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Longer lives mean more diseases of old age

Signs of progress: a health centre in Rwanda embodies some of the developments in disease prevention and treatment Corbis

Increasing longevity combined with lifestyle conditions such as obesity are raising costs and forcing a policy rethink, writes *Andrew Jack*

Behind the joyous images of Brazil's World Cup as a celebration of football lies a sobering message. A sport that for many is something passively consumed on television while eating and drinking to excess is sponsored to a vast degree by beer, soft drink and fast-food companies.

Brazilians themselves have been divided on their government's extravagant spending programme for stadiums to host the championship in a country with vast social division and continued health inequality.

For a broader audience, the question is the promotion of lifestyles that risk triggering premature death – and costlier maintenance in life.

The good news in healthcare is that life expectancy around the globe continues to rise – and with it the total population, now in excess of 7bn. That reflects sharp progress in recent decades in wealth, sanitation, nutrition and medicine.

Prevention and treatment have made strong advances since the start of the 20th century: from an ever-growing number of vaccines offering protection to a record number of people, to basic antibiotics to control infections and ever more sophisticated treatments, such as monoclonal antibodies to treat cancer and enzyme replacement therapy for "orphan diseases".

Improved support for childbirth, and extended coverage of medical services through doctors, clinics and specialist centres have helped offer unprecedented access to facilities that extend life.

The bad news is the corollary: the global population is living longer and ageing, bringing with it both greater vulnerability to infection and a propensity for diseases linked to longevity – such as dementia and many types of cancer.

Expanding wealth, knowledge and political clout are triggering pressure to provide more assistance at inevitably rising cost. Yet, there are also signs that technology, data and innovation – in processes as much as in products – may offer new and more efficient life-saving models, from non-profit medical units in the slums outside Hyderabad to high-tech hospitals in the centre of Cleveland.

For now, it seems that costs are rising as quickly as benefits.

In most richer nations, spending is already into double digits as a share of GDP, while in the US it is touching 20 per cent – a level that Panos Kanavos, reader in international health policy at the London School of Economics, describes as "beyond the limits" that are sustainable or acceptable.

A recent study by the OECD, the rich countries' club, forecasts that in the period 2010-60, health spending as a proportion of GDP for most of its members would continue to rise by between 2 and 10 percentage points.

Countries such as India, soon set to be the world's most populous, still offer scant public healthcare coverage, although the authorities have pledged improved support, including free access to a package of essential medicines.

Many other nations, including China, are moving more rapidly to embrace calls for "universal health

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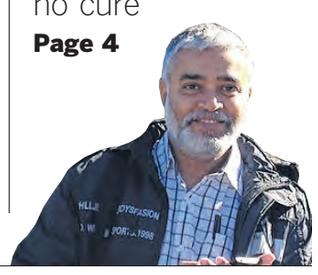

Cult of the individual gives way to collaboration

Teamwork

Clinical egos have to take a back seat, says *Sarah Murray*

Physicians work for three years at the Mayo Clinic before being offered a permanent position, with the decision based not only on their medical skills but on whether they can work as part of a team.

As change ripples through US healthcare, team approaches are taking hold. The challenge, however, is to shake up a culture that rewards individuals and pays for every consultation or treatment.

"We have plenty of people with great reputations," says John Noseworthy, president and chief executive of the clinic, a health system with dozens of locations in several US states.

"But you have to give up a little bit of that self-promotional activity to work in a team."

The culture of individualism is not the only thing being displaced, as the model long practised by the Mayo spreads through the US healthcare sector. The way health services are paid for is also being transformed.

One of the drivers of rising US healthcare costs has been the way providers have been paid by health insurers, employers and unions, as well as federally funded Medicare (covering people aged 65 and above) and Medicaid (covering low-income families).

At the Mayo Clinic – as well as at other centres such as the Ohio-based Cleveland Clinic – doctors are salaried. However, this has not been the norm. More typical is the fee-for-service system, where health providers are reimbursed for each procedure carried out. This system was appropriate at a time when doctors and hospitals were largely in the business of fixing broken bones and curing disease.

However, as complex conditions such as chronic obstructive pulmonary disease and diabetes have become more common, costs have risen. Not only are more individual treatments required over longer periods, large groups of medical professionals need to be involved in care.

Moreover, in a fragmented industry, the fee-for-service system has led to duplication. A primary care physician might, for example, order an MRI for a patient and then refer that patient to a specialist in a different practice, who would order another MRI.

With pressure to lower healthcare expenditure – both economic and as a result of US health reforms – the team approach and a shift from the fee-for-service model are seen as critical to generating efficiencies.

"It's being driven by the Affordable Care Act, but most providers recognise that the system needs to change," says Terri Welter, who heads the contracting and reimbursement practice at ECG Management Consultants, a healthcare advisory.

> 'You have to give up a little bit of that self-promotional activity to work in a team'

"The payments are changing to incentivise providers to work together for improved quality but also to share information and eliminate waste in the system," says Ms Welter.

In one model, rather than making individual reimbursements for, say, a surgery and subsequent treatment for complications, one lump sum would be paid for the operation, including any follow-up. In another model known as "bundled payments", a negotiated fee covers the set of procedures it is expected will be needed to treat a patient's medical condition.

Putting more emphasis on primary care and preventive measures by including dietitians or fitness experts in healthcare teams also helps reduce the incidence of conditions that cost money down the line.

And while the team approach means health providers are increasing collaboration internally, they are also doing so with other practices. "They're typically working with them in a contractual relationship to help integrate their IT, the sharing of information and best practise of clinical protocols," says Ms Welter.

However, the move towards lump sum or bundled payments, rewarding teams rather than individuals, raises questions about who benefits from cost savings and also who pays when care runs over budget.

One solution is for insurers and health providers to share the savings or split any additional costs that arise, with hospitals and health centres taking out their own insurance to cover the risk of extra costs.

This is the model Aetna, the health insurer, is using. "It shifts more risk on to the providers and changes the economic incentives," says Mark Bertolini, the company's chairman, chief executive and president.

A number of other models is emerging. But whatever the arrangement between insurers and providers, the team approach not only lowers costs but can also be better for patients.

