



Meeting the health care challenges of the 21st Century

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Globally the challenge of providing quality, affordable health care has never been so urgent. Over the past 20 years the world has changed dramatically. Whilst rates of infectious diseases are trending down, it is the rapid rise of chronic non-communicable diseases, driven largely by the effects of globalization, that is threatening the health of populations especially in low- and middle- income countries (LMICs)(1).

Chronic non-communicable diseases (NCDs) are already the number one cause of death and disability(2) and it is their rapid, unchecked rise that is particularly concerning, especially for emerging economies(1, 3, 4). These countries, where health systems are already under-resourced will not be able to ‘treat themselves’ out of the problem(5) and the consequent social and economic impacts are potentially devastating. Inaction is estimated to cost developing countries 7 trillion dollars by 2025(1).

Yet, there is much that can be done. Translating simple, proven, cost-effective primary care interventions that focus on prevention and

management of NCDs - especially cardiovascular disease and diabetes - offers the greatest opportunity to avert millions of premature deaths and even greater unnecessary suffering. Overcoming this implementation gap will require investments in human resources, health systems and innovative uses of existing and emerging technologies.

There has never been a greater need for innovation in health care. Existing models of care around the world have been shown to be both financially unsustainable and inequitable. At the same time the business of health care is expanding and more countries are turning to private and public payers and providers. In this environment, social entrepreneurs are well placed to develop innovative models of care. Strong evaluation frameworks, through research collaborations, can assist in the dissemination of findings and contribute to the much needed evidence base. In this paper we explore through our own work in this field, the barriers and opportunities to address these growing health challenges.

The changing burden of disease

Chronic diseases, primarily non-communicable diseases (NCDs) and related conditions are the leading causes of death and disability globally and their rapid rise poses major health challenges for the 21st century. NCDs already account for 63% of global deaths and are the leading cause of death and disability in all regions except Sub-Saharan Africa(1).

Contrary to conventional wisdom, it is those most in need of care that have least access to it. Today 80% of NCD deaths occur in low- and middle-income countries (LMICs). Every year, NCDs kill 9 million people under 60 years of age - 90 per cent of these premature deaths occur in LMIC(1). In India for example, the average age of a first heart attack is over 10 years earlier than the global average (currently approx. 53) and type 2 diabetes is increasingly affecting younger age groups. This leads to staggering personal, social and economic costs and makes NCDs one of the leading threats to global economic growth and development. Over the next 15 years, under a business as usual model, NCDs will cost developing countries more than US\$7 trillion(5). For countries still struggling under the burden of high communicable disease rates, this double burden of diseases poses real threats to gains made towards the Millennium Development Goals (MDGs).

After a long period of neglect, the global problem of NCDs has received increasing attention, culminating in a United Nations high-level meeting in New York in September 2011. At this meeting, only the second such high level meeting for health (the first being for HIV in 2000), world leaders agreed to priority actions for tackling the main four NCDs – cardiovascular disease, diabetes, chronic lung disease and some cancers. Whilst the

definition of NCDs is far broader – including say mental health - these four conditions were chosen as they account for 50% of the burden, are eminently preventable, and share a common set of modifiable risk factors: smoking, poor diet, lack of physical activity and harmful use of alcohol. As Governments grapple with policy options to address the risk factors, the silent epidemic continues and millions of preventable deaths occur. There is an urgent need to improve access to evidence based care for those either with or at highest risk of developing chronic NCDs.

Cardiovascular diseases - heart disease and strokes – are the leading cause of death globally (17 million in 2010)(2). High blood pressure (hypertension) the leading risk factor for cardiovascular disease affects 1 in 3 adults and causes millions of preventable deaths and strokes every year (6). Type 2 Diabetes is growing at alarming rates in LMICs at significant human and economic costs(4, 7, 8). The problem of these chronic diseases is that prevention relies on early intervention. For heart disease, there are often no warning signs, and the first presentation may be with a heart attack or stroke. In the case of diabetes, 1 in 2 people remain undiagnosed(8), leading to a number of preventable complications including blindness, and are at significantly increased risk of premature death (from heart disease).

The challenge

Chronic diseases pose new challenges to health care systems around the world(9). Over the past 10 years as efforts to meet the health related MDGs have picked up there has been a renewed focus on primary health care. It is widely recognised that a strong primary health care system is the most efficient and effective way to address the growing problem(10, 11).

