words, the genetic approach captures a kind of averaged, lifetime exposure to oestrogen receptor activity – it cannot tell us whether starting MHT at 51 versus 65 makes a meaningful difference to dementia risk. That question, the authors are careful to stress, remains open.

Although ER α perturbation was nominally associated with higher cortical grey matter volume and lower hippocampal volume, neither finding survived correction for multiple testing (false discovery rate adjustment), and the authors treat them accordingly – as hypothesis-generating signals rather than conclusions.

A depression signal that demands attention

Where the study does flag a significant concern is in the domain of depression. Genetically proxied ER β perturbation – using the haemoglobin SNP rs1256061 in *ESR2* as the instrumental variable – was significantly associated with a higher risk of depression, with a Wald ratio β of -0.656 (95% CI -0.992 to -0.319 , FDR-corrected $p = 0.002$). ►

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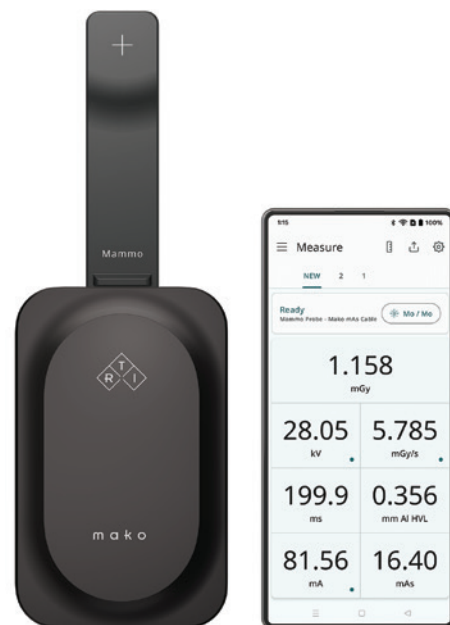
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► Continued from page 32

The directionality here requires a moment's parsing: because lower haemoglobin is used as a proxy for higher oestrogenic activity at $ER\beta$, the negative beta coefficient indicates that greater $ER\beta$ perturbation is associated with *increased* depression risk.

The authors are measured in their interpretation. They write: "Our study highlights psychiatric considerations when targeting oestrogen receptors with MHT, but provides no evidence for either harmful or protective effects on AD risk." They also note that the biological plausibility is supported by $ER\beta$'s particularly high expression in the thalamus and hippocampus – brain regions closely implicated in mood disorders.

This finding sits in tension with a substantial body of clinical trial evidence suggesting that MHT is broadly neutral or even protective for depressive symptoms in menopausal women. The authors do not dismiss that literature but point out that their Mendelian randomisation approach is asking a subtly different question: not whether taking MHT improves mood in women who are already symptomatic, but whether oestrogen receptor perturbation itself has a causal relationship with depression risk across a population.

Caveats the authors are candid about

To their credit, the researchers are unusually forthright about the limitations of their $ER\beta$ findings. The use of haemoglobin as a proxy for $ER\beta$ activity is less robustly validated than bone mineral density is for $ER\alpha$. There are also plausible biological pathways from low haemoglobin to fatigue and depressive symptoms that could violate the exclusion restriction – a core assumption of Mendelian randomisation requiring that the instrumental variable affects the outcome only through the exposure of interest.

A follow-up standard MR analysis of haemoglobin on depression showed an association by inverse-variance weighted method, though not across all sensitivity analyses, suggesting partial violation of this assumption is possible. The authors conclude that "further research with alter-



native $ER\beta$ proxies is needed to confirm this finding."

There are further structural limitations. The analyses were restricted to European-ancestry samples, limiting generalisability. Most GWAS summary statistics were derived from mixed-sex cohorts rather than female-only samples, which may dilute the precision of female-specific estimates. And, by design, the MR framework assumes constant genetic exposure effects over a lifetime – a simplification that may not reflect the reality of hormone biology, which shifts dramatically across reproductive stages.

What this means for clinical practice

The study will not – and should not – immediately change prescribing practice. What it does is add a methodologically distinct layer of evidence to an already complex picture. Taken together with the existing RCT and observational literature, the most defensible reading is that MHT, when used appropriately and initiated at

the right time, is unlikely to substantially increase Alzheimer's risk – a message many clinicians will find broadly consistent with their clinical intuition.

The depression signal, however, warrants closer attention. As the authors put it, "following future research confirming a differential role of $ER\alpha$ and $ER\beta$ in depression, oestrogen receptor modulators that selectively act on $ER\alpha$ could be explored to avoid inducing depressive symptoms with hormone therapy use." That is a genuinely interesting therapeutic hypothesis – one that points towards more targeted, receptor-selective approaches to hormonal treatment in the future.

For now, the study reinforces a familiar but important message: the effects of MHT on the brain are real, biologically plausible, and still incompletely understood. Genetic epidemiology is proving a powerful tool for untangling causality in this field – but it works best as a complement to, not a replacement for, well-designed randomised trials and carefully conducted longitudinal studies. MEN

Reference:

Schindler, L. S., Gill, D., Oppenheimer, H., et al. (2026). Menopausal hormone therapy and risk of neuropsychiatric disease: a drug target Mendelian randomisation study. *npj Women's Health*, 4, 10. <https://doi.org/10.1038/s44294-026-00130-1>



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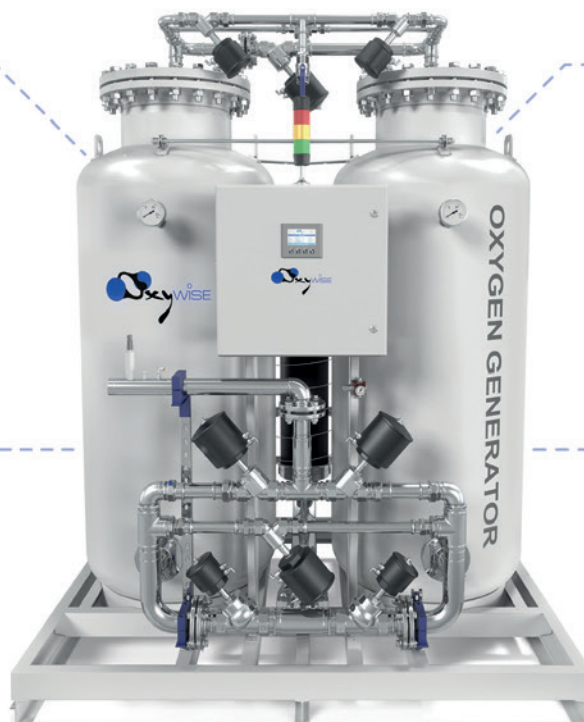
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Major study reveals the asynchronous molecular toll of menopause across reproductive organs

A landmark study published in *Nature Aging* has produced the first comprehensive, multi-organ atlas of female reproductive ageing, using artificial intelligence and supercomputing to analyse over a thousand tissue images alongside gene expression data from hundreds of donors. The findings reveal that menopause is far more than the end of fertility – it is a biological turning point that triggers profound, asynchronous molecular transformations across the reproductive system.