"An integrated system that works in teams and gets it right in a few days, is better for patients than pingponging around the system for six months and not getting back to work," says Dr Noseworthy.

A way to save money and spare patients

Preventive approach

Co-ordinated care is the way forward, writes *Sarah Neville*

In Cornwall, in the south-west of England, volunteers work with primary care doctors to help elderly people stave off the physical and emotional impairments of old age, leading to big reductions in expensive hospital admissions.

In India, pictures of people with suspected mouth cancer, taken by volunteers on mobile phones, are sent to specialists thousands of miles away for diagnosis.

Apart from the obvious use of volunteers, the two have another feature in common, their motivation: the need to address problems before they become entrenched – and much more costly to treat.

It is a strategy that, arguably, has never been more necessary, as developed and developing countries alike struggle with tight budgets.

However, the length of time it can take to see benefits from preventive spending may not always suit politicians, whose horizons often extend little beyond the electoral cycle.

Mary Harney, Ireland's former health minister who is now spearheading an EU initiative to embed a preventive approach into healthcare, says in Europe "we spend 97 per cent of our budget on treatment – it's not even on health, it's on sickness – and we spend 3 per cent on prevention".

Ms Harney says that her organisation, the European Steering Group on Sustainable Healthcare – made up of academics, health professionals and industry representatives – is pressing for 1 per cent of spending to be moved from treatment to prevention.

She adds: "The problem you have is, for ministries and politicians, the results of an investment in prevention are down the road, the results of treatment are more immediate".

One organisation that is making the case that money spent on prevention and early diagnosis is an investment, not a cost, is Fit for Work Europe.

This is led by The Work Foundation think-tank, Lancaster University in the northwest of England, and supported by two companies, AbbVie and GE Healthcare.

It is pioneering fresh approaches to musculoskeletal disorders (MSDs) that it says are the primary cause of sickness absence and years blighted by disability in Europe. It estimates the economic toll at €240bn lost to the European economy each year.

Behind the programme is the assumption that MSDs can become manageable conditions, provided people have access to, and are enrolled in, an early intervention programme which supports them as they seek to return to the workplace.

Patients receive a swift diagnosis and are then given the information they need to manage their condition, in concert with both primary care physicians and the hospital specialists.

Dr Juan Jover, a rheumatologist at Hospital Clinico San Carlos in Madrid, who founded an Early Intervention MSD programme in Spain, has said that "with early intervention, everybody wins.

"We are saving social security money because patients are taking fewer days off work. We are saving the healthcare system money as patients recover faster. And we are ensuring increased patient satisfaction because they receive additional support and faster relief from their symptoms."

The notion that a unified approach to treating an individual not only saves money but spares patients and their families much unnecessary stress underpins CareMore, a California-based organisation that treats only older people funded through the federal programme for the elderly, Medicare.

Its model, which has attracted interest beyond the US, is based on the idea that "the existing segmented healthcare delivery model is fragmented, bloated and inefficient".

It says that patients with serious conditions see an average of 11 doctors, reducing them to "victims of the system" whose care is uncoordinated.

Poorly managed and unnecessary care leads to increases in both costs and death rates, it says, noting that 20 per cent of the frail elderly population generates 60 per cent of healthcare cost.

An example of how patients become partners in their own care is CareMore's high blood pressure care programme.

Blood pressure readings are taken at home, through a home-based electronic blood pressure monitoring system that plugs into the telephone.

They are then sent to CareMore electronically and analysed by health professionals. Educational classes and support groups are offered to help patients manage their conditions and they receive what the company terms "periodic wellness check-ups".

> 'The segmented healthcare delivery model is . . . bloated [and] inefficient'

Ultimately, however impressive some individual schemes may be, many believe that a "whole government" commitment is needed to underpin the preventive approach to living longer lives.

Not only the health department but a far wider range of ministries must come together to lead the endeavour, adherents believe.

Ms Harney, who held Ireland's health portfolio for seven years from 2004, says that the Irish government last year produced a blueprint for an integrated approach across all government departments – and she believes it was the first in the world to do so.

She says: "It's basically about how do we turn every single government department into a department focused on wellbeing and health – and including agriculture and the food sector, the transport sector.

"That's the idea for the future," she adds.

Time will come when electronic records turn into web apps

Big data Digital files can do more than keep track of patients' history, writes *Sarah Murray*

Big data is nothing new to healthcare professionals. Hospitals and clinics have always kept detailed records on their patients. But as that information moves from paper to digital files, the health record is becoming a tool facilitating everything from more consistent care to predicting and preventing disease and chronic illness.

Tom Lawry, director of worldwide health at Microsoft, believes technology is critical to putting these data to work. "We already have data overload," he says. "Look at any healthcare organisation of any size and it has massive amounts of data in silos that it isn't making much use of."

One of the most important tools in breaking down these data silos is the electronic health record. And when combined with other systems, the technology can do more than simply keep track of patients' health history.

At Southern Illinois Healthcare, electronic health records are central to the way its hospitals and clinics improve the efficiency and quality of care.

After tracing with pencil and paper the movements of nurses around its hospital floor, for example, the organisation found room for improvement. So it integrated the standardised care plan designed by Elsevier, the medical and scientific publisher, into its electronic health records.

The care plan gives the nurses standard sets of procedures for dealing with various conditions. And while these can be adapted to individuals, eliminating differences in the way nurses handle their patients leads to more consistent results.

"When there's variability in a patient's condition, that's one thing," says David Holland, chief information officer at Southern Illinois Healthcare. "When it's because they're under a different nurse's care that's another."

He sees the electronic health record as evolving rapidly from being simply a means of automating paper processes. "There will come a time when the healthcare apps we're starting to see on mobile phones will be automated," he says. "So the data you're collecting will feed directly into your electronic health record."

Of course, for some hospitals and healthcare practices, this remains far off. Many are only at the early stages of digitising their data. And while use of electronic health records has been rising, it is not yet universal.

In the US – where government incentives are available for providers investing in electronic health record systems – adoption varies widely across states. In 2013, the percentage of physicians whose system met the basic criteria ranged from 21 per cent in New Jersey to 83 per cent in North Dakota, according to the National Center for Health Statistics.