In LMICs primary care services are traditionally geared towards acute presentations and maternal and child health. In these environments it is not uncommon for chronic disease patients to be referred to hospitals or specialist care providers. As the burden of NCDs balloons in the coming decades there will be an increasing need for the integration of evidence based (chronic disease) prevention and treatment programs into primary health care systems(1, 7, 9).

Inadequate facilities, a short supply of health workers and lack of knowledge about managing NCDs in many countries are significant barriers to delivering care in the community. For LMICs with constrained spending on healthcare, the choice of what to spend limited health dollars on becomes crucial. The WHO has identified a number of “Best Buys” – that is – interventions that are evidence based and are deemed to be cost-effective(1, 12). These include interventions specifically for primary care that emphasise targeted prevention & education for those at risk and where disease is established, ensuring optimal management with readily available, generic medications(12).

The problem then is how to translate these into practice and especially how to deliver at scale in the community where the maximum effect can be realised(11, 13). There is much that we can draw on from the experience in addressing the MDGs, especially community based HIV programs (14, 15) and chronic disease prevention and management programs must build on these platforms in an integrated manner, creating stronger health systems capable of addressing the local health need(15).

Improving health care delivery

The provision of health care is inherently 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 these multiple stakeholders. The cultural context, available resources and socio-economic determinants (such as education, income etc.) are all factors that need to be considered(10).

Resource poor settings tend to be characterised by fragile health care systems with often-inadequate access and a lack of resources for health – both human and financial. Where care is provided, it is inevitably of variable quality and a lack of local knowledge; access to regular supply chain for essential medications and simple diagnostics can mean that preventable problems cannot be addressed. For the rural poor additional barriers to care include long distances to seek care and the associated costs(11).

The WHO estimates a global workforce shortage of over 4 million health workers(16). 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(16). In these areas, increasingly, the focus has been on frontline health workers, often from local communities, providing basic health education(17).

Training a doctor can take anywhere from 6-12 years. Once trained, the vast majority seeks jobs in urban areas creating health inequalities in rural areas. Task shifting, that is, delegating specific tasks from more specialised to less specialised (trained) health workers has been practiced in some form for decades (such as China's barefoot doctors). Traditionally, community health workers (CHWs) were volunteers from a community that provided basic health promotion and education about common conditions. Over the last 10 years there has been a plethora of evidence supporting an expanded role of CHWs especially in addressing the health related MDGs(18). Armed with care protocols, low cost diagnostics and increasingly mobile phones, they are being reinvented as a new trained, paid cadre of health worker able to provide care including advice and treatments for a limited range of common conditions (mostly maternal and child health, HIV and TB treatments)(17).

A plethora of clinical guidelines have been developed for the prevention and management of many common NCDs. Despite this, many such interventions, especially for NCDs are still under-used. For cardiovascular and diabetes, the so called rule of halves applies – that is - less than half of those at risk (of heart disease or diabetes) are actually detected, less than half of those detected receive appropriate treatment and less than half of those receiving treatment have their blood pressure or blood sugar treated to recommended targets. This phenomenon has been shown across health care settings including socio-economically disadvantaged communities in high-income countries like Australia(19).

Closing this practice gap has been a focus of the Primary Care Group at The George Institute, Australia. Led by A/Prof David Peiris, they have developed

and evaluated an integrated electronic decision support tool (eDSS) for improving the identification and management of patients with cardiovascular disease in Australian primary care settings(20). This program, which has been rolled out to over 60 practices including Aboriginal Medical Health Services has recently been evaluated in a large-scale clinical trial. Involving almost 40,000 patients over 18 months, the study showed that the use of eDSS significantly improved the identification and evidence based management of patients at risk (pending publication). A number of other studies have demonstrated the use of eDSS to improve healthcare performance(21). These studies mostly in high-income countries have targeted physicians and other healthcare workers with high levels of training. There is emerging evidence for the use of technology, especially mobile phones, to improve chronic disease care in LMICs(22) and as discussed below, this could dramatically increase the uptake of eDSS tools for NCDs in these settings.

Global Health in the Digital Era

The past decade has seen the mobile phone emerge as one of the most exciting developments in global health(23). The rate at which mobile phone coverage and access has spread has been unparalleled in history. Today there are over 6 billion mobile phone subscriptions the majority in developing countries(24), 95% of the world is covered by basic voice and text access and mobile phones have created previously unimaginable new opportunities, including for health.

