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Pre-Primary Care: An Untapped Global Health Opportunity

By Jonathon Carr-Brown
and Matteo Berlucchi

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“The term ‘primary care’ is a misnomer. The first thing citizens and patients do is think what they can do for themselves, the second is to seek advice from friends and family, and in the last twenty years, the internet. Then they seek professional help. ”

Professor Sir Muir Gray

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“New concepts like pre-primary care are important ...this is the right discussion to have as we seek new approaches to building a genuinely 21st Century health service.”

Rt Hon Jeremy Hunt,
The Secretary of State for Health (England)

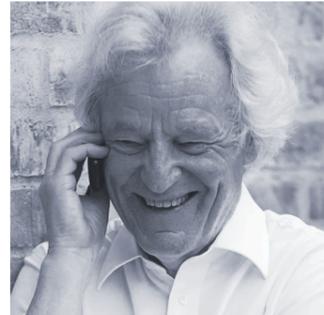
About This Report

Globally healthcare is under pressure. Developed countries are struggling to meet demand and developing nations are battling to retain healthcare professionals to deliver the most basic services.

The challenge for all is how to provide access and quality at an affordable price. For centuries doctors' waiting rooms have remained unchanged - a time defying tableau - queues of people waiting for medical wisdom delivered face to face. The face-to-face consultation remains the gold standard for primary healthcare globally but the human tide descending on primary care practitioners is fracturing the status quo.

This report looks at how digital technology can help enable and equip a new type of provision. The traditional definitions of primary and secondary care have served us well but in a world of under-resourced and underfunded health systems is it time to define a new area of appropriate, trusted and safe provision? We need to develop a concept of pre-primary care to release the power of technology. This report sets out to make the case for creating a pre-primary care sector and describes how it will contribute to redefining global healthcare.

Joint Foreword



Professor Sir Muir Gray CBE
Honorary Professor
Nuffield Department of Primary Care Health Sciences, University of Oxford

The 20th century was the century of the doctor, the 21st century is the century of the patient.

The term 'primary care' is a misnomer. The first thing citizens and patients do is think what they can do for themselves, the second is to seek advice from friends and family, and in the last twenty years, the internet. Then they seek professional help.

Healthcare is what people do themselves, what we call primary care is the first level of professional care but neither it nor specialist services have grasped the implications of the internet.

The genome is often portrayed as the disruptive innovation, but the mobile phone is much more disruptive, opening up information, giving citizens access to the best current knowledge and offering new opportunities for patients and new challenges for professionals.

The key question for all 21st century industries, including health services, to ask is, in the words of Bill Gates: "What is the function of the human being?" It is not to give information or communicate the implications of a decision about an operation. These tasks and many others can be better done using technology. The function of the human being is to provide empathy but to do this they need to make a huge jump to understand how their role has changed with the advent of what this report describes as pre-primary care.

We are in the third healthcare revolution after the public health and the high tech hospital revolutions and this is driven by three forces – citizens, knowledge and digital technology, epitomised by the smart phone.

Sir Muir has worked in the NHS since 1972. He was Director of the UK National Screening Committee, founded the National Library for Health and was NHS England's first Chief Knowledge Officer. Together with Sir Ian Chalmers, he was instrumental in establishing the Cochrane Collaboration



by Henrik B Pettersen,
Executive Chairman,
Your.MD

As executive chairman of Your.MD I am proud to present our pre-primary care manifesto.

Your.MD is defining pre-primary care, a new and uncontested market based on personalised, trustworthy and actionable health information to complement doctors, the scarcest resource in the healthcare system.

"Pre-primary care is the most important piece of primary care as it is what happens before the patient ever goes to see a doctor and, in many cases, prevents them from having to actually see a doctor", Molly Coye M.D. former Chief Innovation Officer of UCLA Health and Social Entrepreneur in Residence at the Network for Excellence in Health Innovation.

We have created a breakthrough end-to-end Artificial Intelligence (AI) platform for pre-primary care because there are not enough doctors in the world to deliver healthcare to everyone, a basic human right (article 25 UN Charter of Human Rights).

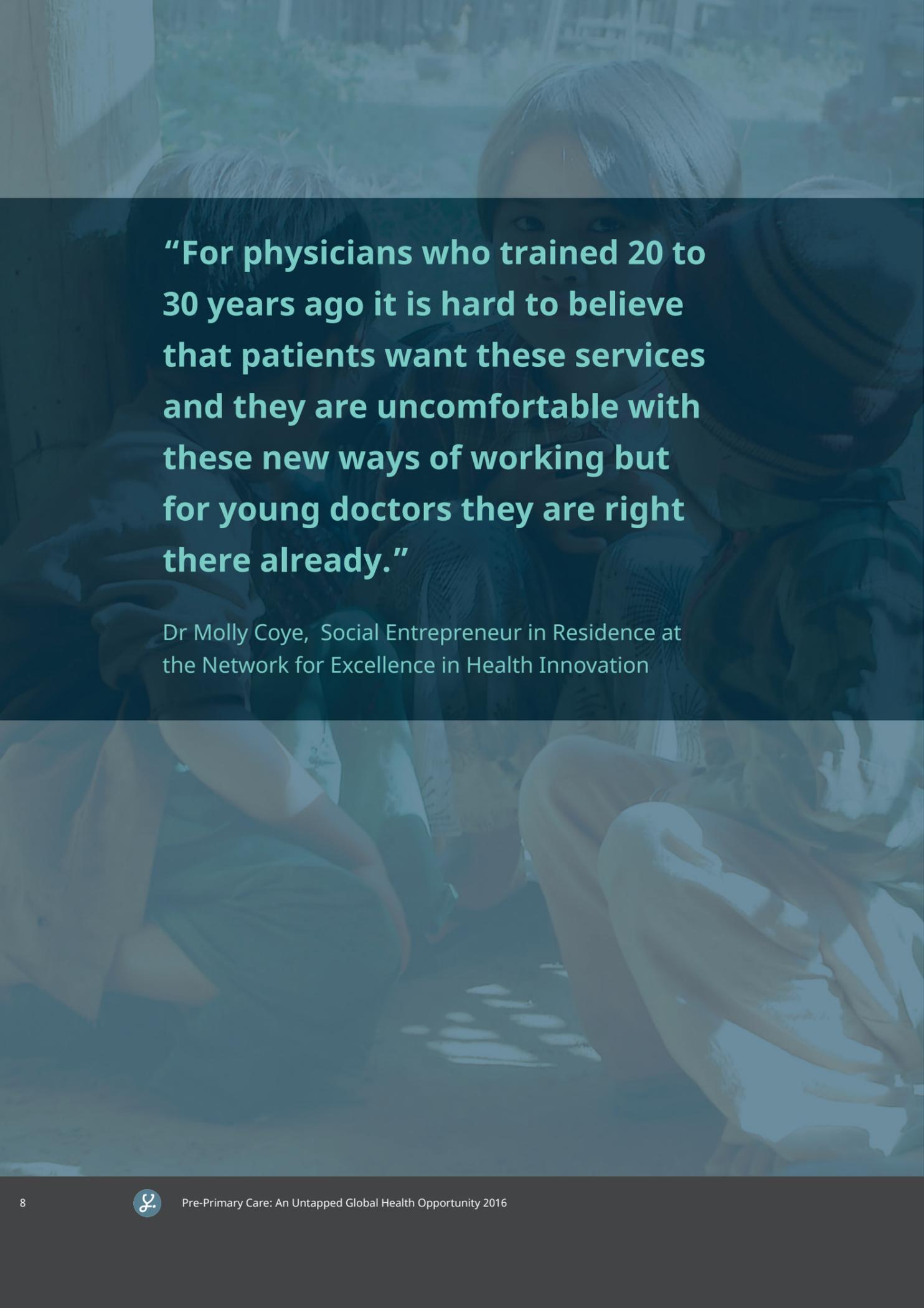
Pre-primary care is one of the biggest markets in the world, yet it is one of the least recognised. Everyone needs healthcare.