For decades, menopause has been understood primarily through the lens of ovarian decline. The ovaries run out of follicles, oestrogen drops, menstruation ceases. Job done, scientifically speaking. But a sweeping new study from the Barcelona Supercomputing Center (BSC-CNS) suggests this picture is dangerously incomplete – and that the true biological story of menopause is playing out simultaneously, and quite differently, across multiple organs at once.

The research, led by Marta Melé and her Transcriptomics and Functional Genomics group at BSC, integrates deep learning analysis of 1,112 histological images with RNA sequencing from 659 samples spanning seven female reproductive organs – the uterus, ovary, vagina, cervix (endocervix and ectocervix), breast, and fallopian tubes – drawn from donors aged 20 to 70 years. The result is the first large-scale, tissue-resolved atlas of female reproductive system ageing, and it challenges the assumption that these organs decline in concert.

Organs on different clocks

The headline finding is striking: reproductive organs do not age uniformly. Using convolutional neural networks (CNNs) trained to distinguish histological images from young (≤ 35 years) and old (> 60 years) donors, the team achieved test accuracy exceeding 0.75 per tile and reaching 1.0 per sample in the ovary, uterus, and vagina – meaning the AI could reliably “read” age from tissue architecture alone.

When the trained model was applied across all age groups to generate organ-spe-

cific ageing trajectories, a clear divergence emerged. The ovary and vagina showed gradual, linear increases in their probability of being classified as “old” across the lifespan. The uterus told a very different story.

The uterus displays a sharply nonlinear trajectory, with most samples from donors aged 20 to 40 classified as young, followed by an abrupt transition beginning around age 45. The steepest change in uterine ageing probability occurs at age 53 – strikingly close to the average age of natural menopause at 51 years.

As the authors write in the paper: “Our results show that histological and transcriptional aging dynamics are asynchronous across female reproductive organs with the ovary and vagina starting to age gradually earlier in life and the uterus undergoing an abrupt change around the age of menopause.”

Melé commented: “Until now, we tended to consider menopause mainly as the end of the ovary’s reproductive function. However, our results show that it acts as a turning point that profoundly reorganises other organs and tissues of the reproductive system, and allow us to identify the genes and molecular processes that could be behind these changes.”

The myometrium in the spotlight

Drilling deeper into organ-level data using Vision Transformers (ViTs) – a more sophisticated class of neural network capable of capturing complex spatial relationships in tissue architecture – the researchers segmented individual tissue types within each

organ to ask: which specific tissues are most affected by ageing?

The answer was unambiguous. The myometrium, the muscular wall of the uterus, emerged as one of the most dramatically age-affected tissues in the entire reproductive tract. Some myometrial image features had over 40% of their variation explained by age alone – an extraordinary figure. Visual inspection of myometrial tissue tiles across the age range revealed a pronounced structural transition between younger and older donors, consistent with molecular changes seen in independent single-cell studies of the menopausal myometrium.

At the molecular level, multi-omics factor analysis (MOFA) – which integrates histological image features with bulk RNA-sequencing data – identified that the most age-associated genes in the myometrium are those governing extracellular matrix (ECM) organisation and collagen metabolism. These genes decline sharply around menopause, pointing to a wholesale remodelling of the uterine wall’s structural scaffolding. Simultaneously, genes involved in chromatin remodelling increase, consistent with the epigenetic reprogramming that accompanies hormonal withdrawal.

The clinical implications are significant. The study found that uterine myometrial age-differentially expressed genes (age-DEGs) are enriched for genes associated with pelvic organ prolapse in genome-wide association studies – a condition affecting millions of women postmenopausally and a leading reason for hysterectomy. The

authors suggest this represents “a mechanistic link between menopause-associated tissue weakening and this highly prevalent condition.”

Epithelial changes across the reproductive tract

While the uterus undergoes the most abrupt shift, the vaginal epithelium also shows a sharp menopausal transition. The researchers directly measured epithelial thickness from segmented histological images using CellProfiler, observing a significant thinning specifically between the 41–50 and 51–60 age decades – a measurable, structural correlate of the hormonal withdrawal that clinicians see reflected in symptoms of genitourinary syndrome of menopause.

More broadly, coordinated epithelial remodelling was observed across the reproductive tract, including in the cervix and fallopian tubes, with an increased nuclear-to-cytoplasm ratio in older donors’ epithelial cells. The authors note that this epithelial ageing may compromise barrier integrity and innate immunity, potentially contributing to pelvic inflammatory disease later in life.

In the ovary, a distinct pattern emerged: one cluster of genes enriched in fertility markers – including AMH, a biomarker of ovarian reserve – shows earlier downregulation, consistent with ovarian fertility decay beginning well before the menopausal transition. Meanwhile, vasculature-related gene expression declines more abruptly around menopause, in keeping with the known age-related suppression of ovarian angiogenesis.

Ageing signals detectable in blood

One of the most clinically translatable aspects of the study is its demonstration that organ-specific ageing signatures are not confined to the tissues themselves. Using plasma proteomics data from 21,441 female participants aged 40–70 years in the UK Biobank, the team trained random forest classifiers on sets of proteins selectively enriched in each reproductive organ.

The result, as first co-author Oleksandra Soldatkina noted, opens the door to non-

invasive monitoring: “We not only identified the molecular changes underlying the ageing of these organs, but we also saw that they can be detected in blood, which opens the door to new clinical tools.”