Early pioneers and researchers in the field of “mHealth” have seized on the ubiquity and affordability of mobile technology to address chronic global

health challenges. There has been a proliferation of small-scale projects (or pilots) that have focused on improving data collection and the use of SMS and IVR to improve health worker co-ordination and patient adherence (to medications). Most of these efforts have centered on maternal and child health, HIV/AIDS(25) and TB(23). Despite the promise of mHealth, there has been a problem getting to scale. An often-cited reason for this so called “pilotitis” is the stand-alone nature of many early projects that were in effect outside the health system. Professor Alain Labrique of the Global Health Initiative at Johns Hopkins has developed a framework highlighting the core areas where technology can be successfully incorporated to strengthen health systems and therefore become a part of integrated health care delivery(26).

New digital trends, i.e. 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 health care. By 2020, smart phone subscriptions are set to exceed 5.6 billion(27), with a significant proportion of that growth in LMICs driven by increasingly cheaper devices - already under \$50 and falling. This year India will surpass the US with over 400m smart phone subscriptions. 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 leap-frogged fixed land-lines.

At the same time there have been exciting developments in low cost point of care diagnostics for a number of common infectious diseases e.g. for malaria and HIV. These have transformed the diagnostic capabilities of front-line health workers and could do similarly for NCDs. Researchers for example at

The Institute for Biomedical Engineering at Oxford University are developing a suite of low cost sensors for measuring blood pressure, performing ECGs etc. These sensors designed for resource-poor settings utilize the computing power of smart phones and make it possible to deliver higher quality diagnostics and management in the community.

A question of design

As Bill Gates and other leading technology luminaries point out, we have reached a point where mobile phones have become a part of everyday lives. We are living in the digital age. Whilst the evidence base for mHealth slowly evolves(28), the question is not “if” technology can improve access, but “how”. Many pioneers of the mHealth movement including Labrique have highlighted that to succeed, we need to shift away from “mHealth” and focus on “health”. The question is now how to harness both existing and emerging technologies to improve access to and the quality of health care.

“As more people obtain access to better and cheaper digital technology, an inflection point is eventually reached, at which the benefits of providing digitally services like banking and health care clearly outweigh the costs¹” – Bill Gates, 2013

The way health care is provided is shaped by many different factors. There is no one size fits all approach. The cultural context, incentives, available

¹ <http://www.project-syndicate.org/commentary/the-dawn-of-developing-countries--digital-empowerment-by-bill-gates#hSI11KyJD6S9vLg6.99>

technology and socio-economic determinants (such as income, education etc) all influence health behaviours and provide both barriers and opportunities(29). To address these researchers and practitioners need to start by understanding the problems from the local users perspective and then work towards solutions.

This process, called human (or user) centered design, is simply about developing understanding or empathy for those we are designing for. As a framework for innovation, it aims to dispel the notion that great ideas are light-bulb moments, but rather we come to solutions by understanding and involving users in the process – often in an iterative and collaborative manner(30). Many of the successful mHealth projects such as the MOTECH Ghana program(31) and organisations like medicmobile(32) whose mission is to improve access to health care using mobile technology emphasise the importance of the design process.

SMART Health R&D

In response to this urgent and growing need for innovative approaches to health care delivery and building on our expertise in clinical decision support research, we have started the SMART Health R&D program.

SMART Health (Systematic, Management, Appraisal, Referral and Treatment) brings together three key areas: primary care workforce re-engineering; fit-for-purpose evidence based programs for clinical care; and facilitative technologies for both healthcare providers and consumers. We envision a technology-assisted “primary care eco-system” that can support, in an integrated manner, providers, frontline health workers and patients.

The program aims to target the leading causes of death and disability in each of the regions in which it is implemented. SMART Health India is the first implementation of the SMART Health R&D program and builds on the Institute's long-term work in rural Andhra Pradesh.

SMART Health India

In India, cardiovascular disease is the leading cause of death and growing. An estimated 118m people have high blood pressure (hypertension), the leading risk factor for heart disease and stroke(33, 34). Over 60 million Indians are estimated to have diabetes (type 2), with 1 in 2 are unaware that they have the condition(2).

In rural areas, where 70% of the population lives, studies have shown that there is a similar pattern of risk factors for cardiovascular disease and diabetes(34). In Andhra Pradesh, like much of rural India, there is a gross shortage of health care workers and primary care systems predominantly focus on acute presentations, communicable diseases and maternal and child health. India's three tier healthcare system provides nurse/midwife level primary healthcare at the sub-centre (population approximately 3,000 to 5,000), doctor-level care at the Primary Health Centre (PHC) (population approximately 20,000 to 30,000), and specialised care at the Community Healthcare Centres (population approximately 80,000 to 120,000). The PHC, which is usually led by one doctor, is expected to provide comprehensive primary healthcare for up to 30,000 residents. This places considerable strain on PHC resources.