The Your.MD pre-primary care platform:

- helps people understand what's wrong with them
- connects them with the most relevant healthcare service providers in their area

All using AI and technology so it is completely scalable.

Our aim is to build the biggest healthcare company in the world to help every human being have basic healthcare without owning any hospitals or doctors.



“For physicians who trained 20 to 30 years ago it is hard to believe that patients want these services and they are uncomfortable with these new ways of working but for young doctors they are right there already.”

Dr Molly Coye, Social Entrepreneur in Residence at the Network for Excellence in Health Innovation

Introduction

The world of healthcare is changing. Developed and emerging healthcare systems are being assaulted equally by ageing populations, a tsunami of chronic conditions and increasing demand for the best technological advances.

Western medicine still favours treating illness over promoting wellness and its medical professionals are trained to diagnose, treat and cure rather than prevent. It is an industry not in collapse but at the peak of its scalability. It is a system rooted in bricks and mortar and the bureaucracy that comes with billion pound budgets and profits.

In developing countries ageing is less of a problem but chronic conditions like diabetes and asthma are hitting already chronically under-resourced healthcare systems struggling to provide rudimentary primary care to their populations.

The evidence suggests we live in a world where our existing models of healthcare are both “financially unsustainable and inequitable.”¹

In the words of Dr Fred Hersch, Chief Medical Officer of Telenor Health based in Bangladesh, neither world can “treat themselves” out of the problem².

¹ Hersch, Meeting the healthcare challenges of the 21st Century

² Hersch, Meeting the healthcare challenges of the 21st Century. Originally quoted by D.Bloom et al The Global Economic Burden of Noncommunicable Diseases 2011

“The smart phone is shaping up to be the dominant computing platform and it’s not hard to imagine that developing countries will leapfrog the PC era in much the same way that mobile communications leapfrogged fixed land lines.”

Dr Fred Hersch, Chief Medical Officer of Telenor Health

Patient Heal Thyself

There comes a point when you have to fix what’s wrong with you before criticising others. The proverb “Physician heal thyself” encapsulates the sentiment and perhaps the motto of the pre-primary care movement – “Patient Heal Thyself”.

Patients in the developed world are quick to criticise healthcare system failures but not so prompt in correcting their own behaviours that exacerbate the burden on healthcare budgets.

In nationalised health economies like the NHS patients see it as their right to use the system they have paid for and in privatised systems consumers see it as a necessity to get their money’s worth. Different systems same behaviours, driven by different perspectives.



Your.MD – AI Personal Health Assistant

The goal of Your.MD is to democratise healthcare and place a doctor in the pocket of every citizen in the world. Using artificial intelligence the Your.MD application is learning from its users every day. Benchmark tests have shown medical accuracy at 85% for the 20 most common conditions. Medical accuracy for a further 500 conditions now sits at more than 60%. This makes Your.MD the most accurate symptom checker in the market today. Your.MD’s medical accuracy is benchmarked for

diagnostic accuracy using externally verified medical test cases from Harvard University and the Royal College of General Practitioners. This is the same method used to test trainee doctors.

Your.MD has also created its own test cases that hold greater relevance to its global database of users, so testing can be more diverse and thus more accurate. Eventually, Your.MD aims to have a case for every condition so Your.MD will be medically more robust.

The 21st Century Health Paradigm

In developing healthcare systems, populations face scarcity of resources and disparity in provision between rural and urban areas. As a result, millions around the world already care for themselves and would value medical assistance that could be placed in their hands.

What if, in the developed world, we enabled citizens to be more responsible and accountable for their own health? What if our doctors told us we all had to take our blood pressure, weight and pulse before coming to see them?

What if, in the developing world, we trained one person in every village, armed them with a mobile phone, miniaturised testing equipment and showed them how to appropriately diagnose, treat and triage members of their community?

How is asking someone to prepare for a medical appointment different from the substantial assistance we now give to the airline industry in conducting its business: we book online, order our food and seats online and we print out tickets. When we reach the airport we increasingly check ourselves in and, lately, even check in our own bags. Our banking and shopping experiences are no different. Self-checkout at supermarkets is ubiquitous. Our service industries are now less service more self-service. With these examples citizens have been happy to trade contact and familiarity for convenience, utility and savings even if that means new inconveniences further along the customer journey.

How is skipping the primary care stage in the developed world any different from Kenya skipping over universal banking and going straight to mobile money? Paradigms change in order for the world to progress. Developing a concept of pre-primary care represents a paradigm shift for healthcare globally.

Dr Eric Topol, author of *The Patient Will See You Now*, says medicine has long been dominated by a “priestly class”, beginning with Imhotep, the first physician (and a priest), in Egypt some 4,600 years ago. Things have hardly changed. Two millennia later Hippocrates, widely considered the father of medicine, insisted that most medical information should be concealed from patients.

As a result, citizens continue to sit in waiting rooms with ailments seeking reassurance, diagnosis and treatment. In the 21st Century, if you want a trusted medical opinion you make an appointment with a professional who has had at least seven to 12 years’ training and is backed by an infrastructure that allows them to empirically prove their medical hypothesis through tests. In developing nations, you either suffer, wait or trek to see trained physicians that are mostly concentrated in urban areas.

It is an inefficient system with the primary care physician acting as a gatekeeper to wider healthcare in most systems. Although many countries operate a system of self-triage to specialist primary care physicians the starting point is always a doctor in a room with a stethoscope no matter what the ailment is, its severity or its longevity.

This approach works as long as you have enough physicians to deal with patients in a timely way. If every individual went to the doctor’s surgery once a year even with the growing population the historical approach might hold the line. However, as populations grow and people live longer with chronic conditions the number of consultations per health professional escalates.

The NHS now estimates that the average citizen sees a nurse or general practitioner five-and-a-half times a year, up from three times in the mid 1990s.³ In India, it is estimated that a primary health centre, which is usually run by one doctor, will be responsible for 30,000 residents⁴.

Over the past ten years, the challenge to meet the pressure of chronic disease in developed countries has focussed on primary care. It was assumed that strong primary care was the most effective and efficient way to address the growing problem.

³ Hippisley-Cox J, Vinogradova Y. Trends in consultation rates in General Practice 1995/1996 to 2008/2009: Analysis of the QResearch® database. Final report to the NHS Information Centre and Department of Health. Leeds: The NHS Information Centre for health and social care; 2009

⁴ Hersch, Meeting the healthcare challenges of the 21st Century. Originally quoted by D.Bloom et al The Global Economic Burden of Noncommunicable Diseases 2011

However, although excellent examples of primary care management of chronic conditions have been developed across the globe scaling them is proving challenging. Inadequate facilities, a short supply of health workers and a lack of knowledge about managing chronic conditions are hampering attempts to hold back the tide.