In addition, not all data systems are interoperable, particularly in the US, where the healthcare industry is highly fragmented.

Yet with a growing number of patients living with complex long-term conditions requiring the attention of a wider range of medical specialists, there is increased pressure for systems to be able to talk to each other.

"There are quite a few data standardisation movements worldwide and they advance at different rates in various countries," says James Mucklow, an IT expert at PA Consulting. "But the problem is there are multiple standards."

Moreover, the widespread use of electronic health records requires doctors and nurses to work differently and to acquire new IT skills. "The change in what a physician does each day is quite radical," says Phil Fasano, chief information officer at Kaiser Permanente, a US health system.

Kaiser Permanente's HealthConnect is one of the worlds largest private electronic health systems, connecting more than 611 medical offices and 37 hospitals. The system gives physicians instant access to patients' medical status and history and allows patients to make and change appointments, check lab results and refill their prescriptions online.

> 'A problem is that there are multiple standards'

Mr Fasano says investing in the system has paid off. Benefits include a reduction in visits to a doctor's office of more than 25 per cent, a 57 per cent drop in medication errors and, in one three-and-a-half-year study, an 88 per cent fall in cardiac-related deaths.

The benefits of access to data and digital health information go further, says Mr Lawry. "It's not using data simply to look at what's happened to you up to now and to do a better job of fixing you," he says.

"It's looking at variables to predict risks and invest in resources to prevent you from getting into that situation in the first place."

Double the dose: harnessing electronic health records should revolutionise treatment Getty Images

Systems Reminders give insight into what motivates consumers

Launched with two laptops in 2001, Silverlink's clients – large healthcare companies – use the company's technology-based communications to reach tens of millions of individuals across the US.

But while the idea is to encourage individuals to look after their health, the company is also generating vast amounts of data that provide insights into how consumers approach healthcare. Silverlink uses interactive automated messages – delivered via phone, email, text, web, and mobile web – to prompt people to book mammograms or colonoscopies, complete their children's vaccinations or refill their health prescriptions. "It's all those things people know they should do but won't without a nudge," says Stan Nowak, the company's chief executive.

The automated interactive communications give advice on how to get tests and procedures too.

However, Silverlink is also generating insights into what motivates people. The automated voice messages can, for example, ask users if they are planning to take a certain test. If the answer is no, users can select the reason why, whether that is lack of transport, high costs or fear of the test. "Once we know what the barrier is, we can address it in the conversation," says Mr Nowak.

Silverlink can also study certain groups within larger populations to help its clients improve the quality of the care they provide.

In one case, UnitedHealthcare, a large US provider, wanted to understand what lay behind disparities in the rates of colorectal cancer screening in ethnic populations so it could increase those rates. Silverlink sent personalised messages tailoured to African-American, Asian, Hispanic-Latino and Caucasian groups while sending standard messages to control groups for these populations. The programme resulted in a 56 per cent improvement in the rate of colorectal cancer screenings over the control group. **SM**

Longer lives mean more diseases of old age and rising costs

Continued from Page 1

coverage". The advent of a new and highly effective treatment for Hepatitis C – which can cause kidney failure and death – has nonetheless left a bitter taste.

Gilead, the developer of the drug, Sofosbuvir (sold under the brand name Sovaldi), is charging $84,000 for a 12-week course of treatment in the US, to the consternation of many even within the pharmaceutical industry. It claims that the price tag reflects both the high costs of development and the improved outcomes and cost savings compared with older, inferior interventions.

Yet with research productivity still sluggish and failure costly, others point to the need for a radical restructuring in the drug sector to boost efficiency.

That will require far greater partnership and transparency between companies, academics, medical centres, regulators and other industries such as information technology.

A second change towards more sustainable healthcare has to be a shift in focus from treatment towards prevention – which accounts for just 3 per cent of European spending, according to Mary Harney, a former Irish health minister.

The challenge will be tackling corporate interests, human behaviour and short-term political thinking.

Progress with tobacco control, including the introduction of plain packaging for cigarettes, bans on smoking in public places and higher taxes are all helping to reduce consumption – and the incidence of lung cancer.

Many public health experts call for similar ambitious efforts in other fields. For instance, one much neglected priority in the fast urbanising zones in many emerging economies is road safety.

Globally, chronic conditions linked to poor diets and sedentary lifestyles are of ever greater concern. Yet tougher measures to control advertising or impose taxes on sugar, salt and fat remain in their infancy.

In her book *The Shape We're In*, Sarah Boseley estimates that diabetes and other conditions linked to the irreversible growth in obesity are costing the UK's National Health Service alone some £5bn.

She highlights close links and potential conflicts of interest between academic researchers and the food industry that remain far less under scrutiny than the funding their counterparts have historically received from the pharmaceutical sector; and a commercial weight-loss sector that provides greater profits to its operators than long-term benefits to its clients.

If "behaviour change" could pay dividends in easing the advance of chronic ailments, more efforts are still required for infectious diseases which have not been defeated in lower income countries, and in some cases, such as tuberculosis, are returning to more industrialised ones.

A sobering recent resurgence of polio in the Middle East and Africa has set back hopes for eradication.

> $84,000
>
> **The cost of a course of Sovaldi treatment in the US**

The H7N9 flu virus currently concentrated in China and the MERS coronavirus, predominantly identified in the Middle East, are reminders of constantly evolving new diseases, often passed from animals to humans, who then spread them through ever greater travel.

That points to the need for better monitoring and disease surveillance to identify risks earlier and more effectively.

More generally, mobile devices, computing power and data analysis have enormous potential to boost understanding of disease.

IBM and Microsoft are among those vaunting their role – although so far progress remains modest. Aside from the technical challenges, the debate around privacy and confidentiality has yet to be adequately resolved.

Even practical considerations concerning more data sharing remain problematic, which points to the need for more radical innovation in healthcare systems and processes as much as in products.

In the UK and beyond, there is still far more discussion than action on integrated care, for instance, as a way to support the elderly more humanely as well as cheaply at home than in hospital.

