

P04 Self-help gadgets are keeping hearts healthy

P06 New technology and techniques are saving lives

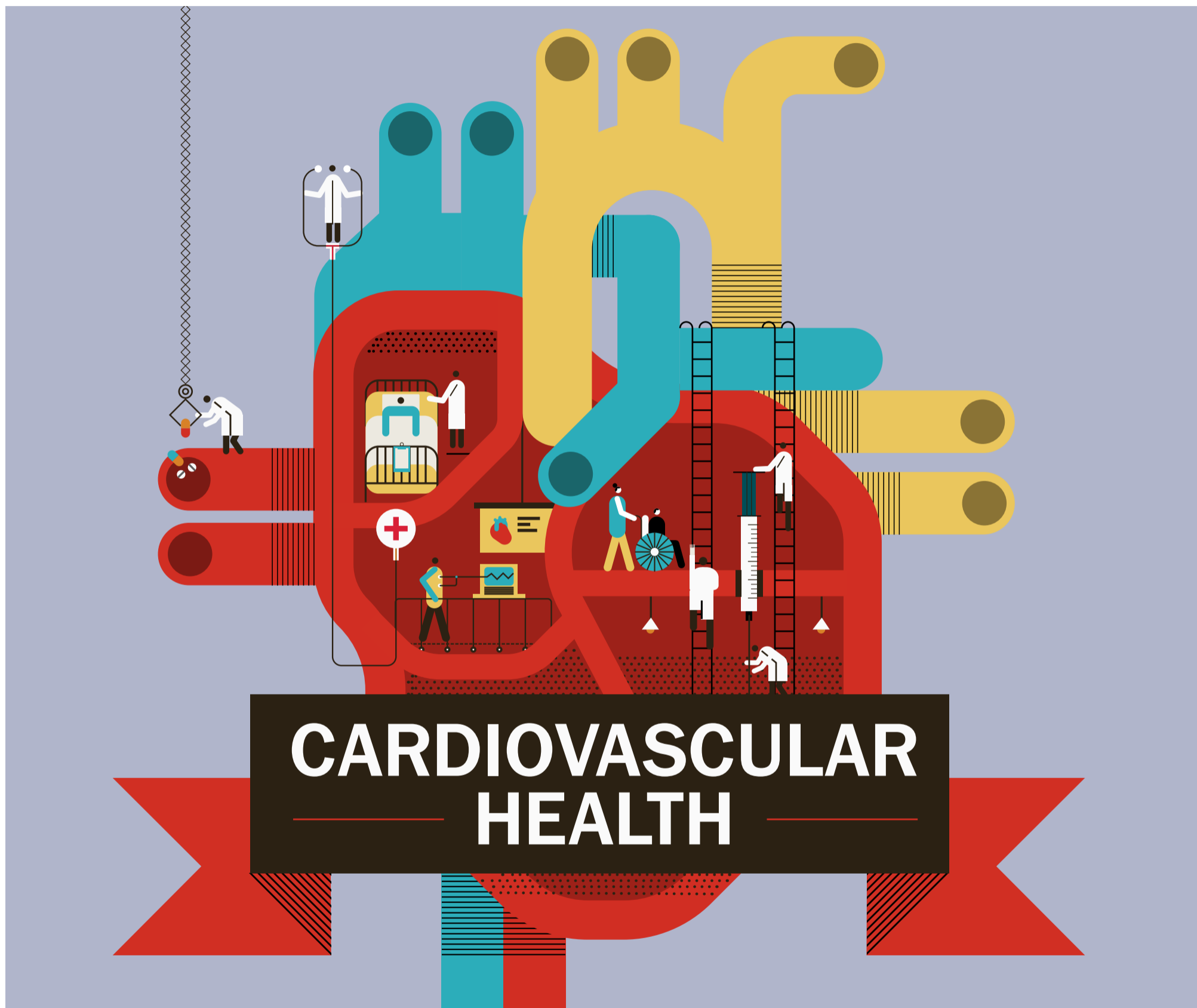
P07 Building a working heart with 3D printing



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IN MEMORY OF

Amirali G. Mamdani, 1934–2014,
 and all those who suffer from CVD

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Overview

GETTING TO THE HEART OF THE MATTER



Despite great strides in cutting the death rate, there is still some way to go in improving the treatment and prevention of heart disease in parts of the UK, writes Nigel Hawkes

The reduction in deaths from cardiovascular disease has been one of the greatest success stories of the past decade. Death rates for coronary heart disease fell in England by 43 per cent between 2001 and 2010, and for stroke by 37 per cent. The figures were even better for premature mortality, with a 46 per cent reduction in death rates from heart disease in those under 75 and a 42 per cent decline in stroke.

Yet cardiovascular disease remains the commonest cause of death, responsible in 2010 for 180,000 deaths in the UK – just under a third of the total – and for 46,000 deaths in people under 75. The burden varies by sex, age, social class and where you live. Death rates in Scotland have fallen more slowly than those in England and remain significantly higher. The relative gap between rich and poor has widened slightly.

And international comparisons, such as the *Global Burden of Disease Study* published in *The Lancet* last year, show that although things have got a lot better in the UK, the same is true of other countries, some of which have done better

still. Looking at the years of life lost to heart disease, the UK has moved from 17th out of 19 to 14th between 1990 and 2010, a modest improvement in the league table; for stroke, it has moved down one place, from 12th to 13th. It remains below the EU15 average for heart disease and about average for stroke. It is clear that there is more to be done.

Disability has declined along with death, but remains large, imposing a burden on individuals, the NHS and the economy as a whole. A total of 2.3 million people in the UK have coronary heart disease and 1.3 million have had a stroke, the British Heart Foundation estimates. It puts the cost of caring for them at just under £10 billion a year and the total cost at more than £21 billion a year.

FOCUSING ON IMPROVEMENT

How can outcomes be improved? The plan produced by NHS England relies on better detection of those at risk, improved control of risk factors and enhanced organisation of care. The overriding principle is to manage cardiovascular disease as a family of diseases, since patients who have one often

develop another, linked by common risk factors: heart disease, peripheral arterial disease and vascular dementia, for example.

The NHS Health Check programme, which offers tests for all those aged between 40 and 74 without previous evidence of disease, aims to identify those at risk. But take-up has been slow, costs are high and many of those found to be at risk could have been identified anyway through GP records.

Acute care for heart attack and stroke varies widely from excellent to poor

Once identified, those at risk are offered advice on lifestyle, diet and exercise; giving up smoking is the single most effective change. But behavioural advice is notoriously hard to follow and tends to widen inequalities, with better-educated people who already have lower risks more likely to comply.

Drugs to reduce blood pressure and blood cholesterol may also be prescribed. Already 7.5 million people are prescribed statins, a number that could increase by a further 4.5 million if the advice from the National Institute for Health and Care Excellence (NICE) to lower the bar to prescribing the drugs is followed. NICE believes this could save an additional 4,000 lives a year at a

cost of £52 million. But influential doctors have questioned the wisdom of medicalising so many outwardly healthy people.

High blood pressure is poorly identified and treated, *The Lancet* study found, with many cases undetected and only around a third of those identified adequately treated. Improving this provides a large scope to improve outcomes.

Acute care for heart attack and stroke varies widely from excellent to poor. The plan is to build on what is already good by concentrating care in fewer more specialised centres, a change often opposed by local interests. The reconfiguration of stroke services in London has reduced mortality by 28 per cent by concentrating specialist care in fewer stroke units and is a model commissioners in other parts of the country are being urged to follow.

Some quick wins might come from focusing on areas where services are poor. For example, too little is done to follow up with patients who suffer mini-strokes – transient ischaemic attacks – though one in twenty will go on to have a stroke within a week. And while patients with the most severe heart attacks are already routed by ambulance crews to cardiac centres, this should be extended to less severe cases, avoiding later transfers. Heart failure, increasingly common in an ageing population, has suffered relative neglect. And the UK lags other European countries in its use of implantable defibrillators to control heart rhythm disorders. ■

SELF-HELP GADGETS

Adopting a healthy lifestyle is by far the best way to improve heart health and innovative technology, including wearable devices, could help, as Ellie Broughton discovers

One of the biggest threats to our health is cardiovascular disease or CVD. It is the number-one cause of death globally, but many of the biggest risk factors for CVD come from our lifestyle choices. According to the World Health Organization, most cardiovascular diseases can be prevented by addressing risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity, high blood pressure, diabetes, and raised lipids.

An *American Journal of Cardiology* study on the value of even minimal exercise in decreasing risk for CVD found that running, even for just five to ten minutes a day, is associated with markedly reduced risks of death from all causes and cardiovascular disease.

In the last ten years, doctors have increasingly called for greater use of statins, the most common preventative medicine against CVD. The clamour reached a crescendo after the National Institute for Health and Care Excellence, the body responsible for clinical guidelines, recommended patients be prescribed the drugs even if they only have a 10 per cent risk of developing CVD in the next decade.

But the challenge of motivating healthy lifestyles remains. Fitness apps for smartphones have proved to be among the most popular technology for encouraging a healthier lifestyle. From MyFitnessPal to the NHS's Stop Smoking app, there are now easy ways to motivate and monitor a heart-healthy lifestyle.

For example, one of the main risk factors for stroke is atrial fibrillation (AF) because the irregular heartbeat caused by AF makes the blood flow more turbulent, which can sometimes cause a small clot. If this travels to the brain, it can cut off part of the blood supply and cause a stroke.