The uterine protein signature showed the same abrupt inflection at around age 50 that was observed in the tissue data – and, crucially, the transition aligned precisely with each donor’s self-reported age at menopause. These results held firm after adjusting for menstrual cycle phase, hormone therapy use, and reproductive history.

A new framework for women’s health

The study’s authors are candid about limitations. The GTEx dataset, which provided the tissue samples, lacks detailed reproductive metadata – menopausal status, parity, hormone therapy use – though validation against the UK Biobank largely mitigates this gap. Age predictions from

vaginal tissue showed lower overall accuracy and a tendency to overestimate age in younger donors, warranting caution in interpreting vaginal trajectories. There is also a notable absence of single-cell datasets covering the endometrium, myometrium, and vagina across both pre- and postmenopausal states – a resource the authors identify as critical for future work.

Nevertheless, the conceptual advance is substantial. As the authors conclude: “Our findings reposition menopause not merely as the end of the reproductive lifespan but as a biological inflection point that initiates divergent ageing trajectories across reproductive tissues.”

In a context where women over 50 already represent 26% of the global population according to the WHO – a figure that will only grow with increasing life expectancy – understanding the full molecular basis of menopause has never been more urgent. This atlas provides the first serious map. MEH



Reference:

Soldatkina, O., Ventura-San Pedro, L., Pujol-Gualdo, N., et al. (2026). Multimodal data analysis reveals asynchronous aging dynamics across female reproductive organs. *Nature Aging*. <https://doi.org/10.1038/s43587-026-01098-y>

Medication intelligence supports the push for healthcare digitalisation in South Africa

Medi-Span collaboration with MEDITECH Expanse EHR transforms clinical decision making by making real-time drug alerts available directly in clinician workflows.

Healthcare organisations across Africa, particularly in regions like South Africa where digital transformation is accelerating, are navigating dynamic demands, rising patient volumes, evolving accreditation standards, and increasing clinical complexity.

South Africa, with a population of over 54 million,^[1] the majority of whom access health services using government-run public healthcare, committed to prioritising digitalisation with its National Digital Health Strategy for South Africa 2019-2024.^[2] Published by the National Department of Health, the strategy focused on “dealing with the quadruple burden of disease, improving quality of care, improving maternal and child health, as well as supporting the health system transformation.” Since the implementation of the strategy, South Africa has risen to the second highest healthcare digital maturity score^[3] in Africa, behind only Gabon, according to an IQVIA report.

Electronic Health Record (EHR) systems have had a “profound impact” on the acceleration of care standards and digitalisation in South Africa and throughout the African continent, the report notes. They have created a deeper understand-

ing of immediate patient care needs and provided a foundation for interoperability with other healthcare applications that support organisations by driving enhanced patient care, public health efforts, and workflow efficiency.

A shared commitment to sustainable, high-quality care

Wolters Kluwer Health has partnered with MEDITECH EHR solutions in Africa to address the pressures regional healthcare systems face with precision, intelligence, and scalability.

The MEDITECH Expanse platform^[4] was designed as a modern, cloud-based, mobile-enabled EHR, supporting healthcare delivery across 27 countries. Its focus on patient-centric workflows and clinical sophistication enables organisations to pursue digital transformation sustainably.

By seamlessly integrating Wolters Kluwer’s Medi-Span® drug data solution^[5] into MEDITECH Expanse, clinicians using the platform receive real-time alerts embedded directly into their workflow, including alerts for:

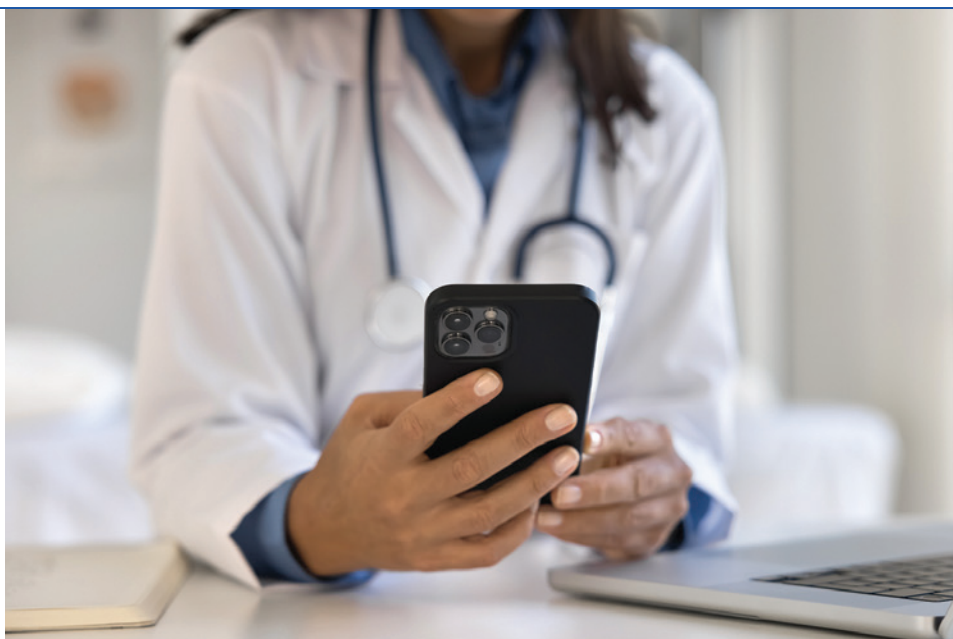
- Dosing^[6]
- Drug interactions and allergies^[7]
- Contraindications
- Clinical considerations

The pairing of MEDITECH’s system-wide daily workflow used throughout South African health systems with globally curated medication intelligence^[8] from Medi-Span – developed by more than 450 expert clinician contributors worldwide – supports continuously updated decision support at the point of care. This empowers clinicians^[9] to make faster and more confident decisions and reduces their cognitive burden. The ability to adapt alert thresholds and dosing guidelines to local regulations helps healthcare providers in South Africa and across the region align decision support with regional clinical standards.

Building confidence in decision-making at the point of care

Confidence, both clinical and organisational, is essential for effective care delivery. As Dr. Sushant Pillai,^[10] managing director of MEDITECH South Africa notes, “When you bring together an advanced EHR platform and a trusted medication intelligence system, you give clinicians the informed confidence they need at the point of care.”