Even efforts to apply evidence-based interventions are proving a burden in the western world. In the UK, the gold standard for Type 2 diabetes training is DAFNE (Dose Adjustment for Normal Eating) a course that requires the at-risk individual to attend 13 one-hour courses over nine months.



Omada Health – Personalised digital behaviour change

Sean Duffy, the founder and CEO of Omada Health, wants to combine the best of evidence-based behavioural science with the best in design and technology. Omada want to identify what works and then translate it into digital therapeutic approaches designed to generate outcomes. The company's first product, Prevent, is an online weight loss and lifestyle program for pre-diabetes. It is based on Diabetes Prevention Program (DPP) studies that showed that modest weight loss, the result of regular physical activity and a low fat, low calorie diet did delay or prevent progression to diabetes.

A company-run study, published in Diabetes Educator, documented the following results:

- Participants completed an average of 13.8 out of 16 lessons
- Body weight was recorded in 90% of the core sessions
- Participants lost five per cent of their body weight during the sessions and maintained this weight loss for 12 months
- Baseline blood sugar levels (HbA1c) regressed from the pre-diabetes range to the normal range

Overall, Prevent was found to have performed as well as residential versions of the course.

NHS England has recently commissioned a £100,000,000 five-year Diabetes Prevention Programme that aims to educate 100,000 people a year using DAFNE. That represents £200 a course. Not a huge price until the scale of the problem is understood. There are five million people thought to be at high risk of contracting Type 2 diabetes in England. The cost of applying this evidence-based approach to all of them would be £1bn⁵.

This is a notional cost because the evidence base suggests although the courses are effective most diabetics will decline to attend because the approach doesn't fit their lifestyle or perception of themselves. The National Audit Office in the UK reported that only 16% of newly diagnosed diabetics were offered structured education and fewer than four per cent of those offered attended the courses⁶.

The provision of healthcare is complex. There are many stakeholders, each with their own objectives, motivations and incentives. Improving health outcomes is as much about provider behaviour change as it is about patient behaviour change and requires buy-in from multiple stakeholders⁷.

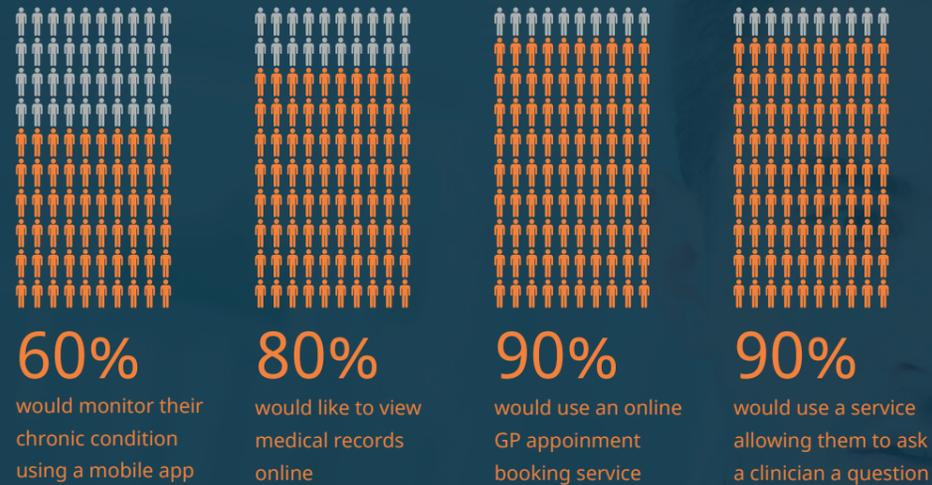
Behaviour change is the marketing concept that has driven the digital consumer revolution over the last 20 years. Retailers and other service industries realised their customers were inherently complex and willing to try a variety of appropriate delivery mechanisms and increased personal involvement to gain quick low cost access to high quality services and products.

⁵ The National Audit Office: Management of adult diabetes services in the NHS: Progress Review - <https://www.england.nhs.uk/ourwork/qual-clin-lead/diabetes-prevention/>

⁶ <https://www.nao.org.uk/wp-content/uploads/2015/10/The-management-of-adult-diabetes-services-in-the-NHS-progress-review-Summary.pdf>

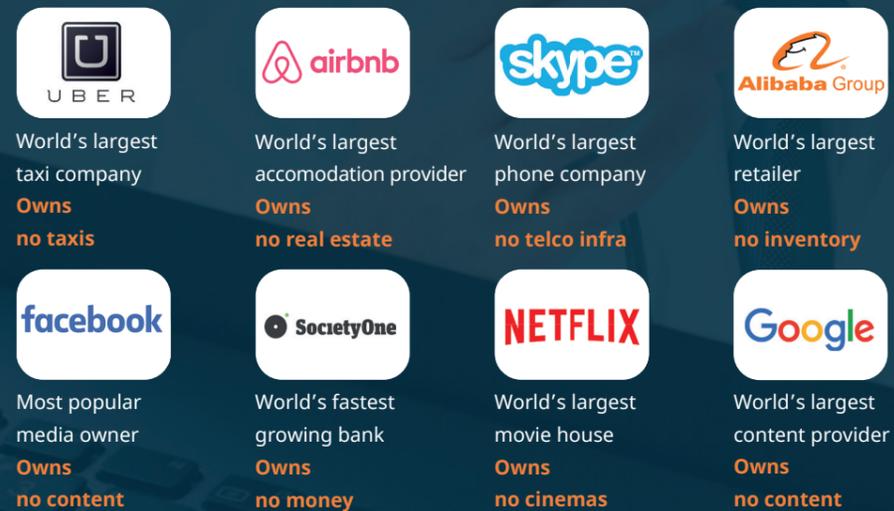
⁷ Hersch, Meeting the healthcare challenges of the 21st Century. Originally quoted by D.Bloom et al The Global Economic Burden of Noncommunicable Diseases 2011

A 2012 survey of 7,000 patients found that ...



Source: Patient Survey 2012, Patient.co.uk and Department of Health and UK Trade and Investment (2015)
 'The UK: your partner for digital health solutions'.

The world's largest companies own ...



A Pre-Primary Concordat

If we accept pre-service tasks and behaviour change in the realm of travel, shopping and banking, what would a similar concordat look like between patients and healthcare providers for such a service prior to or after entering primary care?

Dr Molly Coye, former Chief Information Officer for UCLA Health and current Social Entrepreneur in Residence at the Network for Excellence in Health Innovation, explained: "Most doctors think of healthcare in terms of patients coming to visit them and doing lab tests.

"At UCLA we had 250,000 primary care patients but what happened to support them before they came to see the doctor, and what might have prevented them from having to see the doctor? David Lawrence⁸, the former Chief Executive of Kaiser Permanente, and I began to call that pre-primary care."

She added: "For physicians who trained 20 to 30 years ago it is hard to believe that patients want these services and they are uncomfortable with these new ways of working, but young doctors are right there, ready for it all (see the Patient.co.uk survey detail on p.16).