HOME MONITORS

Traditionally patients have been diagnosed with AF in hospitals or clinics, but a company called AliveCor recognised the potential for people to screen for AF at home, and developed an app and mobile phone attachment to detect the condition by monitoring the patient's heartbeat.

Matthew Fay, a GP with a special interest in cardiology and former national clinical lead for AF, currently runs a service using these products to detect arrhythmic cardiac disease, irregular heartbeat or abnormal heart rhythm, with symptoms including palpitations, dizziness, fainting, shortness of breath and chest discomfort. His is so far the only service in the UK to use the mobile app and attachment.

The biggest strength of having a mobile phone attachment, he says, is that people very rarely go anywhere without their phone, so the device is usually to hand.

He has had plenty of success using the device and, in one particular case, his patient had experienced symptoms for 17 years, seen three cardiologists in two countries and was told she was mentally ill by one doctor. She was diagnosed with dysrhythmia or irregular heartbeat within five days of using the attachment.

However, as Dr Fay points out, he uses the smartphone technology only on specific cases of patients with intermittent palpitation suggestive of cardiac dysrhythmia. At the moment, he says, wearable technology is unproven in clinical trials, has no cost-effectiveness evidence for health systems such as the NHS and is unlikely to cover large enough populations to make a difference to society's present cardiovascular disease burden.

"Ultimately prevention of cardiovascular disease is relatively simple and ultimately quite boring," he adds. "It's a shame we do it so badly, with such devastating consequence."

The most common wearable technology for exercise at the moment is the activity tracker. Popular models include the Jawbone,

Fitbit and the Nike FuelBand. The devices often work by transmitting information directly to the internet or other devices. This is known as machine-to-machine communication or the internet of things. They may link to a mobile device, such as a smartphone or tablet, where activity and energy consumption, for example, can be monitored or compared.

THREE ISSUES

But such devices are not without their challenges. Tom Dawson, founder of UK wearables development company ResCon, says there are three main issues developers need to deal with when designing wearables.

Firstly, he says: "Before we even start, there needs to be motivation from education, cultural change and sometimes crisis."



Fitness apps for smartphones have proved to be among the most popular technology for encouraging a healthier lifestyle



WEARABLE TECHNOLOGY TO HELP YOU GET FIT

MEASURING ACTIVITY



Fitbit manages two major risk factors for cardiovascular disease (CVD) – inactivity and obesity. The device is not specifically targeted at people at high risk of CVD, but like other activity trackers, it is one of the most commonly used wearables on the market.

The company's latest update, the Fitbit Force, was launched last October and features an OLED display that shows time and daily activity.

The Fitbit device is worn like a watch or bracelet and transmits real-time information about how much the wearer exercises and sleeps, among other measures of activity. Users can read data about how healthy their lifestyle is by logging into the Fitbit website or the mobile app.

Last May Fitbit held a reported 50 per cent share of the wearables market, selling more than a million bands in the first quarter of 2014.

STEP-BY-STEP MONITORING



The pedometer was dreamed up by Leonardo da Vinci, but wasn't realised until 1780 when a watchmaker created the first mechanical device that could count steps and measure walking distances. Popularised in 1960s Japan, the main flaw with the pedometer is inaccuracy. Also cheaters could simulate exercise by tapping or hitting some devices against hard surfaces, thus faking a higher level of activity.

Nowadays it's common for multifunctional devices, such as smartphones and iPods, to do the job of the old single-function device. Phones contain hardware called an accelerometer, which measures force of movement and relative change in the height of the device to detect a step. Some devices use a co-processor, and combine a compass and a gyroscope with an accelerometer, to improve accuracy.

LISTENING TO YOUR HEART



Ever heard the blood pulsing through your ears at the end of a run? The ears are one of the best places on your body to measure heart rate and the designers of new "smart" ear buds have created wearables to do just that.

Smart ear buds sit in your outer ear. From their snug position, they can monitor your pulse and send information back to an app. You can then analyse data about how your heart rate changed during a

run, and get the lowdown on distance, calories burnt and how hard your heart worked. They also double as headphones that play music during your workout.

LG and Intel both produce smart ear buds. The LG model, HeartRate, offers bespoke in-ear training updates, and the Intel version, co-produced with SMS Audio, is battery free. Another model, produced by Bragi, has four gigabytes of storage space on the device for music files.

TAKING THE PRESSURE



Whether it's a preventative measure or a way to manage your own health, wearing a blood pressure monitor is now easier than ever. Gone are the days when subjects would be wired up to bulky monitors and checked using huge nylon cuffs. Wireless blood pressure monitors are now available to use at home and some models can be used for ambulatory blood pressure monitoring as you go about your day. They work by monitoring

blood pressure from a device worn on the arm or wrist, and transmitting it wirelessly via Bluetooth to an app on a mobile phone, tablet or computer where you can read and analyse the results. High blood pressure is a significant risk factor in developing CVD, so monitoring the effectiveness of new medication or a better diet might reassure people that lifestyle changes are having the right effect.

Second is the concern that people will start to focus on the tech at the expense of using their own knowledge and experience. "People cannot rely on wearables or apps to reduce their CVD risk. In the end they need to be relying on themselves. Wearables and apps need to be tools to enable a positive change in lifestyle and subsequently performance in day-to-day life," he says.

And echoing Dr Fay, Dr Dawson says the third issue is getting over the lack of interest in healthy living.

Wearables are unlikely to be a solution for everyone and are only likely to have a short-term benefit. Dr Deborah Lupton, a sociologist who researches self-tracking and digital health technologies at Australia's University of Canberra, points out that most people who buy apps and wearables are already interested in voluntarily managing their own health and don't use the apps or devices for long.

In the end, intuition is sometimes the smartest "app" we have for monitoring our own health. "We need to remember not to invest all our trust and faith in digital devices, and incorporate information from various sources, including how we feel, when monitoring and assessing our health," she concludes. ■

Future of Treatment



WAY AHEAD IN TREATMENT

Promising new techniques and treatments for cardiovascular disease are saving lives and transforming patients' experience, writes **Victoria Lambert**

Assembling an Edwards Lifesciences SAPIEN transcatheter heart valve

surgery. Mr Bapat continues: "At Guy's, we are now carrying out 75 per cent of heart surgery in a minimal way, usually without the need to crack open the chest." He expects it to be common practice throughout Britain within a few years, although open heart will always remain the gold standard.

One of the problems in heart surgery is ensuring patients are fit for procedures, a particular problem in atrial fibrillation (AF) cases, where cardioversion – a dose of electric current to the heart – aims to get the beat back into a normal rhythm.

Normal practice, says Oliver Segal, consultant cardiac electrophysiologist, at The Heart Hospital in London, is for patients to be on three weeks of successful, monitored warfarin anticoagulant therapy prior to the operation.

But warfarin is a notoriously tricky drug; it is effective, but not consistent, with poor patient compliance. "Some patients end up waiting months for their operation while we try to get three successive weeks' results so that we can operate safely," says Dr Segal.

DRUG TRIAL

Now results of a trial of a drug called rivaroxaban show that it could be an effective and well-tolerated alternative to warfarin, allowing for much more easily planned cardioversion. Dr Segal says: "It's a great step forward in terms of managing AF as patients are getting cardioversion much faster on average than before." The study found patients on rivaroxaban were then treated with cardioversion 22 days later as opposed to 30 days using warfarin.

Meanwhile, for patients with pacemakers, there is good news from the University of Bern, Switzerland, where scientists are turning the county's clock-making expertise to smart use by designing a natural battery. "Pacemakers have two weak spots," researcher Adrian Zurbuchen explains. "Leads are prone to fracture and the lifetime of batteries is limited." He aims to use the motion of the heart to wind a spring, accumulating mechanical energy to power a pacemaker permanently.

The last area of innovation is monitoring, and here new telemedicine systems are ensuring data is collated and downloaded straight to cardiologists' PCs, to ensure patients are treated more promptly and to spot potential acute incidents.

A recent meta-analysis in the *Journal of Cardiopulmonary Rehabilitation and Prevention* found emerging evidence that internet-based interventions, such as home monitoring, may reduce cardiovascular risk in cardiac patients and in populations with a heightened risk of CVD. It concludes that "such interventions may also represent an alternative method of providing CVD prevention strategies".

Biodegradable stents, battery-free pacemakers, even assays in the lab which end the need for animal testing – advances in coronary medicine are coming thick and fast. And what's exciting for cardiologists is how many developments are within grasp; these are not theories, but work in progress.

Know your risk
Page 08



At a laboratory level, consider the new assay being produced by the Coventry University spin-out company InoCardia, founded by Helen Maddock, which has the potential to predict the drugs that will be a problem in terms of safety and efficacy, before they go into clinical trials.

Dr Maddock explains: "All drugs have to be tested for safety [phase 1] before efficacy [phase 2 and 3] trials, but testing the effect drugs have on the contractility of the heart has always been difficult. This is because it is very difficult to mimic the way the heart muscle works – it contracts and relaxes, but also fills and empties with blood at the same time; it's a very dynamic muscle.

"So researchers have not been able to recreate that artificially very

well and at best have been forced to use whole animals or less sensitive tests for research, which are not ideal and are not always able to predict effects on heart contractility at clinically relevant doses."

Instead Dr Maddock's team have developed what is known as a work-loop assay. It's an in-vitro model, consisting of a muscle undergoing a "contract and relax" cycle while being stimulated via an electrical impulse. This way scientists can assess mechanical muscle performance to a new drug compound.