This shared confidence allows care teams to rely on timely, appropriate information, especially in high-pressure contexts where rapid decision-making is critical, he explains.



For African clinicians managing diverse care settings – from tertiary hospitals in South Africa to resource varying environments in neighboring countries – having current and validated drug data based in evidence is critical to supporting effective decision making.

Supporting accreditation and international quality standards in South Africa and Africa

Hospitals across South Africa and the African continent are increasingly pursuing internationally recognised standards,^[11] such as Joint Commission International (JCI), and they benefit directly from the combined strengths of MEDITECH and Wolters Kluwer. MEDITECH Expanse provides structured, clinically sophisticated workflows, while Medi-Span enhances medication outcomes through precision drug mapping, interaction checks, and evidence-based guidance – all elements vital to accreditation readiness for Afri-

can health systems striving to elevate care quality and patient care.

Together, they create an extensive framework that supports evidence-based prescribing, standardised care delivery, and improved quality metrics. Healthcare organisations gain the tools required to demonstrate compliance while elevating operational performance across multidisciplinary teams.

Strategic value for African health systems: Why this partnership matters

Beyond technical integration, the MEDITECH–Wolters Kluwer partnership delivers value through three key strategic strengths:

- **Complementary expertise:** MEDITECH's workflow-driven EHR design pairs seamlessly with Wolters Kluwer's globally trusted medication intelligence.
- **Regional adaptability:** Localised guidelines, dosing ranges, and alert customisation^[12] support diverse international care models.

- **Future-ready design:** Cloud-native architecture, AI-infused workflows, and data-driven optimisation promote long-term sustainability and innovation.

Combined, these strengths allow healthcare systems to advance transformation initiatives while maintaining consistency and high-quality patient care.

For healthcare providers across Africa and South Africa, the collaboration between MEDITECH and Wolters Kluwer illustrates how integrated clinical intelligence can empower clinicians, elevate patient care, and strengthen healthcare organisations as they adapt to global demands. By delivering precision medication guidance^[13] within advanced EHR workflows, the partnership supports trusted decisions, enhanced outcomes, and more resilient health systems worldwide.

- Learn more about Medi-Span solutions for Africa and around the world here: <https://www.wolterskluwer.com/en/solutions/medi-span/medi-span-around-the-world> 

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Family history finally gets its moment: simple questionnaire smashes documentation rates by 94-fold in primary care

A pre-visit questionnaire that patients complete from home, paired with automatic upload to the electronic health record and a same-day prompt for the family physician, increased new family history documentation roughly 94-fold compared with usual care, according to a matched-pair effectiveness-implementation trial published in the September/October 2025 issue of the *Annals of Family Medicine*. The intervention also triggered tangible downstream actions, including screening recommendations and specialist referrals.

Family history has long occupied an awkward space in primary care. Clinicians know it matters – it is, after all, what the authors, citing Ginsburg and colleagues, describe as the “most useful tool for risk assessment for common chronic diseases” – yet it remains stubbornly under-collected, inconsistently updated, and often buried somewhere unsearchable in the electronic health record (EHR). A Canadian team led by Dr June C. Carroll at Mount Sinai Hospital’s Granovsky Gluskin Family Medicine Centre has now shown that a relatively low-tech, well-engineered workflow can change that picture rather dramatically.

What the intervention actually did

The study, conducted across three University of Toronto-affiliated practices between September 2021 and June 2022, tested a multifaceted bundle rather than a single tool. Patients aged 30-69 received an emailed invitation one to two weeks before a scheduled appointment, along with a consent form and the Family History Screening Questionnaire (FHSQ) – an instrument originally validated in Australian primary care and adapted here to screen for breast, ovarian, colorectal, and prostate cancer, melanoma, ischaemic heart disease, and type 2 diabetes. The team added items on prior genetic testing and

self-reported genetic disorders.

Completed questionnaires uploaded automatically into the PS Suite EHR via the Ocean e-mailing platform, and on the day of the visit the family physician received an EHR prompt flagging that new family history information was available for review. Physicians had also attended a brief webinar on the clinical utility of family history, and patient-facing education was delivered via waiting room televisions, clinic websites, and email links to a YouTube explainer. Control patients and physicians, drawn from the UTOPIAN practice-based research network and matched on age, sex, and EHR type, received no intervention.

In essence, this was an exercise in implementation science as much as anything else, drawing explicitly on the Consolidated Framework for Implementation Research and the literature on what an ideal family history strategy looks like – patient-administered, EHR-integrated, updateable, low-friction.

A 94-fold difference, and what it means in the clinic

The headline number is striking. Within 30 days of the clinic visit, new family history was documented in the EHR for 93 of 576 (16.1%) intervention patients, compared with just 5 of 2,203 (0.2%) control patients – an adjusted odds ratio of 94.2

(95% CI, 36.8–240.8; $P < .001$). For cancer family history specifically, 7.8% of intervention patients had new documentation, against 0.1% of controls. Heart disease family history showed a similar pattern (3.3% vs $<0.01\%$).

For clinicians, the implications run deeper than tidier charts. Of patients who reported discussing their family history at the visit ($n=296$), 24.5% said a screening test had been recommended, 7.8% reported lifestyle advice, 7.5% were referred to a non-genetics specialist, and 2.4% were referred for genetics assessment. The authors note that this genetics referral rate, although superficially modest, aligns reasonably well with the estimated 1.33% population prevalence of pathogenic or likely pathogenic variants in the four conditions queried – hereditary breast and ovarian cancer syndromes, Lynch syndrome, and familial hypercholesterolaemia.

In other words, the questionnaire is not just generating documentation for its own sake – it appears to be identifying patients who genuinely warrant further preventive action, and prompting that action within the visit itself.

Why this worked when previous attempts have stumbled

The literature on family history collection tools is, to put it generously, mixed.



produced a ceiling effect. Only about a third of invited patients consented, and those who did were probably enriched for positive family history. Conducting the trial during the COVID-19 pandemic, when physicians had limited bandwidth for new workflows, may have suppressed the true effect size.