Social businesses need patience and deep pockets

Entrepreneurship Finding and retaining the right staff is difficult, while local superstitions can make the job even harder, reports *Amy Kazmin*

In India's many small towns – and in its vast rural hinterland, – patients, and their doctors, face a tough time obtaining reliable diagnostic tests to identify what ails them.

Small-town pathology laboratories are typically run by technicians who perform only the simplest tests, with varying accuracy. National diagnostic chains are setting up collection points so that samples can be sent to their labs in large urban centres for analysis, but such services are too expensive for many patients.

The Asian Health Alliance, a Bangalore-based social enterprise, is trying to bridge the gap, establishing high-quality, affordable diagnostic centres in semiurban areas. The four-year-old company runs seven diagnostic centres, branded Asian Health Meter, in and around the towns of Gulbarga, Davangere and Hubli in the southern state of Karnataka.

The centres, set up in clusters on a hub-and-spoke model, are intended to provide a full complement of blood and urine tests and full radiological services, including X-ray, ultrasound, MRIs, and CT scans, at prices locals can afford. Asian Health Alliance wants to have 30 centres in two years. But it has already run into one big obstacle: finding doctors willing to work in the sleepy, small towns it tries to serve.

At the Asian Health Meter centre in Davangere – a town of fewer than 500,000, 165km from the state capital Bangalore – the radiologist left for more lucrative opportunities. No replacement has yet been found.

"We find it difficult to get the right talent to run our business," says Tara Mohapatra, the founder and chief executive. "We are facing problems of medical professionals, technicians, well-groomed front office and administrative staff who can properly interact with the patients."

The story of Asian Health Meter reflects both the potential and challenges for social businesses in Indian healthcare, where there are vast unmet needs for accessible, affordable and reliable healthcare for the country's 1.2bn people. India's healthcare system is highly skewed, squeezing hundreds of millions of people between various unpalatable options.

In big cities, luxurious private hospitals – often compared with five-star hotels – provide full services to an increasingly affluent middle-class. But the government healthcare system, mandated to provide affordable treatment to the poor, is dysfunctional, after decades of underfunding.

Social businesses – companies set up with a mission of providing high-quality services at prices affordable to India's working classes – are seen as a way to fill the gaps in the healthcare landscape, an opportunity that specialised impact investors are now exploring.

"There are a lot of critical healthcare areas where the markets are inadequate," says Karuna Jain, a senior portfolio associate in Mumbai for Acumen, a New York based a non-profit global venture fund that invests in companies tackling social problems through sustainable businesses.

Acumen has invested $15m in healthcare businesses in India, including Asian Health Meter; Lifespring, a chain of low-cost maternity hospitals; Ziqitza, an ambulance service provider (*see box*); and low-cost eyecare hospitals.

Elevar Equity, an impact investor supported by the Omidyar Network of eBay founder Pierre Omidyar, has backed Glocal, a company establishing affordable rural hospitals. It has five facilities in West Bengal, and plans to set up 50 across many states.

Aavishkaar, a domestic Indian venture capital fund with a social tilt, has invested in Vaatsalya, a chain of 10 low-cost, rural and semiurban hospitals in Karnataka and Andhra Pradesh; G V Meditech, a similar chain in Uttar Pradesh; and MeraDoctor, a start-up that aims to provide medical advice over mobile phones to rural callers without access to qualified medical professionals.

Yet, despite the obvious opportunity – and the interest it is generating among social entrepreneurs and investors – creating sustainable, affordable healthcare services for the masses is difficult. Costs, for personnel and equipment, are high, with little room for reduction, except in the design of facilities, which usually have no frills.

The shortage of doctors and nurses – because of restrictions on expanding training programmes – makes it tough and costly to recruit and retain medical professionals for small towns or rural areas. Even non-professionals expect to be paid typical market rates.

"If I hire a driver or a nurse, I have to pay them a salary equal to what they get in hospitals," says Sweta Mangal, chief executive of Ziqitza, the ambulance provider. "We are passionate about the work, but for a person in the field, it's about his salary."

Healthcare businesses targeting the poorest Indians must also battle entrenched superstitions and attitudes about sickness, health and modern healthcare – and stiff competition from the poorly trained traditional healers and quacks, who are typically the first port of call for cash-strapped patients.

Ms Jain says: "If you are a social enterprise, you have to invest in raising awareness. These enterprises have a long gestation and you need a management with a mindset of being able to take on more than the core value proposition."

On call: Ziqitza, one of India's biggest ambulance outfits, operates privately but also offers a 'free' service that is paid for by state administrations

Ambulance services Medical emergency inspires Indian friends to create a thriving business

In 2003, five US-educated, Indian professionals, all then working in Mumbai for large companies, sat mulling over their country's acute lack of ambulance services, and decided to pool their savings and start one themselves.

They were spurred on by the experience of one of the friends, Shaffi Mather, whose mother had suffered acute respiratory distress at home in Cochin, while her son was visiting.

Familiar with 911 – the US emergency hotline used to call ambulances, police or fire trucks – Mr Mather realised that in his own home town he was unable to summon emergency medical help. He drove his mother to the hospital – and she was treated successfully – but the experience shook him.

"When educated people, with access to money, are not able to summon help in an emergency, just think about people in a rural part of India," says Sweta Mangal, another of the five friends.

Today, the venture, Ziqitza Health Care Ltd, is one of India's largest ambulance service providers, with 800 ambulances. It is no longer a charity, offering free services, but a business that charges – albeit with tiered prices that are much lower for the poor.

"We cannot run the service on charity money," says Ms Mangal, the chief executive officer.

Most of Ziqitza's business now comes from three state governments – Orissa, Punjab and Bihar. It provides statewide ambulance services, part of a national program launched a few years ago. The service is free to patients, and Ziqitza is paid by the state administrations.

Ziqitza also has 100 ambulances dedicated to its own private services in Mumbai and Kerala. The price is based on the hospital the patients choose to go to. Those taken to swish private hospitals are charged more. Their fees are used to subsidise poorer patients.

Ziqitza, which counts the Acumen Fund, a US charity, US-based Envision Healthcare, and several Indian institutions among its investors, turned over $20m last year, is breaking even, and aims to expand its private services to cover India's eight largest metropolitan areas.