"David and I realised if something can be provided by technology it can be delivered by a lower level of healthcare worker or the patient themselves outside the traditional primary care environment. We felt patients and doctors would be more willing to accept these interventions if we could define a different function for the workers and the tools delivering the service."

In Dr Coye's vision, pre-primary care has no buildings. It is an interstitial market copying giants like: Amazon, a book seller without book shops; Uber, a taxi firm without cars; AirBnb, a hotel without rooms; Netflix, a cinema without theatres; Google, a content provider with no content and Skype, a phone company without phone lines (see p16).

In the same vein, the first truly global provider of pre-primary care will have few doctors and no hospitals. Instead they will have digital devices and tools used at scale in communities often supported by healthcare workers with lower level qualifications.

⁸ David Lawrence was a consultant to the Institute of Innovation at UCLA at the time

Far fetched? Twenty million people – a third of the UK population – look up health advice and information on NHS Choices (www.nhs.uk) every month. A trend that Google’s research department says is a global phenomenon. According to the search engine giant 70% of people now look up health symptoms online before going to see a doctor. And an Intel survey in 2013 found 70% of people would use a sensor in their toilet or bottles, 64% want a personalised healthcare regimen and 53% would trust the test they personally administered.

Dr Coye explained: “Primary care is defined as healthcare provided by a medical professional with whom a patient has initial contact, who coordinates their care, and by whom the patient may be referred to a specialist -- but in the US a lot of people do not see a primary care provider all year.

“In India they have done a lot of work recruiting workers in the community whose job is to search out individuals and families who might be at risk but aren’t attending primary care. These workers are providing baseline checks, education, and leveraging technology and, where necessary, referring into primary care.”

Dr Coye sees a shift to the patient doing more for themselves as an important component in stimulating large scale behaviour change, and believes that the only way to meet the goal of millions of engaged patients is through technology.

Dr Jorgen Skavlan, a Norwegian specialist in family medicine with 30 years’ experience added: “I now, for the first time, see a shift and a potential for real change by introducing pre-primary care. Medical professionals can in the future focus more on those individuals who really need medical attention and with that increase quality, availability and cost control. I think my colleagues will see that this paradigm change will be advantageous for themselves, their patients and the society as a whole.”

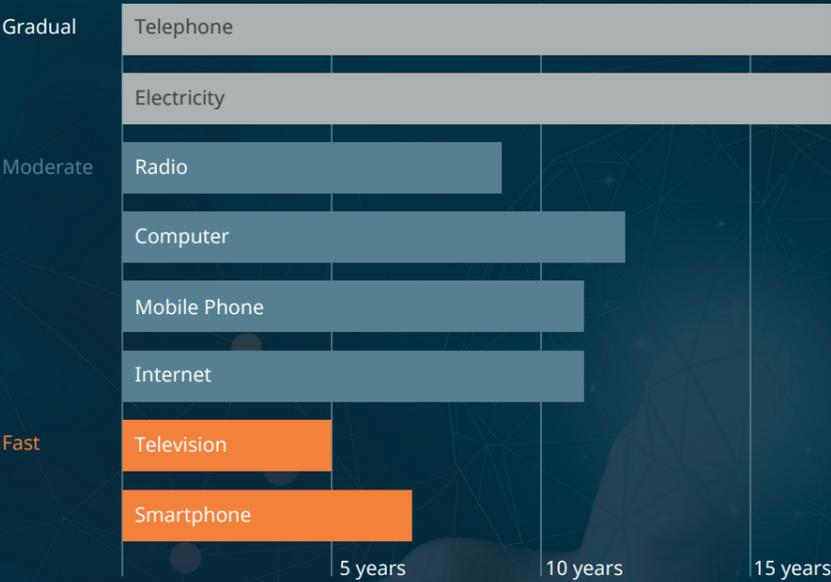
The timing is also important for policy makers. Jeremy Hunt, the UK’s Secretary of State for Health, said: “New concepts like pre-primary care are important given the broad consensus on prevention and the need to improve quality of care just as demand rises from our ageing population. So this is the right discussion to have as we seek new approaches to building a genuinely 21st Century health service.”

Dr Molly Coye’s and David Lawrence’s Pre-Primary Care Functions	
Assess Health Status	<ul style="list-style-type: none"> • Identify risks and opportunities • Report status and measure baseline • Refer for more formal medical intervention
Educate and Motivate	<ul style="list-style-type: none"> • Answer questions • Stimulate behaviour change
Provide Continuing Assessment and Feedback	<ul style="list-style-type: none"> • Prioritise self-management
Monitor Population Trends	<ul style="list-style-type: none"> • Identify new risk • Monitor self-management progress and outcomes • Identify new challenges and opportunities • Rapidly test new interventions
Technology Enablers	<ul style="list-style-type: none"> • Identify and segment individuals by health status • Match type of intervention with self-management goals • Match type of communication and format with self-management goals • Match type of healthcare worker with self-management goals • Provide ongoing analysis of clinical effectiveness, consumer experience and resources used • Enable rapid cycle evaluations of new interventions

The Digital Driving Force

Technology adoption rate

Time taken by technologies to reach 40% to 75% population penetration



Sources: ITU, New York Times, Pew, Wall Street Journal, US Census Bureau

The driving force behind a global digital pre-primary care service is the mobile phone. The past decade has seen the mobile phone emerge as one of the most exciting developments in global health. The rate at which mobile phone coverage and access has spread is unparalleled in the history of technology.

Today there are six billion mobile phone subscriptions – the majority in developing countries. Ninety-five per cent of the world is covered by basic voice and text access. India has already surpassed the US with more than 400 million smart phone subscriptions. And Ericsson estimate there will be 6.3 billion smart phone subscriptions globally by 2021⁹.

The potential for the ubiquity and affordability of mobile technology to democratise healthcare excites pre-primary care entrepreneurs. The convergence of mobile networks with increasing bandwidth capacity for data, the proliferation of low-cost smart devices and cloud computing are opening up new opportunities to support the delivery of pre-primary healthcare (see technology adoption rate table on page 20).

Dr Hersch explained: “The smart phone is shaping up to be the dominant computing platform and it’s not hard to imagine that developing countries will leapfrog the PC era in much the same way that mobile communications leapfrogged fixed land lines.”

At the same time, low-cost point-of-care diagnostic and measurement devices are transforming the capabilities of patients and healthcare workers. Phones can now take ECGs, measure your pulse and blood pressure.

Dr Coye added: “Patient reported data will be vital. Increasingly people will have health monitoring and communication equipment in their home or wear it as they go through their day – and doctors and nurses will become skilled in understanding which patients will benefit from such systems.”

Dr Eric Topol, the author of *The Patient Will See You Now* highlighted in a Wall Street Journal article¹⁰ that wearable sensor tools are now being developed that can: monitor your heart function, check the amount of fluid in your lungs, track your glucose levels, measure eye pressure (to help manage glaucoma), and

⁹ Ericsson Mobility Report: On the pulse of a networked society June 2016

¹⁰ Dr Eric Topol, Wall Street Journal, Jan 2015, The Future of Medicine is in Your Smartphone



capture your brain waves. He added: "Someday, socks and shoes might analyze the human gait to, for instance, tell a Parkinson's patient whether his or her medications are working or tell a caregiver whether an elderly family member is unsteady and at risk of falling."