Equity is the larger concern. The intervention cohort was 94% urban, 73% White, and 84% university-educated, with 59% reporting household incomes above \$100,000. Participation required English literacy, internet access, computer skills, and comfort sharing health information online. Without thoughtful adaptation, a tool like this risks widening rather than narrowing the gap between patients who benefit from preventive genomics and those who do not.

What comes next

The team is planning to revise the FHSQ in response to patient feedback – clearer definitions of “family,” expanded condition lists to include stroke, dementia, and mental health, and broader cultural and linguistic adaptation – and to roll it out as a quality improvement project. Future iterations will assess whether ordered tests actually match patients’ risk levels and whether patients follow through on recommendations.

The authors conclude: “This strategy showed significant improvement in collection and documentation of FH. Patients welcomed the opportunity to provide FH information before appointments. Factors contributing to the intervention’s success included being completed by the patient and seamless EHR integration with a reminder.” MEH

Murray and colleagues, whose 2013 study the authors discuss at length, found that around half of patient-reported family history information collected through portals was never reviewed by clinicians – often because the data sat in a parallel system rather than flowing into the EHR.

Carroll and colleagues frame their result as a product of three converging design choices. As they write in the discussion, the effects were “likely due to time efficiency (patient completion at home, EHR integration); addressing knowledge gaps (easily accessible education, evidence-based clinical decision support); and system integration (incorporation into usual care flow with physician reminders).”

The same-day EHR prompt is probably doing significant work here. Family history that arrives at the moment of clinical decision-making, in the system the physician is already using, is family history that gets acted on. Patient uptake also outstripped comparable studies: 36.4% of invited patients consented, versus 9.8% to 14.6% in Murray’s intervention arms.

Discordant reporting between patients and physicians

One of the more interesting wrinkles in

the data concerns who reported what. Patients were considerably more likely than their family physicians to say that new actions had been taken on the basis of family history. Patients reported screening recommendations at 24.5% of visits; physicians reported changes in screening or management at just 3.4%. Referrals to non-genetics specialists were noted by 7.5% of patients but only 0.8% of physicians.

The authors offer a sensible interpretation: physicians may have been recommending screening based on family history they already knew about, while patients experienced the recommendation as flowing from the new conversation. Lifestyle counselling, similarly, may not register to physicians as a “change in management.” Either way, the gap is a useful reminder that patient-reported and clinician-reported outcomes capture genuinely different things.

Limitations and equity considerations

The authors are upfront about the study’s constraints. Baseline family history documentation was already high – 81.6% of intervention patients and 86.4% of controls had some family history on file before the trial began – which may have

Reference:
Carroll, J. C., Greiver, M., Kukan, S., et al. (2025). An innovative strategy for collecting family health history: An effectiveness-implementation trial in primary care clinics. *Annals of Family Medicine*, 23(5), 399–406. <https://doi.org/10.1370/afm.240472>

Leading the Next Era of Saudi Healthcare Digital Transformation

An exclusive interview with Eng Abdulhameed Attar, the CEO of Balsam United Company (OASIS Systems)

Saudi Arabia is witnessing one of the fastest healthcare transformations in the world, driven by Vision 2030, digital health strategies, NPHIES, value-based care, and the demand for integrated, data-driven healthcare ecosystems.

With over 35 years of experience, OASIS Systems has been at the heart of this journey – empowering more than 100 hospitals across the Kingdom with innovative, reliable, and scalable health information solutions.

In this exclusive interview, Eng Abdulhameed Attar, CEO, shares his perspective on the future of healthcare IT, key challenges facing providers, and how local innovation and strong partnerships are shaping a healthier future.

1. Saudi Arabia is rapidly transforming its healthcare sector. How do you see the future of healthcare IT evolving in the Kingdom?

■ We are entering a new era where healthcare will be more connected, intelligent, and patient-centric. The future lies in unified digital ecosystems, real-time data, AI-powered insights, and seamless interoperability. Saudi Arabia is building a strong foundation for a world-class digital healthcare model.



“

Healthcare transformation is no longer about implementing systems—it is about building connected, intelligent, and sustainable healthcare ecosystems.

- Eng Abdulhameed Attar, CEO, (OASIS Systems)

BY THE NUMBERS



100+

Hospitals across KSA and Oman



20,000+

Beds Managed



24M+

Patients Served



83 M+

Visits Managed



35+

Years of Excellence



63+

Modules

TRUSTED BY LEADING HEALTHCARE ENTITIES



+43

Hospitals



+16

Hospitals



+45

Private Healthcare Facilities



Proudly serving the public and private healthcare sectors with 24/7 support and local presence across the Kingdom.

2. Many organizations have implemented HIS systems, yet operational challenges remain. What is missing today?

■ Technology alone is not enough. Most providers struggle with change management, data quality, and fragmentation across HIS, RCM, and ERP systems never designed to work together. This is exactly the gap OASIS closes — one integrated platform, one data model, one source of truth.

3. How are AI, interoperability, cloud, and patient engagement reshaping operations?

■ They are turning data into decisions at the point of care. At OASIS, AI is being embedded across clinical, RCM, and ERP workflows — predicting claim denials, automating coding, flagging high-risk patients, and giving leadership real-time intelligence. Combined with our 70+ integrations across NPHIES, insurers, devices, labs, and patient channels, this is healthcare AI applied at scale.

4. What are the biggest challenges in digital transformation?

■ User adoption, legacy systems, integration complexity, cybersecurity, and ROI measurement. Success requires the right partner. OASIS delivers local implementation teams, 24/7 in-Kingdom support, and a proven track record across 100+ hospitals — customers are never alone, and never dependent on a vendor thousands of kilometres away.

5. What differentiates OASIS Systems in the Saudi healthcare technology market?

■ OASIS Systems is among the few regional healthcare platforms offering fully integrated HIS, ERP, and RCM solutions within one unified ecosystem. Through OASIS+ for Hospitals and OASIS Care for PHCs and Clinics, the platform delivers more than 63 integrated modules designed to support connected, scalable, and intelligent healthcare operations aligned with Vision 2030 objectives.

We look forward to welcoming you at Global Health Exhibition 2026 – Booth H2A.C30 – to explore our latest innovations in digital healthcare transformation, AI, interoperability, and patient-centered solutions.

6. OASIS has operated in the Saudi market for more than 35 years. What lessons have you learned from supporting both government and private sectors?