Amy Kazmin

'We are passionate about the work, but for a person in the field, it's about salary'

Pharma tries to clean up its act

Green chemistry

The aim is to reduce toxicity and waste in manufacturing, says *Andrew Ward*

Pharmaceutical companies tend to highlight their role in saving lives, but say little about the impact their manufacturing processes might have on public health and the environment.

Addressing that issue is at the heart of Phil Dahlin's role as director of sustainability for Janssen, the pharmaceuticals arm of Johnson & Johnson, the US consumer goods group.

He is leading the company's push to meet a range of targets to cut resource consumption and waste production. This may sound like a distraction for an industry battling to come up with products to replace the many "blockbuster" drugs that have lost patent protection in recent years.

However, Mr Dahlin insists his job is supporting the push for fresh growth: "You can call it green chemistry or lean chemistry. Ultimately, it's good chemistry."

He cites the example of a cancer drug that was broken down by Janssen scientists to explore ways of making the synthesis process more efficient.

They discovered it was possible to reduce raw material input by nearly two-thirds, water usage by more than three-quarters and hazardous waste by 87 per cent.

"During the innovation process, scientists are focused on proving a drug works. They are not so concerned about how it is manufactured," says Mr Dahlin. "So big efficiencies can be found when you go back and focus on the synthesis process."

Janssen is not alone among drugmakers in embracing "green chemistry" – a concept that has been pushed by scientists and activists since the 1990s and more recently by policy makers and regulators.

Pfizer won an award from the UK Institute of Chemical Engineers for reducing the amount of organic process waste generated in the production of Viagra.

Merck & Co and Bristol-Myers Squibb are past winners of the annual US Presidential Green Chemistry award for companies adopting environmentally-friendly ways to design, manufacture and use chemicals.

Green chemistry was defined by US academics Paul Anastas and John Warner in 1998, who identified 12 principles, including toxicity reduction, biodegradability and energy efficiency, to assess environmental impact.

The movement received a boost in 2005 when three scientists – Yves Chauvin of France and Robert Grubbs and Richard Schrock of the US – won the Nobel chemistry prize for simplifying the process of synthesising carbon compounds.

Their breakthrough opened the way for more efficient manufacturing of plastics, medicines and many other products.

In part, green chemistry is simply an extension of the broader environmental agenda to reduce resource usage and pollution.

However, it also taps concern over public health risks from the use of toxic substances in consumer products and from the waste discharges produced by manufacturing plants.

Rising rates of autism and falling sperm counts are among a range of conditions linked with exposure to some of the estimated 83,000 chemicals used in industrial processes.

In a 2010 report, a US government panel concluded that the extent of "environmentally induced cancers" had been "grossly underestimated" and said green chemistry should be "pursued and supported more aggressively" in the interests of public health.

As often with environmental causes, California has been at the forefront of green chemistry. Former governor Arnold Schwarzenegger backed legislation in 2008 to tighten restrictions on toxic chemicals in household goods.

A five-year tug-of-war between manufacturers, environmentalists and scientists followed before the law was enacted last year with an initial 164 chemicals targeted for scrutiny.

In March, Californian regulators issued a list of household products ranging from children's sleeping mats to cleaning products that might need to be reformulated or pulled from the shelves altogether because of hazardous components.

While the law only applies within California, it will influence manufacturing nationwide, given the state's importance to the broader US economy and could become a template for legislation elsewhere.

Keeping momentum going, however, is tough. When pharmaceutical executives discuss the industry's priorities and challenges, green chemistry seldom gets a mention.

Mr Dahlin insists that Johnson & Johnson's commitment is firm, with targets to reduce water consumption and waste disposal at its facilities by 10 per cent each by 2015, from a 2010 baseline.

"We're now trying to push green chemistry back through the supply chain," he says. "That's where the greatest impact could be."

Guiding principles

Developed by US academics Paul Anastas and John Warner in the 1990s, the green chemistry movement is based on a series of principles, including:

- **Prevention** It is better to prevent waste than to treat or clean up waste.
- **Atom economy** Maximise incorporation of materials used in the process into the final product.
- **Less hazardous synthesis** Use substances with little or no toxicity.
- **Safer chemicals** Chemical products should be designed to carry out their desired function while minimising their toxicity.
- **Energy efficiency** Synthetic methods should be conducted at ambient temperature and pressure.
- **Renewable feedstocks** A raw material or feedstock should be renewable rather than depleting.
- **Degradation** Chemical products should be designed so that at the end of their function they break down into innocuous degradation products.

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‘Death is part of the natural order of things’

Profile
Dr Suresh Kumar

Pioneering approach eases suffering where a cure is not possible, says *Amy Kazmin*

In India, many doctors, and the wider society, tend to see the death of a critically ill patient as a “failure” – and encourage ailing patients and their families to attempt every possible means of staving off that eventuality.

But not Dr Suresh Kumar, director of the pioneering Institute of Palliative Medicine, in India’s state of Kerala. Dr Kumar has spent 20 years promoting the concept of compassionate palliative and end-of-life care, trying to ease the suffering and improve the quality of life of the terminally ill, even when there is little prospect of a cure.

“People are tending to live longer, but it doesn’t mean they live forever,” he says. “There is a limit to technology, and there is a limit to what we can do. We should start accepting that death is part of the natural order of things.”

Dr Kumar’s institute, located on the campus of the government medical college in Calicut, has been recognised by the World Health Organisation for its pioneering work on palliative care in lower- and middle-income countries.

Its team of paid professionals, and dedicated volunteers, provides medical and emotional support for about 3,000 home-based patients suffering from advanced cancer, the systemic failures of old age, chronic respiratory ailments, and kidney failure in and around Calicut.

“The basic message we are giving them is that the ultimate outcome is unavoidable, but we are with you in this difficult time, and there are a lot of things we can do,” he says.

Of the institute’s patients, about 80 per cent end up dying at home, avoiding costly, stressful, unpleasant, and ultimately futile, hospital stays. “Hospitals are not the best place to die; they just make your life more miserable,” Dr Kumar says.

Patients registered with the service receive visits from nurses who monitor their condition, doctors who prescribe pain medicine, as and when required, and volunteers trained to provide emotional comfort.