"Previously, drugs could get through initial lab tests and look safe, but prove problematic once they were being used in a proper phase-1 trial in humans. This isn't just costly and wasteful, but potentially dangerous," says Dr Maddock. She hopes the technique will be available for use by next January.

STENTS FOR HEART VALVES

Over in the operating theatre, Vinnie Bapat, consultant cardiothoracic surgeon at Guy's and St Thomas' in London, is at the forefront of new techniques using stents to relieve blocked heart valves. "Traditionally, there were two ways of performing valve surgery: the gold

standard of open heart surgery and more recently TAVI or transcatheter aortic valve implantation," he says.

TAVI is a much less invasive procedure. A stent or small tube is inserted into the damaged aortic valve via a catheter entering through the artery at the groin and is suitable for high-risk patients.

But both methods are being refined. In TAVI, stents with "skirts", frilled edges which make the valve watertight and prevent potential dangerous leakage of blood in the wrong direction, are becoming available. New imaging techniques are improving surgical accuracy. Newly engineered stents are even flexible enough to be moved and repositioned if they are not perfectly sited first time. Some will be bioresorbable or biodegradable.

There is also stent-in-stent surgery, in which Mr Bapat's team are world leaders. "Stents don't last forever and the younger you are, the faster they wear out," he explains. "Now we have found a way to place a stent inside a previous stent to keep it open." He has helped build a teaching app for stent-in-stent surgery which is being downloaded worldwide.

In open heart surgery, new techniques are based around keyhole

5,000

aortic valve replacements are carried out every year in the UK, still mostly by open heart surgery

Source: NHS

8 days

saved pre-op when patients take new drug rivaroxaban before cardioversion or controlled electric-shock treatment

Source: European Heart Journal

2mm

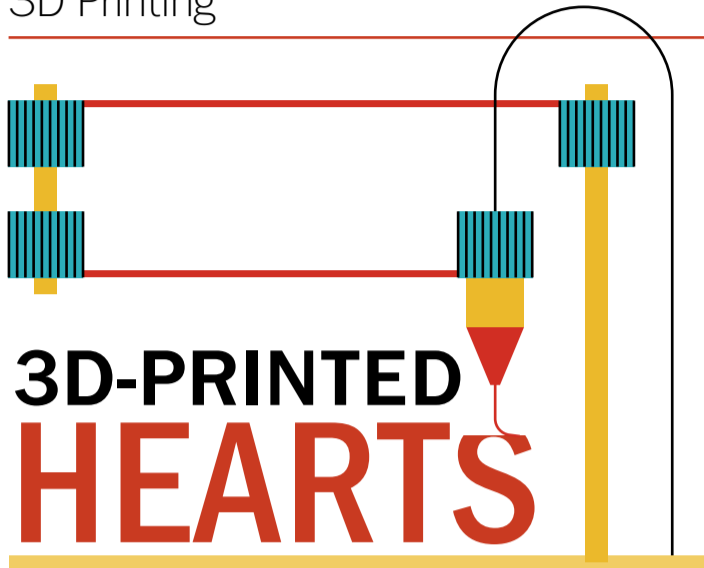
diameter of a stent used for small coronary arteries

Source: National Institute for Health and Care Excellence



Now we have found a way to place a stent inside a previous stent to keep it open

3D Printing



3D-PRINTED HEARTS

Advances in 3D-printing technology present the prospect of building a working heart from human tissue, as **Lorena Tonarelli** reports

Three-dimensional (3D) printing is a major driver of innovation in cardiovascular medicine, with surgeons already using the technology to create synthetic heart models that enable them to plan or even rehearse complex operations – a procedure that can substantially reduce surgery times and improve patient outcomes.

Now the technology is moving to more cutting-edge applications, including an elastic soft silicone membrane shaped to match the outer layer of the heart's wall, containing sensors that measure pH or acidity, temperature and mechanical strain or deliver electrical impulses.

ate cardiac contractile cells and the heart's electrical system."

So far, US and European researchers have 3D printed, from living (but not necessarily human) tissue, sections of cardiac muscle, valve conduits and blood vessels, which could soon be available to patients as replacements for damaged parts. According to Kevin Shake-shoff, professor of tissue engineering at the University of Nottingham: "This appears to be a realistic goal for the next ten years. And the UK is set to be among the first to offer the technology, with leading stem-cell and 3D-printing scientists, world-class heart surgeons and state-of-


Scientists are turning to 3D-printing technology to build complete hearts using human tissue

Developed at Washington University in St Louis, Missouri, the device could monitor cardiac performance, "providing clinicians with a set of internal eyes guarding patients' progression into and from disease", says Professor Igor Efimov, who led the project. As such, it could provide instant feedback on therapies, correct arrhythmias or irregular heartbeat and predict impending heart attacks.

More ambitiously, scientists are turning to 3D-printing technology to build complete hearts using human tissue. "The goal is to recreate the various components of the organ and assemble them together," explains Dr Stuart Williams, director of the Bioficial Organs Programme at the University of Louisville, Kentucky. "We are currently building a 3D-printed heart valve using the patient's own cells, which will reduce the need for blood thinners and the risk of rejection. We have also begun work to recre-

the-art research facilities, such as the Cell Therapy Catapult at Guy's Hospital, London."

However, it may take several decades before 3D-printed living hearts become available for transplant, largely because of the complexity of the structures that must be replicated and the need for them to work perfectly the moment they are implanted.

Jonathan Butcher, who researches tissue-engineered aortic heart valves at Cornell University, Ithaca, New York, says: "These are exciting times, offering great opportunities to advance cardiovascular treatment. But there are engineering and biological challenges to overcome before 3D printing moves into the clinic. We need to raise awareness of both opportunities and challenges, so that governments and industry worldwide continue to support the progress of the technology, and propel it where it needs to go." 



Commercial Feature

Benefit from new heart treatments as soon as they are available

Imperial Private Healthcare offers the newest treatments and surgical innovations for heart diseases, from specialists at Imperial College Healthcare NHS Trust



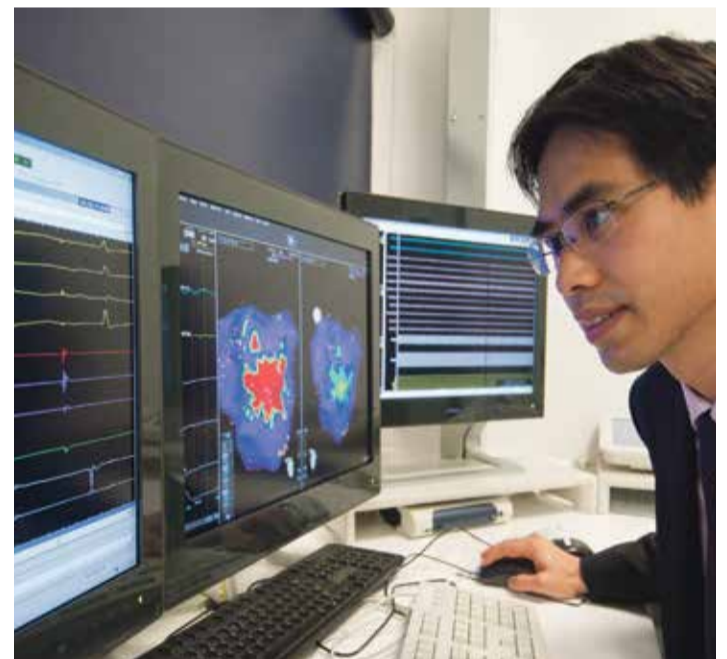
At Imperial Private Healthcare, our patients benefit from cutting-edge innovation in cardiac care, thanks to research by surgeons and specialists at Imperial College Healthcare NHS Trust.

Imperial Private Healthcare offers patients the best of both worlds – modern private facilities in some of London's most established NHS hospitals, with a worldwide reputation for pioneering cardiac services, made possible by the Trust's strong academic partnership with Imperial College London.

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 We have an extremely high throughput of cutting-edge research and surgical techniques, from the lab bench to the clinic

"Heart rhythm disturbances can be difficult to diagnose," explains clinical cardiologist Dr Boon Lim. "Elsewhere patients are made to lie still for hours while waiting for multiple irregular heartbeats to occur. The multi-electrode vest allows patients to be mo-



bile in order to trigger the irregular heartbeat, which we can then rapidly map with precision. This technology is particularly beneficial for patients who have had previous failed treatment attempts because doctors have not been able to accurately locate the source of the irregular heartbeat."

Dr Lim is the senior author of a research paper that tested the vest in 24 patients. He adds: "We are a leader in new technology. We have an extremely high throughput of cutting-edge research and surgical techniques, from the lab bench to the clinic. This is testament to the calibre of the doctors at Imperial and our track record of using the very latest technologies and approaches to help patients."

He is just one of 30 specialists who work in teams to combine their expertise with the skills of radiologists and cardiac surgeons, to provide a

comprehensive and unique package of care for every patient. Patients are treated in five state-of-the-art catheter laboratories and also benefit from access to world-class stroke, vascular and trauma units within Imperial College Healthcare NHS Trust.

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Work out your risk

HOW TO USE SCORE CHARTS TO ASSESS RISK OF CARDIOVASCULAR DISEASE IN AN ASYMPTOMATIC PERSON

- 1 Find the cell nearest to the person's age, cholesterol and blood-pressure values, bearing in mind that risk will be higher as the person approaches the next age, cholesterol or blood-pressure category.
- 2 Check the qualifiers.
- 3 Establish the total ten-year risk for fatal cardiovascular disease (CVD).