SMART Health India has been developed to address the barriers to delivering affordable, quality cardiovascular disease care in these rural settings. Building on our experience with decision support tools, and considering the local context, the system has been designed for use by frontline community health workers (ASHAs) and PHC doctors. It represents a case study into ‘Integrated Innovation’, incorporating a science/technology component (Smart Tablet, CDSS, and cutting edge trial design), a social component (innovative workforce strategies), and a business component (integration with existing health system infrastructure)(35).

Using context appropriate guidelines from the WHO/ISH and Indian National Program for Prevention and Control of Cancer, Diabetes Cardiovascular and Stroke (NPCDCS) a custom decision support tool has been developed. In partnership with the Institute for Biomedical Engineers at Oxford University, the application is integrated with an open source electronic medical record system (openMRS) and can be used in both online and offline modes, facilitating data collection and decision support without mobile network coverage.

An iterative design and agile development process was undertaken, and the final screening and management application created in both English and Telugu (the local language). The CHWs with minimal but focussed training have been successfully and accurately screening patients in the community and referring them to the primary health centre for further management (as per Indian guidelines). There are plans to integrate SMS and Integrated voice response (IVR) systems to support ongoing co-ordination of

community health workers to ensure patient follow up and to provide locally relevant education, lifestyle modification messages and medication adherence support to individuals in the community.

This project funded by the Australian National Health and Medical Research Council through the Global Alliance for Chronic Disease program is currently being rolled out as part of a large scale cluster randomised trial in 54 Primary Health Centres in 18 villages in rural Andhra Pradesh.

The role of social entrepreneurs

Healthcare in India is very fragmented. In urban areas, over 80% of primary care is provided by the private sector and more than 70% of health care spending is paid for out of pocket. For those living on the margin of poverty (~USD7-8/ day), health shocks due to unforeseen health care expenditures can be catastrophic and lead to poverty. This is the reality for 40 million Indians every year.

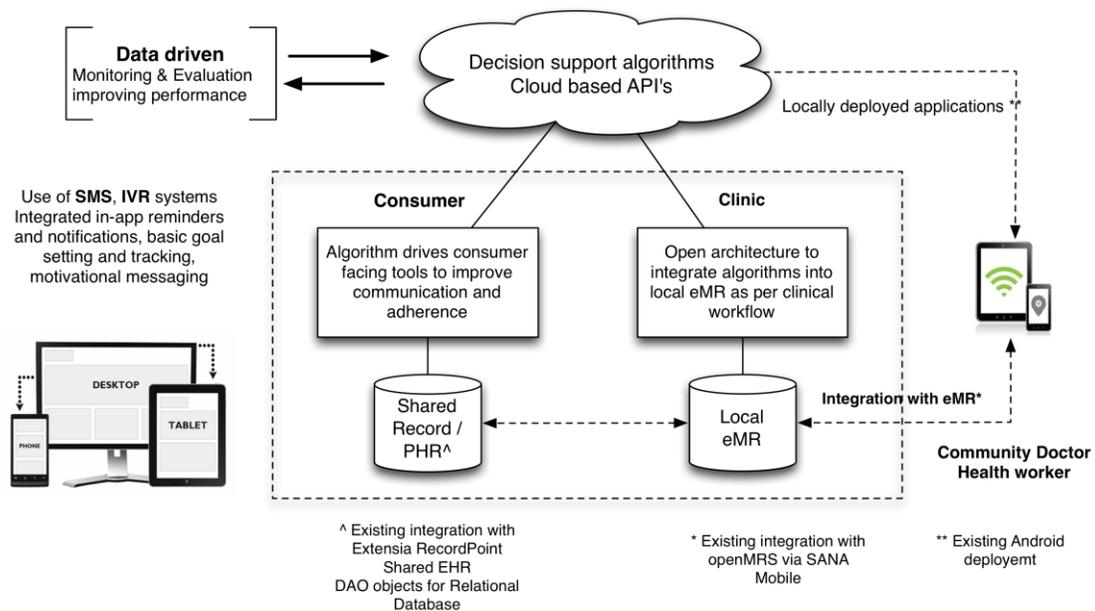
In such an environment, social entrepreneurs play a vital role in finding sustainable approaches to provide affordable health care. By working closely on the ground with communities, they are best positioned to identify the unmet needs, develop, test and refine innovative approaches and new models of care that can deliver value and create social impact.