“Even with a supportive family, when the patient starts talking about dying, people won’t encourage it,” Dr Kumar says. “They will just say ‘everything is going to be OK’. But the patient has many unanswered questions. The volunteers are trained how to respond in a way that supports the patient emotionally, without telling untruths.”

The institute also helps patients who have suffered spinal injuries or are undergoing other heavy medical treatment, such as chemotherapy, and simply need greater assistance than families alone can provide.

“You cannot have this care only for terminally ill people – it should come from a sense of compassion to all human beings,” Dr Kumar says. “You cannot take the position of being compassionate to the dying, but not to the living.”

Besides offering direct services, the institute also trains volunteers to introduce palliative care into their communities.

About 80,000 people have been trained, many of whom are involved in assisting the 50,000 home-based ailing patients across Kerala, where the government has now recognised palliative care as an integral part of primary health. About 25 per cent of volunteers are college students.

The institute is also spreading the concept of palliative care to other parts of India and abroad, using partners in Bangladesh, Sri Lanka and Thailand to explain its model.

A grassroots political organiser for leftist parties during his medical student days, Dr Kumar began thinking about palliative care after

Compassion: Dr Suresh Kumar

repeated encounters with advanced cancer patients in severe pain. The young physician realised they needed far more than mere pain relief.

“When I started talking to them, you realise that pain relief is just a small component of what you can do to help them,” he recalls. “I felt it would be better to do something like this, which was much needed, rather than anaesthesiology.”

The idea of palliative, or end-of-life-care, is relatively new in India, where many doctors are reluctant to give patients, or their families, an accurate picture of their prospects, and instead encourage ever more costly treatments, regardless of the likely success or failure. Families often urge doctors to “do everything” to save beloved relatives, while profit-orientated private hospitals can sometimes put pressure on vulnerable families to spend on costly treatment that they suggest could miraculously improve the patient’s prognosis.

“Society is in denial of death,” Dr Kumar says. “People want to postpone death, even if they know it’s futile. Medical technology and hospital systems support this attitude. It’s a negative cycle.”

In Kerala, the availability of an integrated palliative care programme has allowed hospitals to offer it as a genuine alternative for patients for whom more aggressive treatment is unlikely to provide any real benefit.

“The physical comfort the patient achieves has changed a lot,” he says. “More people see palliative care as an option, and hospitals don’t just ‘give up’ on patients.”

Dr Kumar says he is often asked about the burden of working with terminally ill people, but says he is deeply fulfilled by his mission. “The feedback you get from patients and family keeps you going emotionally, he says. “When you see you can reduce suffering in a lot of people, at the end of the day you are happy you have done something.”

End-of-life care training lags behind ageing populations

Dealing with death Gap between provision and those in need is huge, says *Sarah Murray*

There was a time when the process of dying tended to be short and uncomplicated – the result of disease or stroke.

Today, as greater numbers of people live longer but often suffer from several illnesses requiring complex treatments, death is more drawn-out, placing an increasing burden on healthcare systems.

While populations around the world are ageing, many countries are poorly equipped to provide end-of-life care.

“When you look at the number of people who need palliative care services and the palliative care specialists out there, the gap is enormous,” says David Casarett, professor of medicine and director of hospice and palliative care at the University of Pennsylvania.

Some countries are unable even to help their citizens manage pain. In 2012, almost 18m people died in unnecessary pain because they lacked access to treatment, according to the Worldwide Palliative Care Alliance (WPCA).

“It’s not so much the economics, because drugs such as morphine are not expensive,” says Stephen Connor, senior fellow at the WPCA. “It has do to with the fear of these drugs, which has been overemphasised by international overseeing bodies.”

And while bodies such as the International Narcotics Control Board have recently acknowledged that the balance needs to shift from control to access, the restrictions have left their mark, with few doctors trained to administer pain control drugs, particularly in developing countries.

These countries are also hard hit because the incidence of non-communicable diseases, such as heart disease and diabetes, is rising as they continue to struggle to lower infant deaths and combat infectious disease.

“Low- and middle-income countries are poorly prepared,” says Mr Connor. “Eighty per cent of the need for palliative care is there, whereas 80 per cent of the care being delivered is in developed countries.”