QUALIFIERS

The charts should be used in the light of a clinician's advice and judgment, especially with regard to local conditions.

As with all risk estimation systems, risk will be overestimated in countries with a falling CVD mortality rate and underestimated if it is rising.

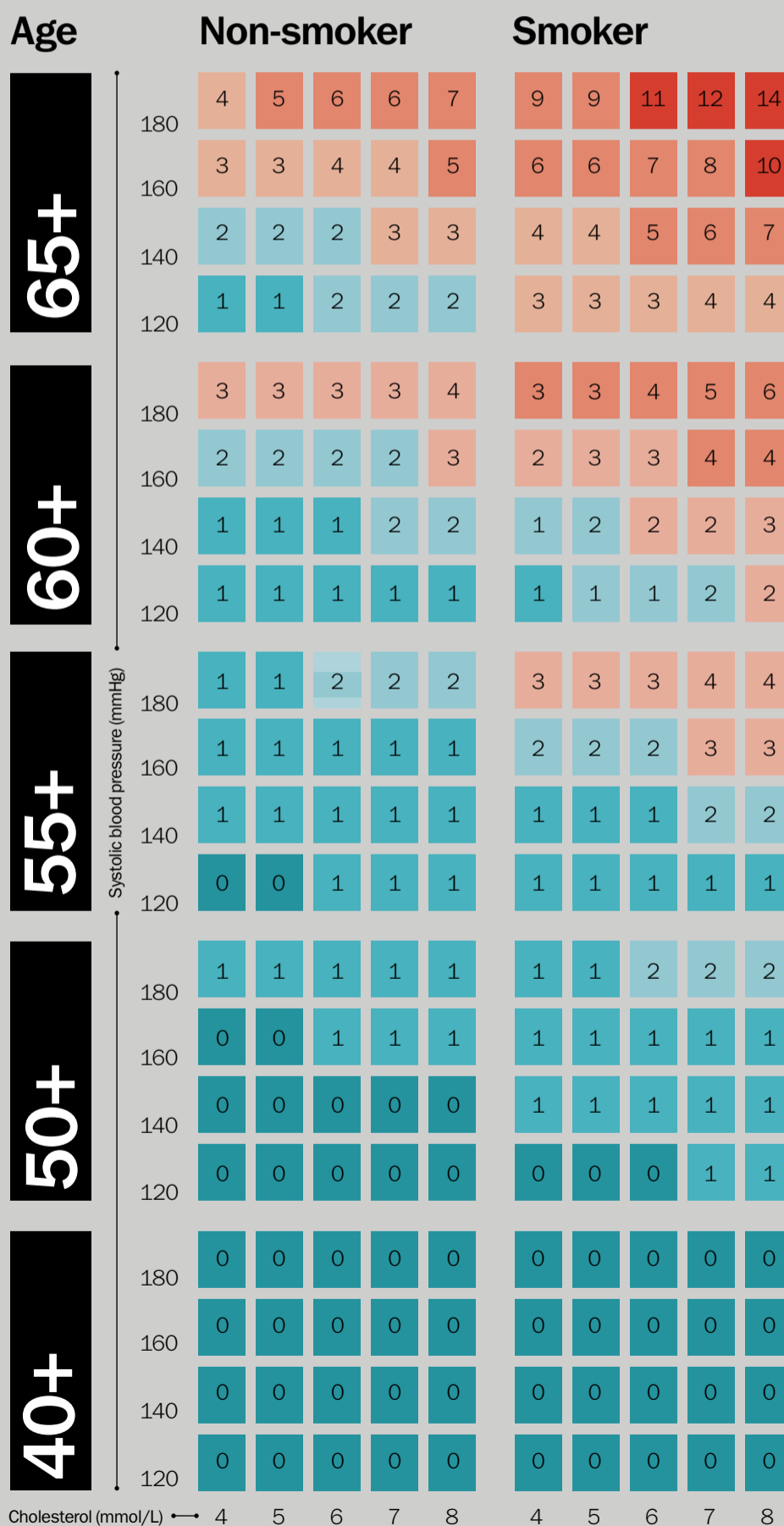
At any given age, risk appears lower for women than for men. However, inspection of the charts shows that their risk is merely deferred by ten years, with a 60-year-old woman resembling a 50-year-old man in terms of risk. Sedentary or obese subjects, especially those with central obesity.

RISK MAY BE HIGHER THAN INDICATED IN THE CHART WITH...

- Those with a strong family history of premature CVD.
- Those with low high-density lipoprotein (HDL) cholesterol** or increased triglyceride, fibrinogen, apoB, lipoprotein(a) levels and perhaps increased high-sensitivity C-reactive protein (CRP).
- Those with moderate to severe chronic kidney disease with glomerular filtration rate (GFR) less than 60ml/min/1.73m².
- Socially deprived individuals and those from some ethnic minorities.
- Asymptomatic subjects with evidence of pre-clinical atherosclerosis, for example plaque on ultrasonography.

UK risk score chart*

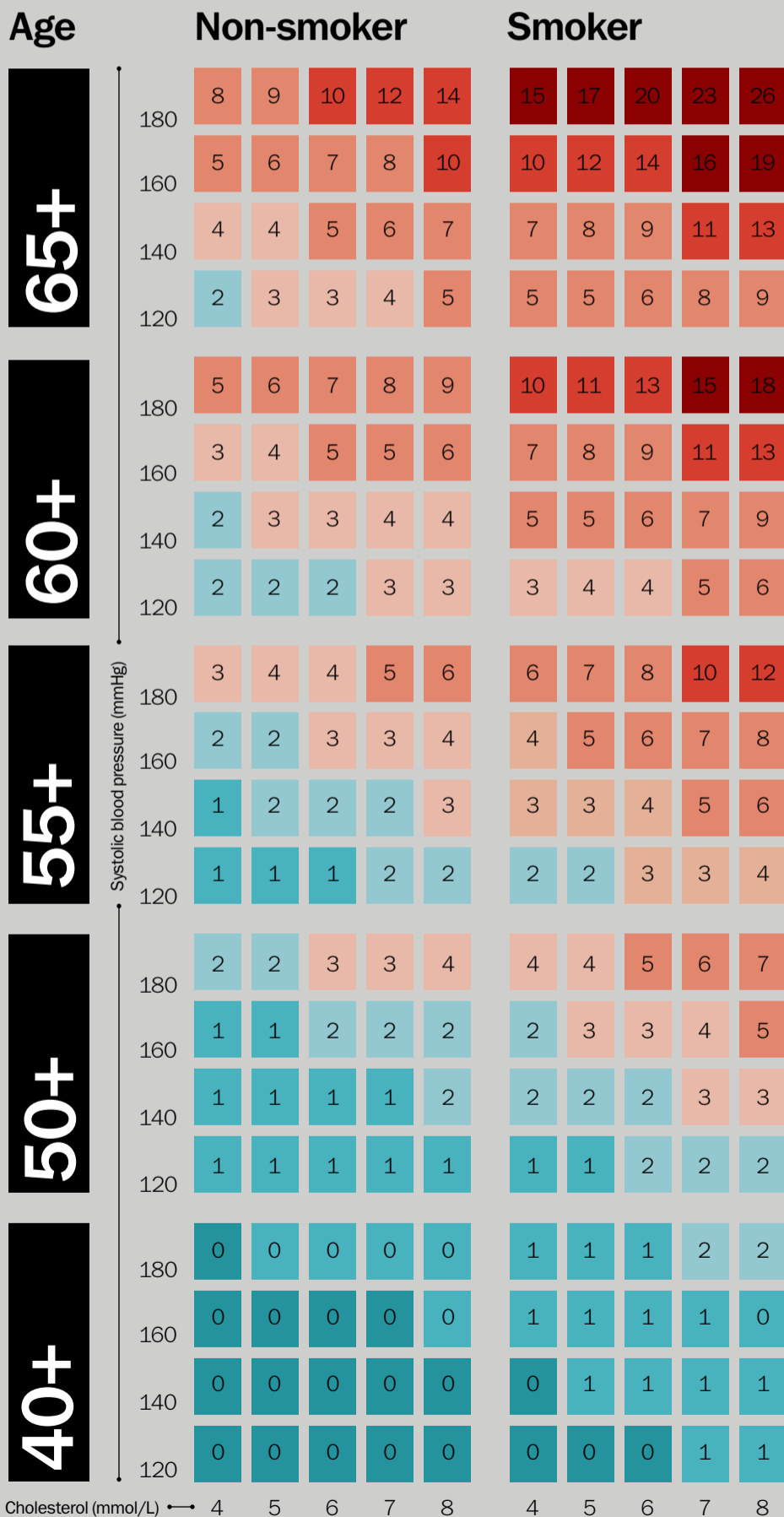
Women





Ten-year risk of fatal CVD in the UK by gender, age, systolic blood pressure, total cholesterol and smoking status

Men



22,000

smokers in the UK die each year from heart and circulatory diseases

33%

of men and nearly 50% of women do not achieve recommended levels of physical activity

25%+

of adults have high blood pressure and half are not receiving treatment

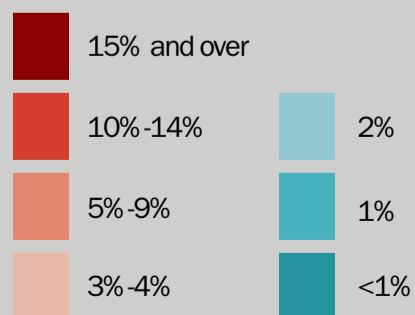
33%+

of men and more than 25% of women regularly exceed recommended alcohol intake

50%

increased risk of heart disease and stroke through physical inactivity

Source: British Heart Foundation



UK risk chart can also be applied to Andorra, Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece*, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, The Netherlands*, Norway, Portugal, San Marino, Slovenia, Spain*, Sweden and Switzerland.