The George Institute at Oxford is engaged in identifying emerging market 'unmet needs' where our research could inform the development of new products or service. Drawing on our clinical and research expertise in the area of NCDs, we have built a multi-disciplinary team to assess and identify

opportunities to increase the impact of our ideas. Working with primary care providers in urban India has revealed a number of important insights. In contrast to rural areas, it is not a lack of access to primary care doctors, but rather their in-ability to confidently deliver chronic disease management that is the major barrier to affordable care (see case study). At the same time, to meet the growing demand, a number of new primary care chains, each with their own IT platforms (often web based eMRs) have entered the market.

SMART Health: Technology Assisted Primary Care

Decision support | Technology assisted | Human centred design



To address this we have set out to deliver a “smart decision support layer”, targeted at primary care providers (public and private) to improve their ability to identify and manage common NCDs. Starting with heart disease, our offering consists of a cloud-based platform to deliver context sensitive, evidence based decision support algorithms. We are developing an open,

standards based architecture to make the service as widely available and accessible across platforms – including mobile phones and smart devices (see diagram). We will work with partners engaged in health service delivery in different settings who want to deliver chronic disease care to refine the system for maximum impact.

Case Study: Swasth India; Affordable health care in Urban India

India is home to the world's largest slums. For the 65 million residents of slums in India, access to affordable quality healthcare is a serious problem. For these urban dwellers, the risk of heart disease and diabetes is on par with the population in general. With little disposable income available for health care, health shocks from unexpected health care expenditures can be devastating.

In this environment there is a desperate need for innovative, low-cost models of care that can address amongst other things the rise of chronic disease. Swasth India, is a social enterprise whose mission is to provide affordable quality health care to low income communities. Working in and around the slums of Mumbai, they have refined their primary care model and successfully built a sustainable social enterprise currently operating 8 clinics and serving over 40,000 families.

For Swasth's GP's, like others we have spoken to in India, there is a lack of up to date knowledge and confidence in assessing cardiovascular disease risk and where required starting initial treatment. This leads to unnecessary referrals at a significant personal cost and is a significant barrier to patients receiving adequate and timely care. Providing evidence based decision support tools could dramatically improve the ability of GPs to identify and manage patients at risk without the need for unnecessary specialist referral making the cost of ongoing care more affordable.

Research Challenges

There is no shortage of cost effective interventions that could if implemented, improve the lives of people all around the world. How to do this effectively remains far more elusive and has led to the development of a new field of scientific inquiry. Implementation science applies both traditional quantitative methods with qualitative research approaches in an attempt to create generaliseable knowledge that can be applied across settings and contexts to answer central questions relating to translating evidence into practice. It seeks to understand behavior – of health professionals, patients and other stakeholders - as a key variable in the sustainable uptake and adoption of evidence based interventions.

In developing countries where the need to improve health care delivery is greatest, the challenge is greater still. Fragile health care systems, inadequate resources and poverty all make the delivery of health care all the more complex. In recognition of this, Jim Kim (President of the World Bank) and Paul Farmer (Partners in Health) have proposed a renewed definition of the “science of health care delivery” that brings in new disciplines, perspectives and methodologies. Their multi-disciplinary approach draws on management, anthropology, sociology, epidemiology, economics and health policy all integrated into an overall strategy that seeks to maximize value in terms of dollars spent and health outcomes achieved(36).

There is an urgent need for more research funding especially into NCDs in LMICs where most of the evidence base is drawn from high-income settings. Developing the local research capacity should be a priority. For

social entrepreneurs and NGO's working on the ground, evaluation and dissemination of findings will be important to build a shared best practice either via traditional research journals or new online communities such as the Harvard based Global Health Delivery Project (ghdonline.org).

Conclusion

At the start of the 21st Century, the long held dream of “health for all” remains as elusive as ever. The growing burden of NCDs if left un-checked will have a devastating impact on the health of the poor and could threaten recent development gains made in pursuit of the MDGs. To meet the existing and future health challenges will require increasing investments in primary health care and finding new ways to implement and scale-up cost-effective, proven interventions. Health care systems, already constrained, will need to find ways to do more with less for less. As technology transforms the health care landscape, understanding the local needs and how to design integrated human centered solutions will become increasingly important. It is here, on the ground, that social entrepreneurs, NGOs and research groups are best placed to develop local innovative approaches, contributing to the development of best practice and creating lasting impact.

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