■ Every organization is unique. Flexibility and listening to customers built our platform: 60+ clinical, administrative, financial, and analytical modules, and 70+ active integrations. We did not adapt to Saudi healthcare from the outside — we grew with it from the inside.

7. How important is Revenue Cycle Management (RCM) in the future sustainability of healthcare organizations?

■ RCM is the financial nervous system of every provider, especially as the Kingdom moves toward value-based care. OASIS RCM is built natively inside our HIS and ERP — not bolted on. Clinical entry, eligibility, claims, and GL posting happen on one record. The result: fewer denials, faster cash, real-time financial transparency.

8. What role should Saudi healthcare technology companies play in supporting Vision 2030?

■ Local companies play a vital role in building national capabilities, driving innovation, ensuring data sovereignty, and creating sustainable solutions tailored to our market. We must collaborate, innovate, and empower the healthcare ecosystem.

9. What is the next strategic chapter for OASIS?

■ Scale Oasis+ for hospitals and Oasis Care for PHCs, polyclinics, and day surgery centers, deepen embedded AI across HIS/RCM/ERP, expand multi-tenant SaaS capabilities, and continue regional expansion. MEH

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Our mission is simple: empower healthcare providers with intelligent solutions that improve outcomes, enhance efficiency, and create meaningful experiences for patients and caregivers.

- Eng Abdulhameed Attar, CEO, Balsam United Company (OASIS Systems)

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1990s

The Beginning
OASIS system
developed to
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healthcare needs.



2000s

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Expansion
Expanded across
hospitals and regions
with a strong local
team.



2010s

Innovation &
Integration
Advanced clinical
modules, integration
capabilities, and
patient portals.



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Aligned with
NPHIES and national
digital
health initiatives.



2024+

The Future
AI, analytics, cloud,
interoperability, and
patient-centered
innovation.

clinician spotting an elevated HbA1c and a patient actually walking into a lifestyle programme can be reduced to a few key-strokes during a routine visit. As the authors put it, “an eReferral is a promising, scalable strategy to connect patients with prediabetes to community DPPs.”

That matters because even small gains in engagement become epidemiologically meaningful at population scale. As the authors note: “Even small improvements in patient engagement, if highly scalable, could result in substantial public health benefits.”

How the eReferral was built

The team, led by Dr Dina H. Griauzde of the VA Ann Arbor Healthcare System and the University of Michigan, designed the order in consultation with the health system’s information technology, compliance and legal teams. Clinicians find it by searching terms such as diabetes prevention or NKFM in the standard Epic order panel – the same workflow they use for any other referral.

The order displays the DPP eligibility criteria (age ≥ 18 years, BMI ≥ 25 kg/m², and either prediabetes or a history of gestational diabetes), auto-populates the patient’s most recent HbA1c value if available, and allows an optional free-text comment. Once signed, it generates a privacy-compliant referral letter routed via EpicCare Link – Epic’s secure web portal for sharing patient information with outside organisations – to a message pool monitored by NKFM staff. Those staff then telephone the patient to explain the programme, verify eligibility, and book them into an information session.

To keep the protected health information footprint minimal, the team deliberately disabled the feature that would allow the community organisation to write back to referring clinicians. Clinician education was also light by design: just two emails to a primary care listserv during the three months after launch.

Reach, adoption and the long tail of users

The researchers evaluated 13 months of re-

al-world use, from June 2021 to June 2022, against the RE-AIM framework (reach, effectiveness, adoption, implementation, maintenance) – well suited to assessing real-world sustainability and scalability rather than mechanistic context.

During that window, 577 patients were referred. Among the 350 targeted primary care clinicians across 14 clinics, 30% (108) used the order at least once. An additional 16 non-targeted clinicians – mostly specialists embedded in the same clinics – also picked it up, suggesting the order diffused organically beyond the intended audience.

The distribution of use, however, was strikingly uneven. The median clinician placed just two referrals, but the range stretched from one to 46. A small group – 11% of referring clinicians, or 14 people – accounted for 51% of all referrals. Conversely, 45% of clinicians used the order exactly once. This long-tail pattern is familiar to anyone who has watched a clinical decision support tool roll out, but it raises a question: is the eReferral catalysing sustained behavioural change in most clinicians, or mostly amplifying the efforts of an already-engaged minority?

The authors are candid. “Future work should explore reasons for this variation and develop targeted strategies to increase appropriate use of the referral,” they write, suggesting grand rounds presentations, EHR best-practice alerts, or alternative pathways such as patient self-referral or population health nurse outreach.

Enrolment: the conversion gap

Of the 577 patients referred, 27% attended a DPP information session and 21% (122 patients) went on to enrol in a class. That conversion rate is consistent with prior work but it also defines the next problem to solve. A referral that does not become an enrolment does not prevent diabetes.

The researchers are clear-eyed that the reach figure – 1.4% of an estimated 30,595 eligible patients during the study period – is modest. They argue, reasonably, that the evaluation period coincided with the COVID-19 pandemic, when only virtual

DPPs were available, which may have dampened both clinician enthusiasm and patient uptake.

Fidelity and the limits of “light touch”

Roughly 73% of referred patients strictly met the predefined eligibility criteria; using broader CDC eligibility criteria (which permit a lower BMI cut-off of ≥ 23 kg/m² for patients identifying as Asian – important given higher diabetes risk at lower BMI in South and East Asian populations – and qualification via an elevated prediabetes risk score), fidelity rose to 81%. The most common reasons for ineligibility were a BMI below 25 kg/m² or an HbA1c outside the 5.7–6.4% range; 23% of ineligible referrals involved patients with an existing type 2 diabetes diagnosis.

Importantly, NKFM staff reported informally that ineligible referrals did not place an undue burden on the organisation – and as the authors point out, “most people can benefit from participation in a group-based lifestyle program, even if they do not meet strict DPP eligibility criteria.” Future iterations could embed clinical decision support to tighten targeting where resources are constrained.

Use of the order was also maintained without further nudges: an average of 45 referrals per month in the final quarter versus 54 per month in months two through eight.