**Note that HDL cholesterol impacts on risk in both sexes, at all ages, and at all levels of risk. This effect can be estimated using the electronic version of SCORE, known as HeartScore, which has been updated to include HDL cholesterol level.

Commercial Feature

Heart surgery without the usual scarring

Patients bear testimony to a surgical technique which avoids unsightly scarring, cuts the risk of infection, slashes recovery time – and saves money

Architect Stephen Davis felt out of breath first and then came the chest pains after a round of golf while on holiday in Portugal. He returned to the UK swiftly and was diagnosed with a blockage to the heart that needed triple by-pass surgery.

Stephen, who runs his own practice in Birmingham, had already been diagnosed with high blood pressure and high cholesterol, and was booked in for surgery on January 27 this year.

Remarkably, he was back at work the following week and enjoying a ski holiday within two months of the operation, which was carried out using endoscopic vessel harvesting (EVH). This uses special instruments and powerful imaging to help the surgeon remove vein from the leg or the radial artery from the arm through a small incision immediately before the by-pass surgery.

Around 20,000 coronary artery by-pass graft (CABG) operations are performed in the UK every year to improve blood flow to the heart muscle. One of the more daunting features has been the lengthy cut in the leg or arm to remove the vessel to be used in the by-pass. Around 85 per cent of by-pass operations use lengths of the great saphenous vein, which runs the length of the leg.

Stephen had it removed via EVH in a precision keyhole procedure via a 3cm cut just below his knee.

"I had a phenomenal recovery," he says. "Under the knife on Monday, walking around easily on the Wednesday, out on Thursday and I went into work for a few hours the following week.

"I had spoken to a few people who had by-pass surgery and they said the biggest pain was from the leg, and they were left with a pretty horrific looking scar from groin to ankle.

"But I have a barely noticeable scar just below my knee and I now play

50%

REDUCTION IN WOUND-HEALING COMPLICATIONS AMONG PATIENTS WITH DIABETES

golf regularly. It was a real success and has given me a new lease of life."

His operation was performed by Heyman Luckraz, consultant cardiothoracic surgeon at New Cross Hospital in Wolverhampton. Prabhjeet Kaur, surgical care practitioner at New Cross Hospital, is presenting their research evidence on the benefits of EVH at the annual meeting of the European Association for Cardio-Thoracic Surgery (EACTS) next month.

Dr Luckraz was concerned that around 50 per cent of his hospital patients had difficulty with infection, swelling, leakage or pain after their operation and moved to the EVH system, which drastically reduced infection rates and demonstrated a "phenomenal" cost saving to the NHS.

EVH, which also works for harvesting the radial artery in the arm, has been standard practice in US hospitals for more than 12 years and is becoming more widely available in the UK.

It helps surgeons retrieve a quality vessel, swiftly and efficiently to enhance their task of repairing the heart. For the patient, it is a passport to rapid recovery times with vastly reduced wound problems.

"A clear preference for CABG over the use of angioplasty with stents in patients with moderate to severe coronary artery disease was established by the five-year SYNTAX study of 1,800 patients in Europe and the United States," says David Taggart, professor of cardiovascular surgery at Oxford University. It demonstrated up to an almost 10 per cent improvement of long-term survival and a significant reduction of later heart attacks with CABG.


"It is a clear winner," he says. "The key thing we need to get into the equation is to make sure patients are aware of this information because for many years the patients were often treated by the cardiologist and did not always get the option of CABG."

He advises that treatment decisions should be made by a heart team not a single doctor, adding: "It is vital that they are given the appropriate information so they can make a truly informed choice."

Consultant cardiac surgeon Toufan Bahrami, of Royal Brompton & Harefield NHS Foundation Trust, is a pioneer in EVH. He was first involved in UK early trials in 2005 and has since trained many UK and European surgeons.

Mr Bahrami has witnessed the growth of EVH and seen first hand its surgical and financial effectiveness. His trust is now the only one in the UK performing EVH on 100

per cent of its CABG patients, both on the NHS and privately, with eight years of follow-up data from 3,000 patients – the largest in Europe – demonstrating outstanding short and long-term outcomes. This data will be presented at EACTS. "Out of 3,000 EVH operations we have had no infections," he says. "I am sure in the next five to ten years, every patient should have EVH."

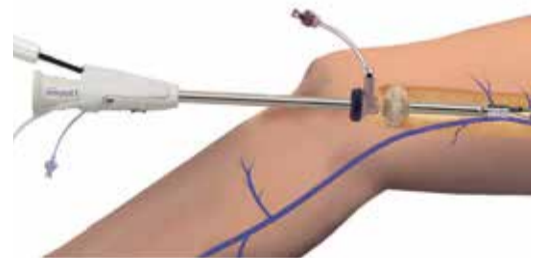
 It worked a treat with no complications and the result has been incredible

Currently EVH is not available at every UK hospital.

Sunil Ohri, consultant cardiac surgeon from Southampton, who performed his first EVH operation in 2002, says: "The benefits to the patients are very clear and have been well documented. The most important factor is with wound complications. This is a 2 to 3cms incision compared to one long incision on the leg. Wound breakdown is not a problem and infection is minimized, and there is less pain."



But rather than have the traditional cut tracking from his groin to ankle, 59-year-old



Faster recovery. Smaller scars. Less pain.

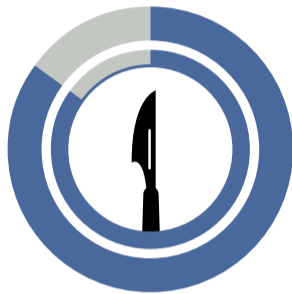


MAQUET
GETINGE GROUP

"Reduced pain levels, particularly if you are elderly, means you can mobilise faster, getting out of bed within 48 hours which down-risks potential complications from staying in a hospital bed," says Mr Ohri. "Patients get home quicker and there is the cosmetic aspect, particularly with younger patients, of not having a big scar.

"In Southampton, we ran a follow-up study of 200 CABG patients tracking them after discharge. We wanted to understand what the post-discharge care demand was and found that EVH patients hardly had any additional requirements for care once they had been discharged.

"While the patients with the classic open operation on their leg needed additional antibiotics, had wound breakdowns dealt with by a district nurse over a few weeks or attended a wound clinic at their GP surgery. But the information showed we can get patients out faster with EVH and that there is less risk once they have left."



85%

OF CORONARY ARTERY
BY-PASS GRAFT OPERATIONS
USE LENGTHS OF THE GREAT
SAPHENOUS VEIN, WHICH RUNS
THE LENGTH OF THE LEG

In Wolverhampton, Dr Luckraz's own study revealed that only two people from 50 EVH patients had minor infection problems with overall group treatment costs of £40,000 compared with 50 who received the traditional method and had an infection rate of around 25 per cent with costs reaching £78,000.

Globally more than 1.8 million patients have been successfully treated with the EVH procedure giving them the opportunity to concentrate on getting better quicker. Patients are often told the worst problem is how their leg recovers, but the pain and swelling is much less with EVH.

EVH is particularly effective with heavier and diabetic patients, who have reduced wound-healing capabilities, and a study showed that the procedure decreases infection risk by 78 per cent in high-risk and unhealthy patients. The combined results of three studies, covering 16,000 patients, showed wound complication reduction greater than 50 per cent with EVH.

A further study, published in the *Annals of Thoracic Surgery*, reported that no EVH patient needed treatment for wound complications compared with 6 per cent of those who underwent the traditional vein harvesting operation.

Research also shows that traditionally treated patients spend an average 1.5 days longer in hospital and cost the health service up to ten times more than EVH patients for follow-up treatments.

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NICE APPROVAL FOR EVH PROCEDURE

The National Institute for Health and Care Excellence (NICE), the government body that regulates medical procedures in the UK, issued updated guidance on EVH in June giving its approval of the technique.

Its systematic analysis of 44 clinical studies, covering 269,474 patients, ruled there was no difference in long-term results between EVH and open techniques. NICE listed reduced hospital stay, reduced

risk of wound infection, early rehabilitation, reduced rate of re-admission and patient satisfaction among the benefits.

"It is very promising," says Dr Heyman Luckraz, who is a member of the Society of Clinical Perfusion Scientists' Council. "With this guidance, and the data we have collected and generated, we have shown this is a safe thing to use for the patient and it is cost-effective in the longer term."

Stories of success and a quick return to health

Richard Lea, a 66-year-old retired joiner from Macclesfield, Cheshire, received EVH as part of his quadruple by-pass surgery at Wythenshawe Hospital, University Hospital of South Manchester NHS Trust, on August 13, under Professor Nizar Yonan.

"I had two friends who had by-pass surgery and they said the leg wound was the worst part of it," says Mr Lea. "I had four blockages to my heart so needed a quadruple by-pass and they said they were going to get the vein with keyhole surgery.

"It worked a treat with no complications and the result has been incredible. I was out in six days and I've only got three nicks in my leg that you can barely see. To think it was only a couple of weeks ago is amazing. I saw my friend, who had it done 16 years ago, and he said he could still feel the scar down his leg."