In addition, Topol is certain that smart phone attachments will soon enable you to perform an array of routine lab tests via your phone at a fraction of the current cost. Blood electrolytes; liver, kidney and thyroid function; analysis of breath, sweat and urine—all could be checked with small fluid samples in little labs that plug directly into smart phones.

Meanwhile, nearly all sophisticated medical imaging devices are being miniaturised: hand-held ultrasound devices are already available and some medical schools have begun issuing them in the place of the old-school stethoscope. Hand-held MRI (magnetic resonance imaging) machines are not far behind, and engineers at UCLA have come up with a smart phone-sized device that can generate X-rays. Topol claims: "It won't be long before you can take a smart phone X-ray selfie if you're worried that you might have broken a bone."

The decentralisation of healthcare through low-cost and highly portable point-of-care diagnostics has the potential to revolutionise current limitations in patient screening – a development that makes the prospect of the developing world jumping to a pre-primary care model possible and even more likely.

Technology not only opens up the potential of a new pre-primary care diagnostic relationship with medical providers driven by citizens but also the possibility to revolutionise specialities where patients do not necessarily benefit from face-to-face engagement.

Mental health is a leading cause of disability in the western world. The UK Faculty of Public Health estimated in 2009-10 that poor mental health cost England £105bn and the Organisation for Economic Co-operation and Development estimated in 2014 that 40% of all new disability claimants in England had mental health issues amounting to a £70bn drain on the economy.

BigWhiteWall – Patient-Guided Mental Health Management

Access to mental health provision is oversubscribed throughout the developed world. BigWhiteWall (BWW) was developed to provide immediate support for sufferers prior to and after face-to-face referrals. In a survey of BWW members, 46% reported sharing an issue or feelings on BWW for the first time and 70% of members from local health contracts reported that using BWW improved their wellbeing in at least one way. Other findings included:

- People taking BWW GuidedSupport courses for anxiety experienced an average reduction of 3.5 points on the

GAD7 (anxiety) scale

- For people taking depression courses, the average reduction in the PHQ9 (depression) scale was 3.5 points
- BWW's LiveTherapy service has consistently shown recovery rates above the average achieved by Improving Access to Psychological Therapies provision. Of people referred into BWW's LiveTherapy programme by their GP, 57% were moving to recovery. The national average recovery rate is 45%, according to NHS statistics.

Source: <https://www.bigwhitewall.com/info/research-and-outcomes/#>

Smart phones can now quantify your state of mind by a composite of real-time data: tone and inflection of voice, facial expression, breathing pattern, heart rate, galvanic skin response, blood pressure, even the frequency and content of your emails and texts.

A recent study by Gale Lucas in the Journal of Computers in Human Behavior¹¹ demonstrated that people are more willing to disclose their inner thoughts to a computer avatar or virtual psychiatrist than a real one. With machines working to quantify moods and even offer virtual counselling to help make up for our

¹¹ Computers in Human Behavior; It's only a computer: Virtual humans increase willingness to disclose, Gale M. Lucas, Jonathan Gratch, Aisha King, Louis-Philippe Morency

profound shortage of mental health professionals, we can glimpse a new pre-primary approach to improving mental health.

While the world is currently focusing on digitally giving citizens access via video, voice or messaging to doctors this trend is quickly abating as suppliers realise the solution does not solve the shortage of qualified health professionals. A telephone or a Skype conversation is more convenient for the patient but probably takes up the same amount of time in a doctor's day leading to only marginal productivity gains when what is needed to save healthcare is an algorithmic productivity gain.

Bruce Wilcox, a Loebner Prize¹² winner and chatbot expert said: "This transfer to digital pre-primary care must happen. Mostly people get sick at night or at weekends when doctors aren't around. That's when they need reassurance.

"We are at least five years away but apps like Your.MD will be able to diagnose as well as the average doctor by then and I know that because artificial intelligence systems like the IBM Watson programme are already better than a doctor in specialties like radiology and pathology.

"It is inevitable that these apps are going to get better. Once you start adding sensor technology and giving people the freedom to order tests themselves it is going to be difficult to see what the doctor is adding. The Star Trek tricorder is coming. Doctors know more and they can order a test and narrow down the possibilities but that is an arbitrary restriction. What we are in the process of developing is a digital Dr House."

¹² The Loebner Prize is an annual competition in artificial intelligence that awards prizes to the chatterbot considered by the judges to be the most human-like

The Evidential and Cultural Challenge

At the moment, one barrier to wider adoption, particularly in the western world, is the appetite for apps is not matched by the evidence of their impact on people's health and their interactions with healthcare providers. There are mixed feelings about them among professionals. In a global survey of doctors, despite their own use of technology (see digital channels table below)¹³:

- 41% agreed with the statement that mobile apps could be a 'game-changer' for improving health
- only 36% stated that they would recommend a mobile health app in future to their patients

To date, there has been a real focus on apps and devices to improve wellness – such as step and calorie counters – as well as those focused on a single disease. There has been less of a focus on tools for complex costly patients.

One interviewee said that developers shy away from apps for complex patients. David Blumenthal, president of the Commonwealth Fund, said in a recent Cello Health Insight report: "They're too complicated, they're too unappealing, the ROI [return on investment] is too unclear, the time to pay off is too long [and] they need to know too much about these patients in order to develop these applications."

Digital channels most commonly used by doctors to communicate:

	With colleagues	With patients
Phone calls	89%	84%
Email	88%	48%
Text	68%	30%
WhatsApp	31%	15%
Social Media	30%	8%
IM	25%	7%
Skype	17%	4%
WeChat	3%	1%

¹³ Cello Health Insight, 2014 and 2015

The Commercial Challenge

A systematic review into smart phone apps for the prevention, detection and management of cancer found that, while there are a 'considerable number' of apps available, the evidence for them is 'lacking' (Bender and others, 2013).

Devices such as Fitbit and smart phones collect a huge amount of data. Patient portals such as Patients Know Best allow patients to integrate these with their EHR (electronic health record), while companies like EMIS Health and Medelinked are able to access data stored in Apple's Health app once the end user has consented to share it. However, generally speaking there are issues around uploading app data to EHRs and even more so in meaningfully interpreting the results.

Several interviewees in the Cello survey had mixed views on the potential of wearables and apps.

David Furniss, Vice President, Global Government and Health at BT said: "There is an overemphasis on the device that people are using to capture the information and not on what am I going to do with the information now I have captured it." There also remain security concerns around the use of mobile technology, particularly in unregulated markets.

In 2015, the UK NHS Health Apps Library carried out a systematic assessment of 79 apps certified as clinically safe and trustworthy. It found that 89% transmitted information to online services and that 66% of apps sending identifying information over the internet did not use encryption¹⁴.

Dr Hersch admitted the evidence base for digital pre-primary care is slowly evolving but he still believes "the question is not 'if' technology can improve access but 'how'". Dr Hersch explained: "I envision a technology-assisted pre-primary care eco-system that can support in an integrated manner providers, frontline health workers and patients."

For Dr Coye the answer is rapid testing cycles: "Where a clinician is doubtful we should be doing a fast six-month test. Pull in the data and then discuss it. This will not answer every doctor's doubts but it will grow the evidence base. But the strongest evidence over time is doctors saying this really works."