The bigger picture

The study lands at a moment when the prevention conversation is shifting globally. GLP-1 receptor agonists are reshaping obesity treatment in markets that can afford or access them, and the authors flag that DPPs may need to evolve – perhaps emphasising resistance training and high-protein diets to preserve muscle mass – for patients on these medications. Equally, lifestyle programmes remain the only realistic option for the many patients without coverage for obesity pharmacotherapy.

As the authors conclude: “Connecting health systems with community-based organizations that provide evidence-based treatment programs such as the DPP is a vital step in improving the health of patients and communities.” 

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Scherr, K. A., Turner, C. D., Wolf, S., et al. (2025). Use of an electronic health record order to directly refer patients with prediabetes to community-based diabetes prevention programs. *Annals of Family Medicine*, 23(5), 449–456. <https://doi.org/10.1370/afm.240337>

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Auto Disable Syringe

Oneject Auto Disable Syringe design is a simple yet effective technology by Star Syringe Limited (UK). Following an injection the plunger locks and disables automatically rendering the syringe unusable.

Safety Needle

Oneject Safety Needle offers high quality stainless steel needles for fine and painless needles with special silicone.

Disposable Syringe

Safeject Disposable Syringe that uses Oneject Safety Needle so that it has a higher level of security.

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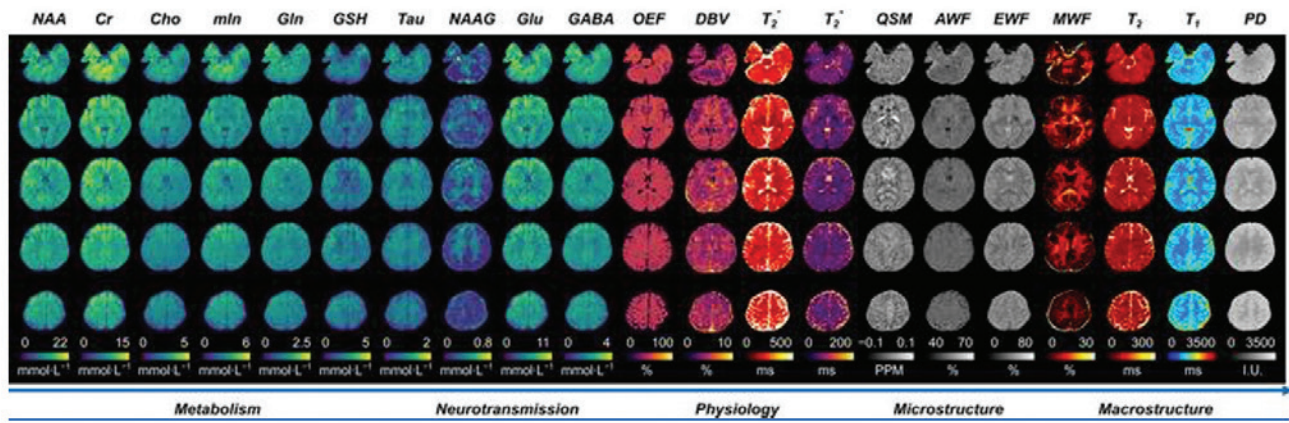
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Whole-brain images from a healthy volunteer encompassing 21 biomarkers, taken in a single MRx scan. The information provides a comprehensive spectrum of information on tissue metabolism, neurotransmission, physiological function and structural characteristics. These biomarkers offer potential for better early detection and more accurate diagnosis and prognosis of brain diseases.

One scan, 21 biomarkers: the MRI upgrade that could upend neurological diagnosis

A new AI-powered imaging framework called multiplexed MRI, or MRx, can simultaneously map more than 20 structural, physiological and molecular biomarkers of the whole brain in a single 14-minute scan on standard clinical hardware. Published in *Nature* on 6 May 2026, the technology – developed at the University of Illinois Urbana-Champaign – has already demonstrated superior characterisation of brain tumours and multiple sclerosis lesions, and could fundamentally alter how neurological disease is detected, staged and managed.

Walk into an MRI suite today and the fundamental workflow has changed remarkably little since the 1970s. The patient lies still, the machine hums, and the radiologist receives a handful of anatomical images – T1- and T2-weighted scans, perhaps a diffusion sequence – that reveal what tissue looks like, but offer only glimpses of what it is actually doing at a molecular level. For a clinician trying to distinguish the grade of a glioma, characterise an active multiple sclerosis (MS) lesion, or detect the earliest biochemical fingerprints of Alzheimer's disease, that limitation matters enormously.

The implications for clinical practice are immediate and far-reaching. Research published in *Nature* this week describes a system that, used with existing 3T clinical scanners and no contrast agents, can deliver a comprehensive metabolic, physiological and structural portrait of the brain – in roughly the time it currently takes to run a conventional T1-weighted sequence alone.

What MRx actually does

Conventional clinical MRI exploits the magnetic resonance signal from tissue water molecules, generating the high-resolution anatomical images that have made the modality indispensable. More than 100 million scans are performed worldwide each year. What that water signal cannot readily cap-

ture, however, is the rich molecular activity occurring simultaneously: the concentrations of N-acetylaspartate (NAA), creatine (Cr), choline (Cho), myo-inositol (mIn), glutamate (Glu), glutamine (Gln), γ -aminobutyric acid (GABA), glutathione (GSH) and a suite of other metabolites and neurotransmitters that together reflect neuronal integrity, glial proliferation, cell membrane turnover, inflammation, oxidative stress and synaptic function. These can be accessed individually through MR spectroscopy or spectroscopic imaging, but not simultaneously, and not in clinically practical scan times.

MRx changes that equation by redesigning both data acquisition and processing from the ground up. Rather than selectively exciting specific molecules as existing techniques do, the system uses wideband radiofrequency pulses to excite and encode the entire detectable proton spin system – water and metabolites alike – in a single rapid, sparsely sampled acquisition. Specialised spin-echo modules encode T1, T2 and J-evolution information simultaneously, while variable-density sparse sampling of the high-dimensional data space keeps acquisition times manageable.

The result of a 14-minute whole-brain scan is simultaneous maps of 21 biomarkers spanning metabolism (NAA, Cr, Cho, mIn, Glu, Gln, GABA, GSH, Tau, NAAG),

neurotransmission, physiological parameters including oxygen extraction fraction (OEF) and deoxygenated blood volume (DBV), and structural characteristics including myelin water fraction (MWF), axonal water fraction (AWF) and quantitative susceptibility mapping (QSM).