Professor Yonan says: "Wythenshawe Hospital has carried out more than 1,500 EVH cases since 2008 –



as routine practice and for research purposes, having published scientific papers suggesting EVH offers better patient satisfaction through less scarring, reduced GP and district nurse visits and reduced wound complications.

"Although every patient gets benefit from EVH through their experience, the most beneficial patients are diabetic, those with peripheral vascular disease and women who love the cosmetic benefits."

Veronica Stokes can just about detect the tiny white scar where her watch sits, which is one of two minute signs of her surgery. The 81 year old was admitted to London's Royal Brompton Hospital after feeling cramp in her shoulders and some breathlessness.

"I also had cramp in my jaw sometimes, but they were not the classic symptoms," she says. "The cardiologist wanted me to go to Royal Brompton and I've had extremely good care throughout."

A surgical team, led by consultant surgeon Anthony de Souza, used EVH to get a radial artery from her left arm to perform a double by-pass and heart valve replacement.

Seven months on and the former dyslexia teacher, who lives near Winchester, Hampshire, is playing tennis again and marvelling at the lack of scarring on her arm.

"I've recovered very well and didn't need any pain killers throughout the recovery," she



says. "I obviously have the scar on my chest from the surgery, but if you look carefully at my left arm, just where the watch strap is, you will see a little nick and another on the inner side of the elbow, where the radial artery was taken out. It was all done very skillfully and there was no long incision in my arm."

All patients' procedures were performed on the MAQUET Vasoview Endoscopic Vessel Harvesting system

If your doctor is recommending Coronary Artery Bypass Graft (CABG) surgery, it's time to learn about Endoscopic Vessel Harvesting (EVH).

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Q&A

HEART DISEASE IN AFRICA



Interventional cardiologist Dr Nasiruddin Jamal, head of the cardiology unit at the Aga Khan Hospital in Dar es Salaam, Tanzania, answers a *Raconteur* Q&A on the challenges and opportunities of treating and preventing cardiovascular disease in a developing country with an at-risk population

Q HOW DOES THE TREATMENT OF CARDIOVASCULAR DISEASE (CVD) DIFFER IN DEVELOPING ECONOMIES COMPARED WITH THE UK?

A The incidence of CVD is on the increase worldwide. Mortality from CVD has declined in Western countries, but it is on the rise in developing countries. Treating CVD in countries such as Tanzania is certainly more challenging, mainly due to lack of awareness and knowledge about the disease, and how to prevent it, among local populations. This lack of knowledge, coupled with lack of resources, leads to a high non-compliance rate with prescribed treatments. You also have to understand, we're working with populations that have a high prevalence of other infections, especially HIV, which can sometimes be a causative or exacerbating factor. Meanwhile, there's very little epidemiologic information available, a general lack of highly trained medical personnel and the cost of treatment remains very high.

Heart Failure
Page 14



Q WHAT ARE THE BIGGEST BARRIERS TO REDUCING CVD?

A The top priority is public education. This is a must if we want to decrease the number of CVD cases. Secondly, lack of knowledge among healthcare workers about the relevant guidelines and the importance of evidence-based treatments are getting in the way of early and more frequent diagnoses. Informing and educating healthcare workers about these guidelines is critical.

Q WHAT ARE THE LOW-COST TREATMENT OPTIONS?

A There are low-cost medications, but there is a lot that can be done without medication, which is a very cost-effective way to prevent or decrease CVD. Things such as low-salt diets for hypertension, low-fat diets, which help with coronary artery disease, exercising, stopping smoking and drinking alcohol. What we need is education on diet, safe places for people to exercise, and anti-drinking and anti-smoking campaigns to help address what we can do without having to medicate.

Q WHAT IS THE NATURE OF LOCAL TREATMENT?

A I think local treatment is frequently influenced by the pharmaceutical industry. Unfortunately, many practitioners may not be doing their own research or following guidelines. Not enough education is being imparted to patients to help them manage the situation, and while doctors might be quick to perform some tests, such as echocardiograms, to satisfy patients that their heart has been checked, the quality of research and interpretation of the results is debatable.

Q WHAT ARE LOCAL ATTITUDES TO CARDIOVASCULAR HEALTH?

A People are very concerned about CVD. They lack education. There is a lot of misinformation. Even young people with any pain anywhere in the chest think they have heart disease or have been told they have angina. We need a good education campaign to increase understanding.

Q WHAT ARE PEOPLE'S CONCERNS?

A They are concerned about the possibility of heart attacks and strokes, and about the affordability of diagnostic tests and treatment. But generally, patients lack insight about the chronic nature of the illness and often stop treatment after just a short time.

Q WHAT IS YOUR VISION FOR TREATING AND PREVENTING CVD?

A We are working to become centres of excellence for cardiovascular disease, providing preventative, diagnostic and tertiary care for treatment. This is happening in both Dar es Salaam and at the Aga Khan University (AKU) Hospital in Nairobi, Kenya. Our rural health centres are also providing evidence-based basic diagnostics and management. We plan to roll out the use of telemedicine to improve on what we can offer patients and help us make timely, appropriate referrals.

Q WHAT ARE YOUR PERSONAL AIMS?

A My number-one aim is to establish a state-of-the-art, world-class cardiac programme at the Aga Khan Hospital in Dar es Salaam, and become a referral centre for CVD throughout Tanzania and neighbouring countries, in close linkage with AKU Nairobi. Part of my agenda will also be improving basic cardiovascular care in the

outlying clinics and implementing the successful use of telemedicine across our network in the region. In order to do this, a big job will be training local personnel.

Q WHAT ARE THE THREE TOP PRIORITIES FOR REDUCING CVD IN EAST AFRICA?

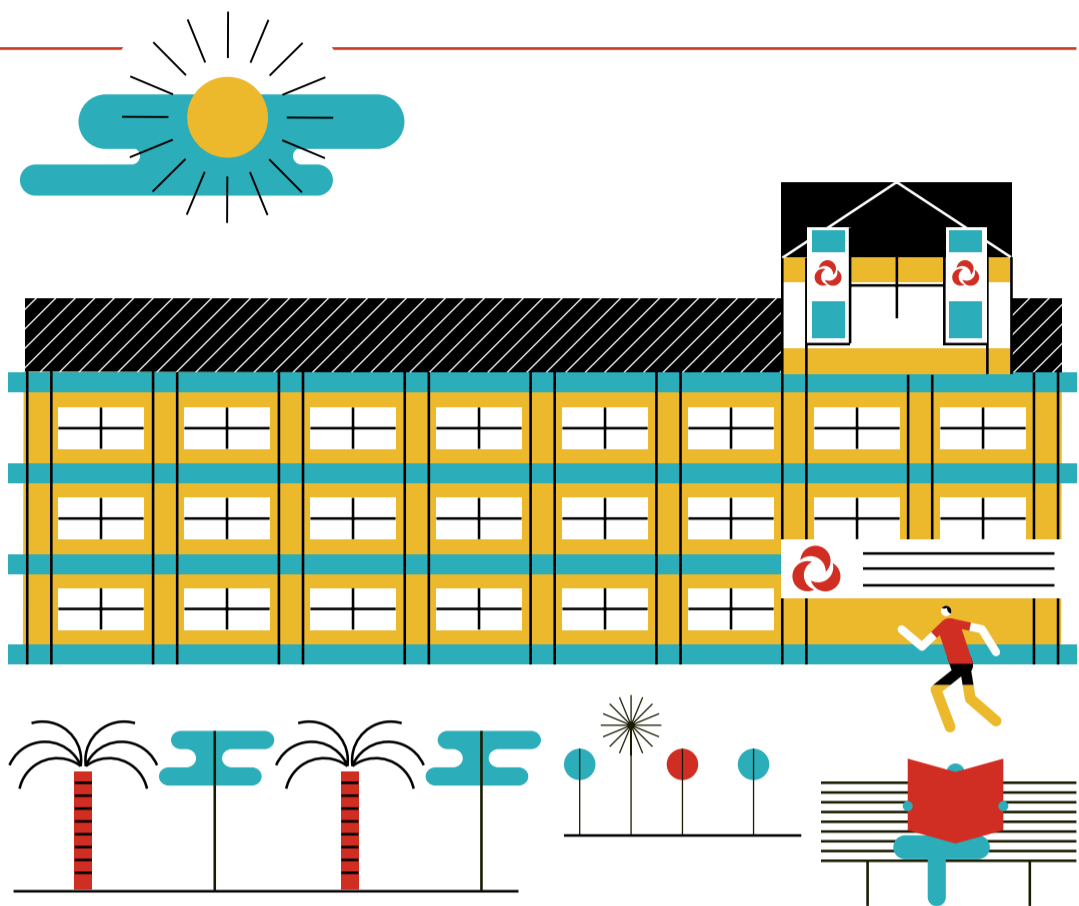
A First, a massive public education campaign about hypertension and diabetes as well as CVD. Second, relevant local research on changes in nutrition. And third, affordable medication.

Q WHAT ROLE DOES THE GOVERNMENT PLAY WITH CVD IN TANZANIA?

A Government hospitals are trying to provide free or low-cost diagnostics and management. I am not sure if there is a well thought out long-term strategy or a dialogue between government and local cardiovascular experts to come up with a strategy.

Q SHOULD NON-COMMUNICABLE DISEASES, INCLUDING CVD, BE PART OF THE UNITED NATIONS MILLENNIUM DEVELOPMENT GOALS?