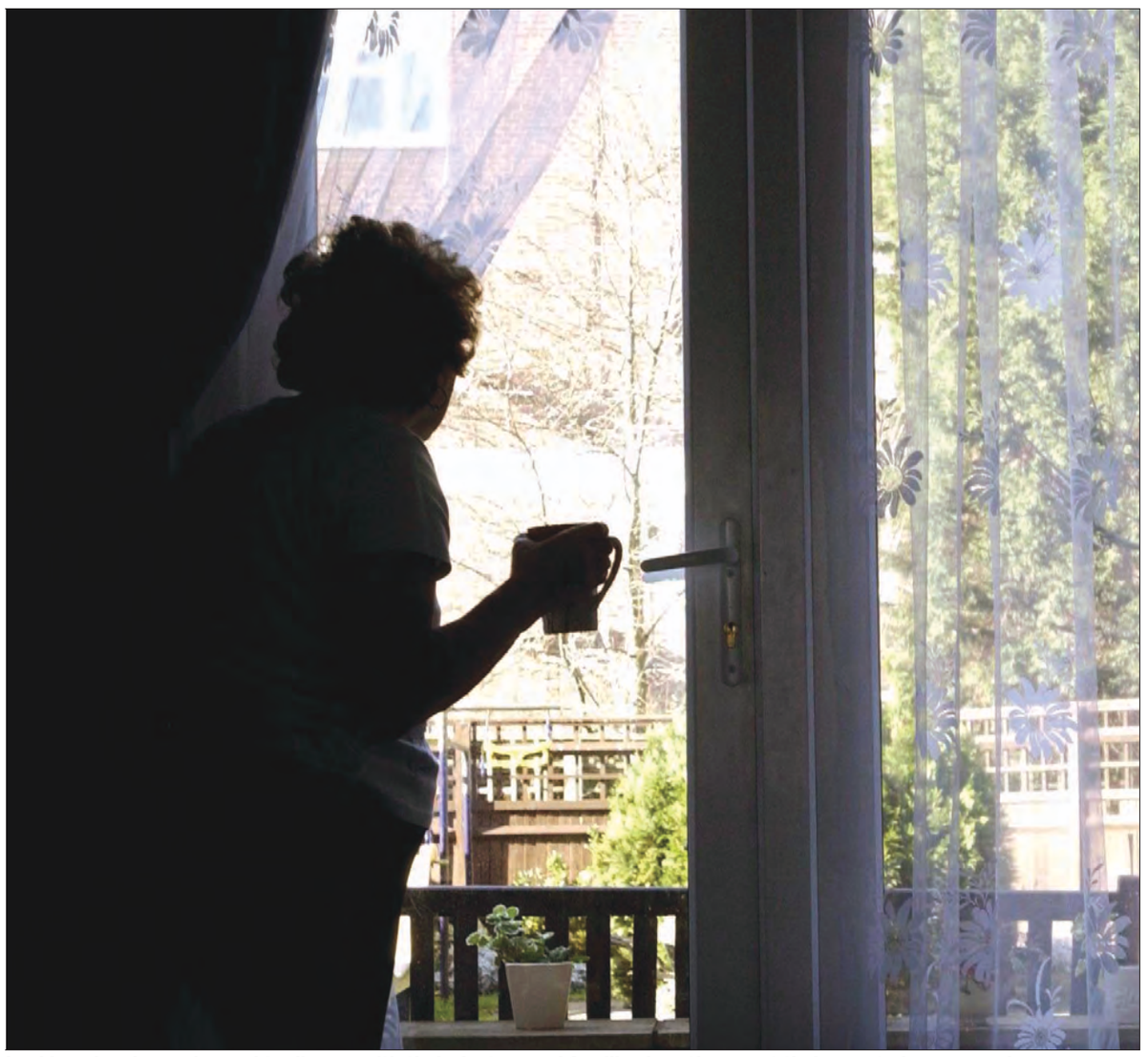
Even in wealthy countries, it is hard to scale up end-of-life care because it requires such a wide range of professionals, from doctors and nurses to psychologists and social workers.

In the US, for example, the emphasis on fee-for-service reimbursement does not create financial incentives for care that is delivered by teams. And while shifts in the way US healthcare is paid for will encourage new approaches, this is only starting to take root (*see story, page 3*).

Insufficient care for people at the end of their lives itself leads to additional costs, since, without symptom management or pain relief, they tend to end up back in hospital.

In Europe, efforts are being made to assess the skills of physicians in this area.

The European Association for Palliative Care (EAPC) recently started a project to assess how many countries are providing recognised palliative care training for doctors.



Looking ahead: people need to discuss with their doctors and families how they want their care to be managed Daniel Lynch

“The good news is that there are 15 countries in Europe where that is recognised,” says Sheila Payne, EAPC president and co-director of Lancaster University’s International Observatory on End of Life Care.

“But,” she adds, “there are 52 countries in Europe, so there’s still a long way to go.”

Given the growing demand for care, however, the use of specialists will not be sufficient. Prof Payne says that instruction on how to look after dying people needs to be incorporated into teaching at all medical schools.

“If we can help all doctors when they qualify to understand how to assess and manage people’s pain and symptoms, that will make a huge difference,” she says.

But if the medical community needs to become better equipped to offer end-of-life care, another community can also contribute to improved care: citizens themselves.

First, families play a critical role. But to allow their relatives to remain at home, they need assistance. “People with no support for a dying relative will take them back to the hospital,” says Mr Connor.

Equally important is encouraging individuals to become more active in their own care and to discuss with their doctors and families preferences for how they would like their care to be managed.

Yet this is not always easy. While death is a universal and inescapable fact for humans, in modern society people often have a hard time confronting it and few want to talk about dying.

In the UK, efforts are being made to change this. In one grassroots movement, informal events called Death Cafés – where tea and cakes are served – provide forums where people can get together to discuss death and dying.

“We need to open up the conversation,” says Prof Payne. “It’s not that people don’t think about it, but in many cultures we’re not comfortable talking about dying and bereavement. Having those conversations would be helpful.”

Commentary Four leading health professionals take stock, plot trends and find solutions

Medicine as a team sport

Toby Cosgrove, president and chief executive of the Cleveland Clinic

Manufacturing, retail and transport have been furiously modernising over the past 20 years. They’ve become sleeker, faster and more customer-focused. Healthcare is only now waking up to this process.

High costs, regulation and digital disruption are forcing us to perform more efficiently. The individualistic, doctor-centred model is no longer sustainable. The new era rewards integration, collaboration and network building.

Medicine has become a team sport. Non-profit group practices where salaried physicians collaborate on patient care have an advantage.

Conventional hospitals are hornets’ nests of conflicting agendas. Group practice doctors, nurses and support personnel have aligned goals. They can work as a team to root out the deeply ingrained inefficiencies found in all hospitals.

At Cleveland Clinic, multidisciplinary task forces evaluate surgical procedures, physician preference items and supply chain. They standardise purchase of instruments based on cost plus proven clinical effectiveness. This has allowed us to cut more than $200m out of our supply chain in four years.

We are forging broad alliances to share our cost-saving expertise with other providers and find new economies of scale. This teamwork needs to be widespread across our industry if we are to meet the real medical challenges of our time: obesity, chronic disease and diseases of the ageing brain.

Putting a value on medical treatments

Sir Andrew Dillon, chief executive of UK National Institute for Health and Care Excellence (Nice)

There is no universal truth in valuing new medicines. When a medicine is licensed, we can be confident (based on what we know at the time) that its benefits outweigh its risks. And we know it will have some therapeutic gain for some patients. But the question Nice has to address is whether that incremental benefit is sufficient to justify what the National Health Service is being asked to pay.

Nice uses a broad definition of value. We start with the results of clinical studies. We talk to health professionals and to patients. We compare the technology with current standard practice.

Once we get a fix on its added value to patients, we assess the opportunity cost to the NHS: Will the additional health gain it brings be more or less than what it displaces? This is important if we are to avoid jumping to the next new thing without considering what the NHS – operating with fixed costs – might have to give up as a result.