The AI backbone

Capturing all that signal is only half the challenge. Disentangling and quantifying it is arguably harder, because the molecular signals are three to four orders of magnitude weaker than the water signal, they spectrally overlap substantially, and reconstructing a high-dimensional image from sparse data is mathematically ill-posed. This is where MRx's physics-based machine learning framework does its critical work.

"MRx is a new artificial-intelligence-powered imaging framework that can measure many markers without the need for contrast agents," said study co-author Rong Guo, formerly a PhD student in the Liang group and now a senior scientist at Siemens Healthineers. "With our integration of ultrafast data acquisition and physics-based machine learning methods for data processing, MRx overcomes several longstanding bottlenecks to fast, high-resolution multiplexed imaging. This gives clinicians and researchers better understanding of not only the brain's struc-



Inclusion changes the world

Let's celebrate World Autism Awareness Day on April 2nd along with the launch of our initiative to integrate individuals on the spectrum into the workforce.

Space courtesy



ture, but also its physiology and molecular processes, within a single imaging framework.”

The processing pipeline uses physics-based linear subspace models – derived from quantum mechanical simulation of molecular signals – synergistically with neural networks trained on distributions of expected biomarker values. A Bayesian reconstruction framework integrates these priors with the acquired data, effectively enabling high-quality reconstruction from the highly sparse, noisy measurements that ultrafast acquisition inevitably yields.

Tumour characterisation: beyond the T1 contrast

The clinical demonstration that will likely attract the most immediate attention involves brain tumours. Eight patients with histologically confirmed tumours – spanning low-grade oligodendroglioma (WHO grade II and III) through to glioblastoma multiforme – underwent both MRx and standard clinical imaging, including post-contrast T1-weighted and FLAIR sequences.

Where conventional MRI separates tumour core from oedema by their gross appearance, MRx provides a multidimensional metabolic fingerprint of each tissue compartment. The researchers observed metabolic alterations, oedema, axonal damage and demyelination in tumour tissue, and found that the combined MRx biomarker profiles could differentiate tumour subtypes that appear similar on standard structural imaging. Elevated GABA in oligodendrogliomas, changes in oxygen extraction fraction in high-grade lesions, and lactate elevations consistent with anaerobic metabolism contributed to a tissue state index that had clear discriminative power across tumour grades.

The authors note in their Discussion that MRx could enable “differentiating between low-grade and high-grade brain tumours and separating among normal-appearing tissues, enhancing tumour core and peritumour oedema” – distinctions with direct implications for radiotherapy target delineation and surgical planning.

Multiple sclerosis: staging lesions without gadolinium

The MS findings are equally compelling.

Currently, identifying active versus chronic MS lesions typically requires gadolinium-based contrast agents, which carry their own risk profile and are increasingly scrutinised for gadolinium deposition. MRx characterised lesions at different stages by detecting changes related to inflammation, demyelination, gliosis, axonal injury and metabolic activity – all without contrast agents.

Notably, the authors found that subtle MRx biomarker patterns could reveal early tissue alterations and help predict lesion progression, suggesting a potential role in prognosis as well as diagnosis. The ability to identify chronically active lesions – a phenotype associated with more aggressive disease course – based on metabolic and myelin markers rather than contrast enhancement alone could have meaningful implications for treatment decisions.

Clinical feasibility: speed and existing hardware

A point the investigators are emphatic about is that MRx runs on standard 3T clinical MRI systems – the workhorse of hospital radiology departments worldwide. No hardware upgrade is required. The 14-minute whole-brain acquisition compares favourably with conventional multicontrast clinical MRI protocols that can take up to an hour, potentially making the technology straightforward to integrate into routine clinical workflows once validated at scale.

“MRx can be a powerful tool for noninvasive tissue characterisation, helping to advance personalised, precision and predictive medicine,” said Zhi-Pei Liang, professor of electrical and computer engineering and Beckman Institute member at the University of Illinois, who led the research. “By providing rich, multidimensional biomarkers to capture disease progression and treatment response, this capability could open new opportunities for more precise diagnosis, individualised treatment planning and improved patient outcomes.”

The wider horizon

Beyond tumours and MS, the paper’s Discussion maps out a broad potential application space. In stroke, the simultaneous capture of oxygen metabolism, perfusion

and tissue viability could help identify salvageable penumbral tissue rapidly in acute settings. In epilepsy, integrating NAA and mIn with structural changes could guide surgical planning. The authors argue that in Alzheimer’s disease, MRx could offer insights into early disease by simultaneously assessing molecular markers of neuronal dysfunction, oxidative stress, demyelination and amyloid-related iron deposition – a multi-target profile currently impossible to obtain non-invasively in a single session.

The authors also point to an emerging opportunity in so-called digital twin modelling for precision medicine, noting that current generative AI models for disease prediction are constrained by the limited richness of available imaging biomarkers. MRx data, they suggest, could help address that.

What remains to be done

The current study is, as the authors acknowledge, a feasibility demonstration rather than a prospective clinical trial. Patient numbers are small – eight tumour patients and seven with MS – and the work was performed at a small number of centres, albeit with reproducibility assessments across four sites. Large-scale multicentre validation, regulatory clearance pathways and health economic analyses lie ahead before MRx becomes part of routine radiological practice.

“Diseases such as tumours, multiple sclerosis and neurodegenerative disorders are highly heterogeneous,” said Yudu Li, professor of bioengineering at the University of Illinois and first author of the paper. “The rich set of biomarkers obtained using MRx has the potential to provide deeper insights into brain function and disease processes, while also improving the sensitivity and specificity of detection and diagnosis.”

That is, in essence, the promise: not a replacement for what MRI already does well, but a radical expansion of the biological information it can deliver – without new hardware, without contrast injections, and within a clinically acceptable time window. Whether that promise translates into routine diagnostic impact will depend on the trials and regulatory work still to come. But the engineering foundations, at least, appear firmly laid. MEH

Journal reference:

Li, Y., Guo, R., Zhao, Y., et al. (2026). Multiplexed magnetic resonance imaging. *Nature*. <https://doi.org/10.1038/s41586-026-10475-x>



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