A Most definitely. Developing nations will all need massive assistance. They will need human resources, financial assistance and educational campaigns similar to those for HIV. I do not believe developing countries can combat CVD by themselves. ■



We're working with populations that have a high prevalence of other infections, especially HIV, which can sometimes be a causative or exacerbating factor



Commercial Feature

Replacement valves save lives

The silent nature of heart valve disease presents a major challenge to health services in the UK where the number of people aged over 65 is expected to almost double to 19 million in the next 30 years



Bernard Prendergast
Consultant cardiologist
Oxford University Hospitals NHS Trust

The most common and life-threatening heart valve disease is aortic stenosis (AS), which affects up to 10 per cent of the over-80 age bracket, while many more have other silent valve diseases.

Diagnosis is often only made at an advanced stage because its classic symptoms of breathlessness, fatigue, chest tightening and dizziness can be misinterpreted as a natural part of ageing.

AS occurs when scarring, inflammation or a build-up of calcium deposits narrows the valve opening and obstructs the flow of oxygenated blood from the heart.

Muscles in the heart-chamber wall are forced to stretch and thicken to push blood through the valve leading to an increased likelihood of heart failure, and up to 50 per cent of AS patients may die within two years of diagnosis.

It cannot be treated with medicines, but aortic valve replacement can save lives, and promote a longer and better quality of life.

This can be achieved by open heart surgery or transcatheter aortic valve implantation, known as TAVI, which enables valve replacement without opening the chest. The new valve is squeezed down into a balloon and positioned for implantation, via a catheter introduced through the femoral artery, or other keyhole techniques are used.

The procedure, currently suitable for carefully selected patients, is shorter than open heart surgery, in-

volves less pain and recovery time is enhanced from six to eight weeks to two to four weeks.

But the key to treating AS is early diagnosis and getting the patient on a swift pathway of treatment.

"Surgical treatment of AS by means of open heart or keyhole valve surgery restores life expectancy back to that of the normal population, so timely intervention not only saves lives, but also improves quality of life over many years," says Bernard Prendergast, consultant cardiologist and cardiology clinical director, Oxford University Hospitals NHS Trust. "It is a major winner if the patient can get access to it before it's too late."

He advocates greater public and GP awareness of the symptoms to boost the diagnosis rate, and allow patients the opportunity to access the correct surgery.

"Valve disease is almost always clinically silent for many years," he says. "It may be insidious for a long time and, because the majority of patients affected are elderly, many of the symptoms are often attributed to getting old. The cardinal symptoms of AS are shortness of breath, chest pains due to angina and dizziness or blackouts.

"But they don't develop until very late in the condition and might not be noticed without the use of a stethoscope to detect a heart murmur.

"Clinical suspicion needs to be raised. If elderly patients come with the symptoms of AS, a doctor needs to think about the condition as a possible diagnosis. The symptoms should not be brushed off as the effects of ageing or as lung disease, as you can easily waste six months sending the patient down the wrong pathway."

Dr Prendergast believes that GPs have a difficult task assessing elderly patients, who may present with several conditions, in a tight ten-minute consultation time frame.

"As well as improved levels of awareness in primary care, the public too needs to have more awareness of the symptoms of heart valve disease," he adds. "If GPs see a patient with these symptoms, they should

ANALYSING THE IMPACT OF HEART VALVE DISEASE



10%

of the over-80 age bracket are affected by aortic stenosis (AS)



AS occurs when scarring, inflammation or a build-up of calcium deposits narrows the valve opening and obstructs the flow of oxygenated blood from the heart



50%

of patients with severe AS may die within two years of diagnosis

SYMPTOMS OF AORTIC STENOSIS

- 1 BREATHLESSNESS
- 2 FATIGUE
- 3 CHEST TIGHTENING
- 4 DIZZINESS

Valve disease can be clinically silent for many years because the majority of patients affected are elderly and many of the symptoms are often attributed to getting old



TRANSCATHETER AORTIC VALVE IMPLANTATION (TAVI)



Recovery time from the procedure, compared to 6-8 weeks for open heart surgery



The procedure is currently only suitable for a subset of carefully selected patients



One million lives are at risk because of poor knowledge about the dangers from heart valve disease

suspect the diagnosis and listen to the heart. We then need to offer timely access to echocardiography to confirm the diagnosis and more specialists in valve disease, who know how to handle the information and offer the best treatments to patients."

The recently formed physician-patient group Heart Valve Voice estimates that one million lives are at risk because of poor knowledge about the dangers from heart valve disease.

"It can have catastrophic consequences if the symptoms are mistaken or simply put down to being a sign of ageing. At the moment many people are referred to surgery too late and, as a result, they do not derive the optimal benefits from surgery and their future health may be compromised," says Professor Ben Bridgewater, chairman of Heart

Valve Voice and consultant cardiac surgeon, University Hospital of South Manchester. "It is important that we push for earlier diagnosis and treatment."

Ivy Lovell, from Orpington, Kent, had no idea she had valve disease and it was not diagnosed even though she had suffered two falls from dizzy spells. She was eventually treated at King's Hospital in London with a TAVI and says: "I've felt in perfect health. I'm 90 years of age and I can take long walks and drive to see my family. Effective diagnosis and management gave me my life back."

For more information please visit www.bhf.org.uk or alternatively the British Heart Valve Society www.bhvs.org.uk

Heart Failure

WHEN THE HEART FAILS

FAILS

Being told you have heart failure can make you feel as if your world is coming to an end, writes **Judy Hobson**. But thanks to implantable devices, such as pacemakers and cardioverter defibrillators, as well as better drugs, patients now live longer and enjoy a better quality of life

With the National Institute for Health and Care Excellence about to issue guidance on the treatment and management of acute heart failure in NHS hospitals in England, Wales and Northern Ireland, and exciting research going on into the use of stem cells to grow new heart muscle, the condition is entering an exciting new phase destined to further improve survival rates.

Martin Cowie, professor of cardiology at Imperial College London, with a special interest in heart failure, says: "We already have a lot of people alive today who would have died years ago. We're in an exciting era where we have new guidelines on treatment, as well as new therapeutic options. This means people with heart failure will no longer see their diagnosis as the end of the world."

The key to how someone with heart failure fares, he says, is rapid diagnosis and getting the correct treatment tailored to their needs.

"Problems only occur," the professor adds, "when this doesn't happen and the patient ends up being frequently readmitted to hospital and with a poor quality of life."

He is optimistic the new guidelines, due out next month, will ensure every patient wherever they live and whatever their age will get a rapid diagnosis by a cardiologist. This will improve survival rates, he believes, particularly among older patients who sometimes end up on a medical or geriatric ward unseen by a cardiologist.

More than 800,000 people in the UK are living with heart failure, according to the National Heart Failure Audit 2012-13. Over the next 20 years this figure will soar to 1.2 million as a result of our burgeoning elderly population and more people surviving a heart attack.

Heart failure is caused by abnormalities in the structure and function of the heart that mean it is unable to pump sufficient blood to meet

the body's demands. For example, the tissue in the heart muscle gets damaged during a heart attack or a valve has deteriorated through the ageing process. British Heart Foundation statistics show heart failure rises steeply with age, affecting 13.1 per cent of men and 11.9 per cent of women over 75.

Apart from a heart attack, heart failure can be due to angina, where the coronary arteries leading to the heart muscle become narrowed, high blood pressure, a viral infection such as rheumatic fever, a genetic disorder, valve disease and an irregular heart rhythm.

SYMPTOMS AND TREATMENT

Those with mild to moderate heart failure often have few symptoms, but those whose condition is more severe get short of breath, develop chest pain, retain fluid making their feet and ankles swell, and feel fatigued.

Patients undergo blood tests, which detect biomarkers released into the blood when the heart is damaged, have an exercise electrocardiogram (ECG) and an echocardiogram – an ultrasound of the heart

– and are then put on medication.

Most are prescribed diuretics, ACE (angiotensin converting enzyme) inhibitors and beta blockers. Those with an irregular heart rhythm also get an anti-coagulant to prevent blood clots.

ACE inhibitors reduce the activity of a chemical called angiotensin which can cause blood vessels to narrow and the body to retain fluid. Some patients may experience a dry persistent cough. They can be switched on to ARBs (angiotensin receptor blockers) which act in a similar way.

Beta blockers lower blood pressure and reduce the risk of a further heart attack. As well as slowing the heart, they can slow the body making patients sluggish and tired, but dosage can be adjusted.

Calcium channel blockers reduce the amount of calcium getting into the cells of coronary arteries, making them relax and widen. This increases blood supply to the heart.

Implantable devices, such as pacemakers and cardioverter defibrillators, are used when the heart pumps out of sync or has an abnormal rhythm.