The final step is to ask our independent advisory committees to decide the right thing for the NHS to do. They make the scientific and social value judgments that convert the evidence into a recommendation, having regard to a range of factors including effects on quality of life that haven’t been captured in the studies and the ambition the NHS has for doing the best it can for everyone who relies on it for their care.

Innovating in a fragmented industry

Michael Dixon, a partner at Sequoia Capital, US

Companies face myriad challenges when bringing innovations to market in healthcare. The idiosyncratic industry is filled with poorly aligned goals and a variety of market dynamics.

The most innovative companies are able to get past these barriers. On the health insurance side of the market, some of the more successful have targeted employers directly with an offering that can make a meaningful dent in their spend.

In the US, self-insured employers, which provide care for 100m Americans, have clear incentives to innovate (for example, Starbucks spends more money buying healthcare than coffee).

On the provider side, a number of companies have reimagined care delivery from the ground up, with convenient, low-cost locations, a consumer-first mindset and purpose-built IT systems – and their competitors are too heavily burdened by legacy costs to compete.

There is no panacea for rapidly growing global healthcare costs but there are promising advances that should help us fight the battle. Take mobile devices that enable telemedicine and data collection or next-gen sequencing, which will help identify long-term health risks.

If we can understand an individual’s health risks and then provide the tools and incentives to manage those risks, we have a shot at saving lives and reducing cost.

Challenges in the developing world

Shuaib Siddiqui, director at Acumen Fund, charity

Most healthcare solutions are focused on providing services in urban areas. With roughly two-thirds of the population of India and sub-Saharan Africa living in rural areas and making up a large portion of the world’s poor, how do we make healthcare services available to them?

Problems to be overcome include increasing awareness, understanding cultural barriers, making services affordable for the consumer and viable for the companies providing it, and using capital to design innovative business models for service delivery in resource starved settings.

Making diagnostic services more accessible will cut the cost of care for rural communities. There are instances where diagnostics and treatment are being embedded in primary care centres and hospitals in second-tier cities, using hub-and-spoke models to expand healthcare access.

More can be done through education, prevention and field-based disease testing. Companies are using mobile technology more effectively, linking patient and doctors virtually, but more mobile diagnostic solutions are needed.

Healthcare providers are adopting innovative cross-subsidy pricing models that bridge the gap between the rich and poor, allowing them to reach a larger market.

Nationalised health insurance schemes may make healthcare accessible to rural communities via public-private partnerships.

Technology sees rise of the ‘expert patient’

Innovation

Using big data to mobilise consumer knowledge can reduce costs and improve outcomes, says *Rose Jacobs*

Most of us have grown accustomed to turning to our computers for guidance. Look up a book on Amazon, a film on Netflix, a contact on LinkedIn, and the websites will suggest: “If you liked that, you will love this.”

George Carpenter, chief executive of a small neuroscience analytics company called CNS Response, wants to offer a similar service – only his is for psychiatrists trying to decide what if anything to prescribe their depressed patients. “It’s like Amazon . . . we’re like that, for your brain,” he told a conference last year.

The idea of crowdsourcing prescription decisions may seem a step too far, but it is the sort of initiative that might produce a real change in the way healthcare is administered. This area has traditionally seen incremental improvements at best, even as huge advances are made in the science of medicine.

“I’m excited about the availability of data,” says Nils Behnke, a partner at consultant Bain & Company’s healthcare practice. “It used to be a push model, where, say, a pharmaceutical company would come up with something, price it as high as seemed feasible, introduce it to the system and try to get as many customers as possible. Now it sometimes works the other way around.”

That is, people with rare diseases might find one another online, join forces to pool data and advocate for research into new treatments and even ease the process of pharmaceutical groups finding candidates for clinical trials by volunteering themselves.

“Healthcare is becoming collaborative instead of the investment being focused on the back office,” says Vivek Kundra, who was the White House’s first chief information officer and now an executive vice-president at Salesforce.com, whose software supports the CNS Response system.

That, in his view, is down to three forces: rising healthcare costs around the world, and attempts to tamp that growth; the need of nations to address disease at scale, particularly in places where the population is ageing; and the rise of personalised medicine.

‘Healthcare is becoming collaborative instead of the investment being focused on the back office,’ says Vivek Kundra

If those are the drivers, the tools, evangelists believe, are the Cloud, social media and mobile technologies.

And if the cloud democratises data and social media extend decision-making power to patients, mobile technology changes the dynamics of healthcare delivery. It is no longer unusual for specialists to be Skyped in to a consultation, and that is just the start: mobile phone apps may soon be monitoring individuals’ basic health metrics, reminding patients to take medicines and sending information back to doctors or insurers.

The treatment of long-term conditions, such as diabetes, is ripe for these technologies, which enhance patients’ self-care options, drive down costs and improve quality of life.

Of course, these controls could alternatively create a more paternalistic system of watcher and watched – and Mr Behnke sees privacy issues as a potential drag on the pace of change. But Thomas Cawston at Reform, the UK think-tank, thinks it will enable patient choice among people only beginning to see themselves as consumers of healthcare rather than passive recipients.

That could improve health outcomes and reduce costs. Studies have shown that patients involved in decision making are more likely to visit a pharmacy than a GP, and less likely to opt for surgery, choosing instead less invasive but equally effective measures.

In a forthcoming report on “the expert patient”, Mr Cawston cites a 2012 study suggesting that “mobilising patients’ knowledge and contribution to care through a programme of initiatives costing between £100 and £450 per person could deliver savings of £4.4bn in the NHS.”

Consumer-driven systems best serve motivated, engaged consumers. As for the rest, whereas in retail or entertainment, it does not matter if they are left behind, in healthcare it does.

Mr Behnke foresees a bifurcated system where primary care becomes centred on patient choice but more complex decisions – about, say, cancer care – remain in the hands of experts. Here, doctors might make use of democratised data but might not include patients in this process.

He sees institutional hurdles as a potential drag – from medical schools wedded to old systems, to investors focused on quarterly earnings.

The rest of us, Mr Kundra believes, are ready: “Patients have been hungering for this change and medical systems are beginning to catch up.”