¹⁴ BMC Medicine (Huckvale, Sept 2015) Unaddressed privacy risks in accredited health and wellness apps: a cross-sectional systematic assessment

What is likely to delay the introduction of pre-primary care systems longer than evidential and cultural resistance is money.

Who pays is a central question. Most systems segregate payments for services between primary, secondary and emergency care. Prevention and pre-emptive assessment are not new concepts but governments are reluctant to fund schemes.

Dr Coye explained: "The demand for primary care is such that general practitioners have nothing to fear. Their rice bowl won't be broken because the demographic is too large. But the money to pay for pre-primary care has to come out of someone's pocket.

"The evidence is that technology enabled care management can rapidly improve clinical effectiveness and reduce the total cost of care. And there are creative deals to be done. I can see a future where a health system pays a Type 2 diabetic patient \$2,000 a year to diet and exercise in order to recoup \$3,000 from a health insurer that would have otherwise paid \$12,000 dollars in hospital and emergency room charges - and you would have a much healthier individual." A recent McKinsey report ehealth 2.0¹⁵ looked at four potential options for payment:

- User payment
- Free in return for data
- Health system payment
- Outcome-based payment

The report concluded that asking users to pay could restrict the market to those willing to pay - a segment that is unlikely to include those who would benefit most. Providing digital services in return for data raises privacy concerns and other data-sharing issues. Where data sharing works the patient is usually making a contribution to research e.g. patientslikeme or Flatiron Health. Payment by healthcare systems via "prescriptions" is an option preferred by developers but only makes sense in developed countries if the application can deliver measureable outcomes. In developing countries, payment by healthcare systems is also unlikely unless there is clear evidence of improved health outcomes to

¹⁵ McKinsey: ehealth 2.0: How health systems can gain a leadership role in digital health; Gerardo Aue, Stefan Biesdorf, Nicolaus Henke

The Global Promise

warrant the shifting of budgets. If “cash releasing” savings can be identified then outcome or value-based reimbursement models become sustainable both for the payor and developers. Payors are more likely to embrace enabling technology if their risk is diminished.

Trond Riiber Knudsen, former McKinsey Global Senior Partner and now chairman and CEO of TRK Group, the Oslo-based investment and advisory firm focused on disruptive technology, said: “Smart and high quality AI driven digital health platforms, broadly accessible to the world’s growing population, will be key to a more effective healthcare model in the years ahead - contributing to solving three fundamental challenges:

- 1 Driving economic sustainability in health systems by eliminating waste in the primary care model, where potential patients today turn up unscreened often “wasting” precious doctor time
- 2 Increasing accessibility to high quality medical advice for patient groups who currently do not seek medical advice and populations without coverage, thus significantly enhancing medical coverage in developed and developing countries
- 3 Putting the patient at the centre of the healthcare model, thus making the healthcare market more patient-centric and contributing to patient driven preventive care

By attacking these issues early in the patient journey, these platforms will create a whole new market space - the pre-primary care market.”

In the West, pre-primary care technology will emerge as access pressures on primary care become so acute no doctor can ignore the case for change. In developing countries there is a clear need for an eco-system to be developed to plug the gap where no primary care exists or is ever likely to exist.

The World Health Organization (WHO) estimates there is a global workforce shortage of four million healthcare workers¹⁶. For developing countries this is further exacerbated by the “brain drain” that has seen an exodus of doctors and nurses to developed countries. The situation is particularly bleak in rural areas where critical workforce shortages can mean one doctor for tens of thousands of people.

The net result is that anywhere between 400 million and 2.5 billion people cannot get access to healthcare (see graphic below). For decades now the world has recognised that the quality of primary care directly relates to life expectancy.

Universal Health Coverage: The challenge



400

million people worldwide
lack access to essential
health services



6%

of people in developing countries
are impoverished, or further
impoverished as a result of having to
pay for the health care they need

¹⁶ World Health Organization; World Health Report, Primary Health Care 2008

The World Bank Group, the WHO and the Bill and Melinda Gates Foundation “conservatively” estimate 400 million people on the planet do not have access to basic services usually provided by primary care.

All too often, primary healthcare is a weak link in health systems. The recent outbreak of Ebola, a disease that can be prevented through basic health measures, both exacerbated and was partially fuelled by broken or non-existent primary healthcare systems.

A Gates Foundation report also found that across 37 countries 6% of the world’s population was tipped or pushed further into extreme poverty (<\$1.25/day) because they had to pay for health services out of their own pockets. When the study factored in a poverty measure of <\$2/day, 17% of people in these countries were impoverished, or further impoverished, by health expenses.

Dr. Kaushik Basu, Senior Vice President and Chief Economist at the World Bank Group, commenting on the report¹⁷ said: “These high levels of impoverishment, which happen when poor people have to pay out of pocket for their own emergency healthcare, pose a major threat to the goal of eliminating extreme poverty. As we transition to a post-2015 development era, we must act on these findings, or the world’s poor risk being left behind.”

The WHO and the World Bank Group recommend that countries pursuing universal health coverage should aim to achieve a minimum of 80% population coverage for essential health services, and that everyone everywhere should be protected from catastrophic and impoverishing health payments.

Dr Hersch, explained: “In the West we latch onto primary care because it is the first line but the reality for the majority of the world is that primary care doesn’t exist. In Bangladesh where I work, you are lucky if you have three doctors for 10,000 people. The WHO classes anything below one to 1,000 as an unsafe system. The further out you go into the rural community the less primary healthcare you get. Access is a huge issue and the solution isn’t to train more doctors.”

¹⁷ Monitoring progress towards universal health coverage at country and global levels

He added: “This idea of defining pre-primary care in the global context is about empowering people to address a market failure, democratising healthcare, giving power back to people and demystifying healthcare for the consumer.

“How can we leverage digital technology to link people and support them through a journey? It doesn’t all have to be digital, it could be a technology-enabled healthcare worker in the community.

“Yes, there are certain things you need a doctor for but all sides have to be reasonable about this. We’re not diagnosing cancer with an app but we could be stopping the spread of non-communicable diseases by efficiently disseminating information. We sometimes over medicalise the medicine when what we are talking about is promoting health.

As a doctor I’m not trying to get rid of myself but I think we’ve forgotten that medicine is an art as much as a science. We’ve buried the art by trying to deliver more care, when what is needed is time for better quality of care. If doctors are pressured for time you cannot expect them to deliver holistic ‘patient-centered’ care. If we can unload pressure in the system and bring in tools to make the workload more manageable then doctors will return to being caregivers rather than reactionary decision makers.”

Dr Hersch added: “If you understand the health risks of a population (through access to good data) then you can begin to intervene more strategically and offer the right “digital therapeutics” at the right time to activate them and begin the (difficult) process of behaviour change.”

Several countries offer examples of high-performing primary healthcare. Brazil’s efforts to train and assign primary healthcare workers to specific neighbourhoods have led to dramatic gains in health, especially in the country’s poorest areas. Ghana’s efforts to implement mobile-based primary healthcare have helped the country achieve reduced infant mortality and increased life expectancy.

“The demand for primary care is such that general practitioners have nothing to fear. Their rice bowl won’t be broken, the demographic is too large.”

Dr Molly Coye, Social Entrepreneur in Residence at the Network for Excellence in Health Innovation

The Minor Ailments Burden

In the developed world we have misplaced our self-reliance and our health systems are suffering as generations fail to maintain their bodies or attempt to care for themselves. This over reliance on the medical establishment is estimated to cost the NHS £2bn a year.