FINE-TUNING

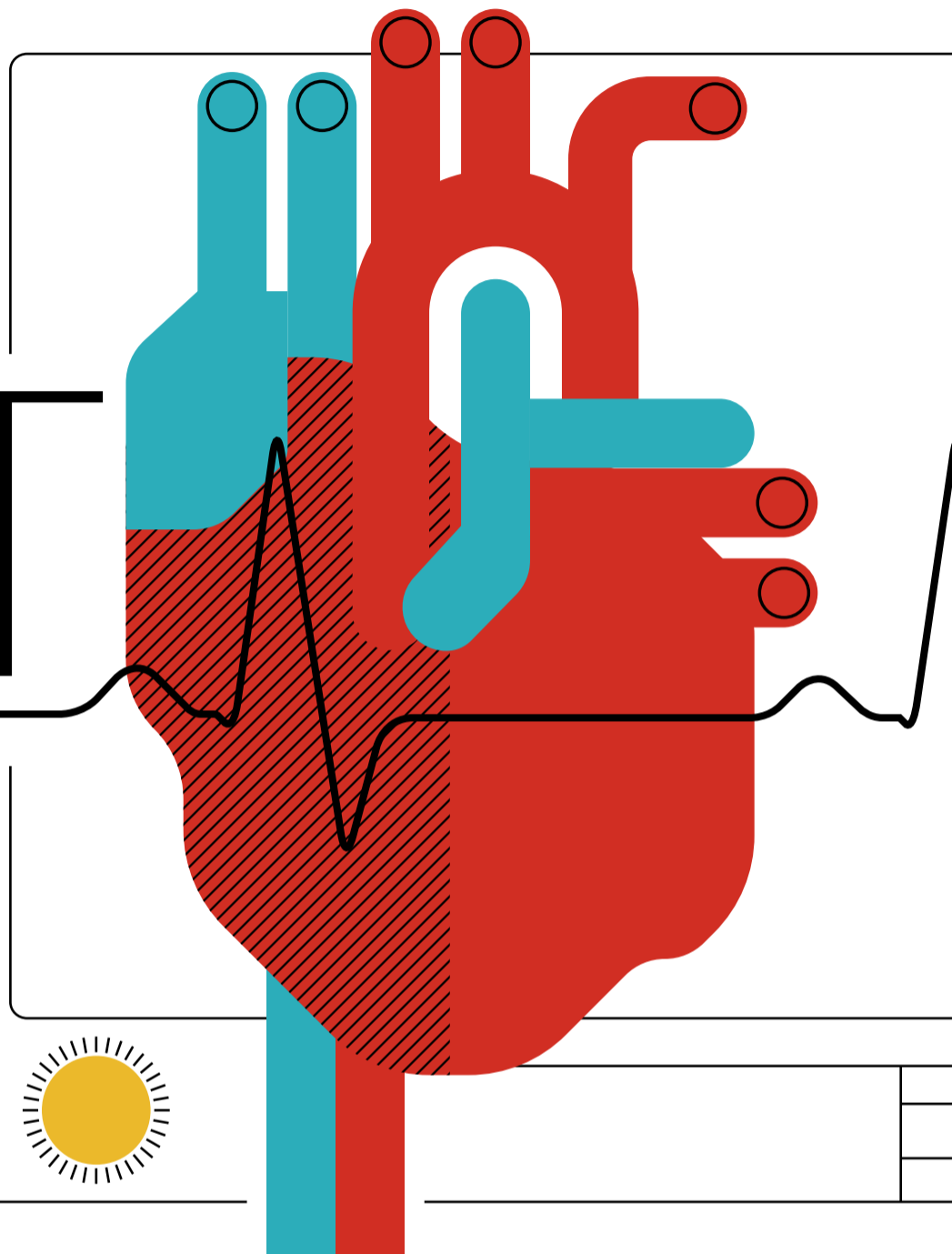
"Getting patients on the right tablets at the correct dosage is a matter of fine-tuning," Professor Cowie says. "The job isn't finished when they are discharged from hospital. You need to see them within two weeks to assess how they are doing on their medication and they need following up at regular intervals, either at the hospital clinic or by a community heart failure nurse or a GP with a special interest in heart problems."

The test results, says Julie Ward, a senior cardiac nurse with the British Heart Foundation, enable treatment and exercise to be tailored individually.

"If excess fluid is a frequent problem, a higher dosage of diuretics [to promote production of urine] will be prescribed. Patients are advised to take these at breakfast in order not to be woken at night by the need to use the toilet," she says.

"They should check their weight first thing to see if there has been an accumulation of fluid overnight. If so, they may need three diuretic tablets that day."

Professor Cowie adds: "You



The key to how someone with heart failure

fares is rapid diagnosis and getting the correct treatment tailored to their needs



Opinion

120



80



Heart failure is a silent epidemic which must be curbed, says **Dr Gordon Tomaselli**, of Johns Hopkins Hospital, Baltimore, Maryland

THE 'OTHER' HEART DISEASE



In common parlance, heart disease and heart attack have become nearly synonymous. Myocardial infarction represents one of the most frequent, and arguably most dramatic, manifestations of cardiac pathology, but it is just the gleaming tip of the big iceberg that is heart disease.

This melding of heart attack with heart disease in the popular imagination masks the presence of another important cardiac pathology – heart failure or what I call “the other” heart disease, one that generates less fanfare, fewer headlines and remains under the public’s radar.

Heart failure, whose hallmark feature is a heart muscle too weak or too stiff to pump blood effectively, affects more than 23 million people globally. Fuelled in part by the rising tides of hypertension, diabetes and people living longer, both the prevalence and incidence of heart failure are steadily increasing, and so is the number of people who succumb to it.

der, but a syndrome dauntingly complex in its etiology and course. It can stem from inherited pathologies of the cardiac muscle or develop as the end-result of longstanding, untreated hypertension, poorly controlled diabetes, malfunctioning heart valves or the after-effects of multiple heart attacks. It may be the price we pay for medical advances that have allowed many to live to an age when their hearts start to give out.

Heart failure represents one of medicine’s greatest success stories and one of its most disappointing failures. We have made great strides in managing heart failure’s acute manifestations, but remain woefully underprepared and mal-equipped to avert its onset and diagnose it early, before the disease takes serious toll on the heart and other vital organs.

We have made some critical progress in slowing down the irreversible march of the disease with an armamentarium that includes both pharmacological and interventional approaches. Pacemaker-based resynchronization therapy and implantable cardioverter defibrillators are now mainstays in the treatment of advanced heart failure. For those with end-stage disease, we use ventricular assist devices, mechanical pumps that serve as bridges to transplant and, increasingly, as “destination” or permanent therapy. Albeit cautiously, we are now starting to use stem cells to regenerate heart muscle – an approach deemed science fiction not even two decades ago. These are all laudable achievements, humbling feats of scientific acumen and clinical creativity, which have prolonged patients’ lives.

All our high-tech gadgets and dizzyingly complex critical interventions notwithstanding, we lag behind in prevention, early detection and individualised therapy – the three Holy Grails of medicine. Finding them will take synergistic

efforts by primary care clinicians, basic and translational scientists, and public health experts.

While we have unraveled the causes of most forms of heart failure and described the crude mechanics behind them, we still don’t understand the precise molecular mechanisms that drive the earliest and subtlest shifts in cardiac cell function, which over time culminate into clinical disease. I am confident that in the next 20 years, basic and translational research will unravel these important molecular mechanisms, and these insights will become the foundation for therapies that prevent heart failure from progressing into overt disease in the first place.

More often than not, heart failure tiptoes its way in. It can be an insidious disease, with an often unrelenting course. Primary care clinicians remain the frontline detectors of the first and subtlest signs of the disease – vague fatigue, mild exhaustion, a persistently elevated heart rate. But we now know that heart failure begins long before its first clinical symptoms emerge. Therefore, clinician-scientists in academic centres across the globe will have to ramp up their quest for highly sensitive and specific biomarkers that herald the onset of the disease before it produces clinical signs. Such a biomarker could become part of the standard metabolic panel during routine physicals, alerting a physician of the earliest molecular malfunctions in the cells of the cardiac muscle, well before the first physiological signs of the disease emerge.

PRECISION-TARGETED TREATMENT

No two patients with heart failure are the same. We already know that patients metabolise drugs differently and respond differently to treatment – variances rooted in gender, race and individual biology. But we are now beginning to appreciate even subtler differences in the genesis of cardiac disease. Heart failure is caused by a constellation of genetic predispositions, epigenetic modifiers, physiologic malfunctions, lifestyle influences and social behaviors. The degree to which each one of these factors contributes to disease onset varies from one person to the next. Our ongoing research into the genetic and epigenetic influences that trigger heart failure holds the promise of individualised therapies that will precision-target pathologies on a patient-specific basis.


And as we move forward, all of us, whether we are primary care clinicians practising on the frontline, cardiologists treating patients in specialty practices or clinician-scientists working in research hospitals, must remember to ask the fundamental questions in medicine: “Why this patient? Why this disease? Why now?”

need to do something that makes you breathless then have a rest and then do a bit more. If you exercise, you’ll get a little fitter, regain your confidence and this may keep you out of a nursing home.”

In the past someone with heart failure after a moderate heart attack was prescribed bed rest. Today, says Ms Ward, the emphasis is on what exercise they can manage.

“While one person will struggle to climb stairs, another will be able to climb two flights to bed. It’s a question of tailoring what you can do to the degree of heart failure you have. If you get breathless walking to the shop, you need a good rest afterwards or to rest half way there. You’ll have good and bad days. If you’ve been doing a bit more one day, it’s not unusual to need to rest a little more the next,” she says.

“Keeping a daily record of how you’re feeling emotionally and physically, as well as noting what you’ve eaten, your weight, the exercise you’ve done and your blood pressure can be very helpful when you next see your GP or cardiologist. It enables you to have your say and puts you back in control.”

 Clinician-scientists will have to ramp up their quest for highly sensitive and specific biomarkers that herald the onset of the disease before it produces clinical signs

We, as clinicians, ought to do a better job in educating people about its existence, its symptoms and the toll it takes for heart failure is not a looming epidemic, but a *de facto* pandemic. Altering the course of this global health crisis requires parallel efforts in the lab and in clinic. Heart failure is not a single disorder,



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