In 2007¹⁸ a study of the medical records of 130 UK general practices over a two-year period found 51m - 90% of the consultations - were for minor ailments and 88% of those were suitable for self-care.



WebGP - Patient Triage

Hurley Group, a London-based GP organisation, has developed a patient self-triage system. On entering the site consumers can either make a face-to-face appointment in several days’ time or fill out one of 100 digital forms that relate to the condition they want to discuss. That form triggers a phone call to the patient either from a nurse or GP within 24 hours (some surgeries call back within an hour). The system was developed after Dr Arvind Madan looked at the Hurley Group’s patient data and realised most people had minor ailments, knew what was wrong with them

mostly knew what to do but were seeking reassurance. An analysis of a pilot study of WebGP over six months found that:

- of the e-consults, 40% led to a prescription, 40% led to a GP appointment and 20% led to a telephone consultation
- 18% of patients self-managed an issue for which they had planned to see a GP
- for every WebGP user requiring a GP response via an e-consult, five users required online self-help only (WebGP, 2014).

Even more surprising was that 75% of all the consultations were about ten specific minor ailments: back pain; dermatitis; heartburn; nasal congestion; constipation; migraine; cough; acne; sprain and headache.

¹⁸ Self Care: N. Pillay; THE ECONOMIC BURDEN OF MINOR AILMENTS ON THE NATIONAL HEALTH SERVICE IN THE UK (2010)



All these ailments were considered to be suitable either for a pharmacy visit or self-care but in a staggering 90% of the consultations for minor ailments patients received prescriptions worth £371m when they could have bought cheaper over-the-counter medicine.

In total, the study found that 20% of a GP's time was being spent on minor ailments that could have been treated by a pharmacist or an individual at home with better information and pre-primary care support. Further studies suggest that between 15% and 40% of all A&E visits are for minor ailments and injuries that could have been treated at home.

In 2004, the European Self-Medication Industry Association (AESGP)¹⁹ carried out a detailed economic analysis of a move from prescribed medicines to self-medication in the UK. It concluded that the change would free up an average time of eight minutes per consultation. Time freed up as a result of the lower number of doctor visits for minor ailments represented 2.8 million doctor working hours per annum or 21 hours per doctor per year.

The cost of minor ailment consultations in the NHS 2006-2007¹

57 million GP consultations per annum (equating to 220,000 a day) involve minor ailment discussions, 90% of which (51.4 million) are for minor ailments alone

20% of the NHS annual 290 million total GP consultations involve minor ailments and 18% of GP consultations are for minor ailments only

91% of minor ailment consultations result in a prescription being issued (52 million per annum) at a cost of £370 million

£2 billion of NHS resource is allocated to minor ailment consultations (consultation and prescription costs²), 90% of which (£1.8 bn) is for minor ailment only consultations

Over 75% of the cost for minor ailment consultations is attributable to the GP's time, equating to £1.5 billion

The top 10 minor ailments are responsible for 75% of consultation costs and 85% of prescription costs, amounting to £1.62 billion

1. Information Centre for Health and Social Services, 2006/7

2. Consultation costs based on PSSRU 2006 £2.50 per minute and average length of consultation is 11.7 minutes from the Information Centre for Health and Social Services, 2006/7 resulting in £29.25. Prescription costs based on £370m from the MIMS price index

19 AESGP/ European Self-Medication Industry. The economic and public health value of self-medication. AESGP 2004

Top 10 NHS minor ailments by number of consultations¹

Minor ailment	Total consultations (millions)
Back pain	8.4
Dermatitis	6.8
Heartburn and indigestion	6.8
Nasal Congestion	5.3
Constipation	4.3
Migraine	2.7
Cough	2.6
Acne	2.4
Sprains and strains	2.2
Headache	1.8

1. Self Care: N. Pillay: *The Economic Burden of Minor Ailments on the National Health Service in the UK* (2010)

Research carried out by the Proprietary Association of Great Britain (PAGB) and IMS Health suggests that a focus on pre-primary care could reduce GP visits by 40%; outpatient visits by 17%; A&E visits by 50% and hospital admissions by 50%. In addition, two thirds of GP prescriptions could be transferred to cheaper over-the-counter drugs or no medicine at all.

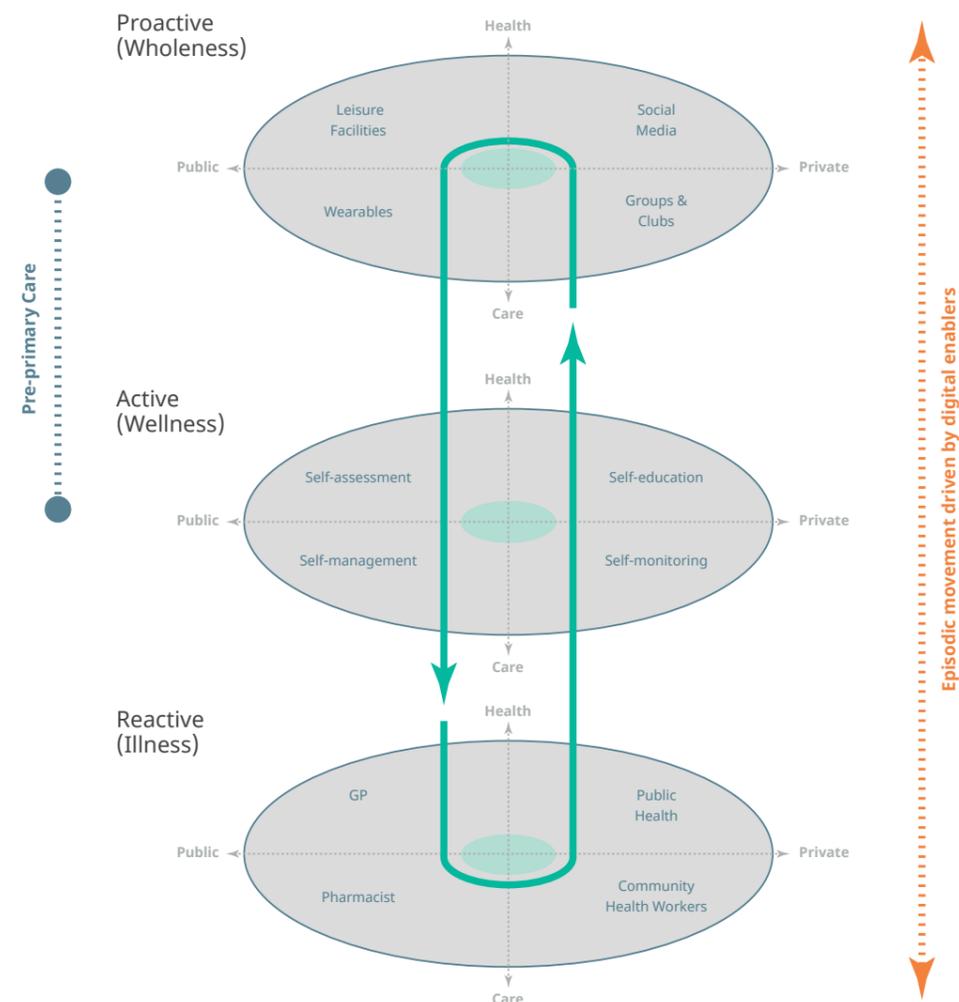
Nicolas Roope, founder of Poke and acclaimed digital designer and entrepreneur, said: "In the NHS the conversation is about money against a seemingly fixed cost resource of doctors, practices, hospitals, beds and drugs. If you want more service, less waiting, you have to pump in more money. Attempts at efficiency gains through management restructuring have turned into a running joke in Whitehall and across the media. There seems to be no way out of this quagmire. But there is a way.

"If we could take a huge chunk of the informational quotient of doctors' time and replace it with more distributed, more accurate, free service for everyone, doctors would be left to focus on what they really need to be there for. This would allow a refocusing of time and resources that would immediately result in more rapid and accurate solutions and much lower waiting times for those still requiring attention.

"The frontline of primary care that takes up 20% of doctors' time can be largely improved, sped up and replaced by technology like artificial intelligence. Less cost and less burden on public healthcare, and more focus and attention on when a doctor needs to be in the same room as the patient to resolve the problem.

“Conversational artificial intelligence personalises responses from the very first question, carving up millions of diagnoses rapidly towards the result that is right and accurate for you.”

Care Loop: Primary into Pre-Primary



Source: Adapted from original concept by Impeller Ventures

“Technology like Your.MD is not a challenge to the medical profession. On the contrary, it’s an adrenaline shot to its arm. Seventy per cent of doctors in the UK report they don’t have time to do their job²⁰. For some time patients have gotten used to their doctors looking up symptoms on their PCs, which leaves many wondering why the medical profession hasn’t followed banking and many other services and cut the need for physical premises, with costly physical professionals, enabling what everyone now knows to be standard procedures in smart phone-app-land.”

Jim Dawton, Director of Impeller Ventures and former Lead Specialist Designer at the Technology Strategy Board, described the challenge more prosaically.

“Primary care is like the shed at the bottom of my garden. I’ve put so much stuff in it over the years I now can’t find the space inside to reorganise it. The only approach is to put another shed alongside it and take out the stuff that doesn’t need to be in the first shed anymore.”

Impeller Ventures believes the solution can be found in pre-primary care. The diagram on p36 is based on its Wellness and Wholeness model of care and has been modified to show the practical interventions at each level.

MyDirectives - Patient Voice

Driven by their grandparents’ traumatic end-of-life experiences, MyDirectives’ founders Scott Brown and Jeff Zucker from Dallas, USA have developed a multi-media approach that de-medicalises, standardises and demystifies the process of describing your preferences, values and goals in the event of a health crisis. Available 24/7 anywhere in the world it frees clinicians from the burden of sitting down

and recording patients’ decisions and statements and makes it easy for doctors to retrieve a patient’s statements anywhere in the world. Coordinate Care Oklahoma (CCO) has now invited more than one million of its 4.2m users in five states to create a MyDirectives’ profile. The directives created can now be accessed in 45 hospitals in the CCO family.

²⁰ DH GP national worklife study 2013

“Primary care is like the shed at the bottom of my garden. I’ve put so much stuff in it over the years I now can’t find the space inside to reorganise it. The only approach is to put another shed alongside it and take out the stuff that doesn’t need to be in the first shed anymore.”

Jim Dawton, Director of Impeller Ventures and former Lead Specialist Designer at the Technology Strategy Board

Conclusion

Bill Gates, the founder of Microsoft, predicted: “As more people obtain access to better and cheaper digital technology, an inflection point is eventually reached, at which the benefits of providing digital services like banking and healthcare clearly outweigh the costs.”

Imagine community health workers in the developing world armed with care protocols, low-cost diagnostics and mobile phones with artificial intelligence-driven decision support software.

An army of individuals with the ability to provide care, including advice and treatments, for a range of common conditions, minor ailments and injuries and information about prevention and behaviour change digital therapeutics. Pre-primary care driven by artificial intelligence, natural language programming, high quality content and early intervention. People diagnosing themselves and ordering tests then using doctors to help them interpret the results.

To meet existing and future health challenges we will require increasing investment in pre-primary healthcare driven by digital technology. Healthcare systems will need to do more for less by deploying their biggest assets - patients doing more of the heavy lifting for the service.

As technology transforms it will increasingly be able to meet local needs and deliver multiple approaches that fit individual’s lifestyles and needs. Truly personalised healthcare at scale.

Soon we will see a global health brand based on the provision of trusted pre-primary care. As Dr Topol said in the Wall Street Journal: “Just as the printing press democratized information, the medicalized smart phone will democratize healthcare. Anywhere you can get a mobile signal, you’ll have new ways to practise data-driven medicine. Patients won’t just be empowered; they’ll be emancipated.”

Dr Coye concluded: “Primary care physicians will be more accepting of pre-primary care if they understand that valuable clinical and psychosocial services can be accomplished by technology-enabled health workers and by patients themselves, and that this will reduce the physicians’ workload, improve clinical outcomes and reduce the total cost of care.”

Pre-primary care is the solution – and it is here today.

About the Authors



Jonathon Carr-Brown is the former managing director of NHS Choices (www.nhs.uk). He was one of the founders of the site when it launched in 2007 and as managing director (2010 – 2014) increased the health information site's traffic from seven million visits a month to 45 million. During that time he was involved in introducing information prescriptions to the NHS and digital concepts like online LifeChecks and commenting on GPs.

He is now managing director of Lost for Words a consultancy dedicated to introducing innovative digital ideas into the healthcare sector.

Prior to his digital career he was a speechwriter to the UK's Secretary of State for Health (2006) and enjoyed an award-winning 20-year career as a journalist. This period included stints as the political editor of The Independent on Sunday and the Health Correspondent of the Sunday Times. He is now also an Honorary Teaching Fellow at the Institute of Global Health Innovation within the Faculty of Medicine at Imperial College London.



Matteo Berlucchi is CEO at Your.MD - the world's first Personal Health Assistant to combine Artificial Intelligence, machine learning and content from the NHS to deliver free, personalised health information to a global audience. As one of the first Internet entrepreneurs in Europe, Berlucchi brings his vast experience and pioneering knowledge to his role at Your.MD where he spearheads investor relations, conceives and directs the company's vision and is Your.MD's

primary spokesperson.

A digital specialist, Berlucchi has spent his career building and growing companies and services operating across the online and mobile sectors. Prior to Your.MD, Berlucchi was Chief Digital Officer at Northern & Shell where he developed the company's digital assets and forged new opportunities with digital partners and start-ups. Berlucchi was also founder and CEO of aNobii, the 'social ebook' platform funded by Penguin, Random House and HarperCollins; Livestation, the first live news platform to broadcast on an iPhone; and Skinkers, an award-winning digital communication platform.

Berlucchi has also served as an advisor to multiple individuals and businesses. He is currently a mentor at Seedcamp, advising entrepreneurial start-ups, and supports internet and software entrepreneurs to get their businesses off the ground through Firestartr. Berlucchi has also served as Entrepreneur in Residence for Goldsmiths, University of London.

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“Doctors know more and they can order a test and narrow down the possibilities but that is an arbitrary restriction. What we are in the process of developing is a digital Dr House.”

Bruce Wilcox, Loebner Prize winner



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