HEALTH HORIZONS 2021: EMERGING OPPORTUNITIES FOR SOCIAL ENTREPRENEURS IN INDIA

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About The Organizations

The Villgro Innovations Foundation and Okapi Research undertook this report as the first of a series of sector-focused studies on emerging opportunities for social entrepreneurs. The analysis and scenarios are meant to provoke would-be social entrepreneurs, impact investors, incubators and others to think deeply about how ongoing social, political, economic and technological change is creating new opportunities for market-based responses to social challenges. We hope that the report will encourage readers to look ahead and inspire them to shape the way the future unfolds.

Healthcare Technology Innovation Centre, IIT Madras and Resilience Design and Research Labs (formerly CIRM Design Labs) have joined the group as expert contributors for the sector report on health. Dr. Brinda Dalal, President of Dhoopa Ventures, has joined us as an advisor on futures methodology as well as on the frontiers of medicine and wellness.

Villgro Innovations Foundation

Villgro believes in the power of invention and market-based models in transforming the lives of the poor in India. As India’s oldest and foremost social enterprise incubator, Villgro has supported med-tech and other innovators and social entrepreneurs during their early stages of growth. Since 2001, Villgro has incubated 103 such enterprises, provided ₹76 million in seed funding and helped them secure ₹873 million in follow-on funding. These enterprises have generated around 4000 jobs and touched over 6.8 million lives. This research is part of Villgro’s efforts to deepen its understanding of the future of medical technologies and healthcare for the next billion as it builds a dedicated platform to fund and support impact-focused med-tech innovators and to help the development of the ecosystem to support innovators and entrepreneurs.

www.villgro.org

Okapi Research & Advisory

Okapi is an India-based research and consulting group focused on institutional design for complex goals in changing times. We work closely with public and private sector leaders to help them create policy environments, ecosystems and organisations that sustainably aggregate individual contributions to broader group purposes. Okapi’s practice draws extensively on academic social science research for insights and innovative approaches to the challenges our clients face: from regulatory design and public investment prioritisation to mapping actors, networks and dynamics in innovation ecosystems or integrating social and financial goals in organisational processes. We specialise in helping clients develop the ability to identify and monitor critical challenges and institutionalise responses to them. Okapi is incubated by IIT Madras.

www.okapia.co

Healthcare Technology Innovation Centre, IIT Madras

Healthcare Technology Innovation Centre (HTIC) of IIT Madras is an R&D centre established through a joint initiative of IIT Madras and the Department of Biotechnology (DBT), Government of India, to develop affordable healthcare technologies. Since its inception in 2011, HTIC has evolved into a unique and leading med-tech innovation ecosystem in the country, bringing together and collaborating with more than 20 medical institutions, industry and government agencies to develop affordable healthcare technologies for unmet clinical needs. HTIC is delivering innovations and technologies that are reaching the field, enabling business
and bringing benefits to lives, businesses and society. Several technologies in areas of cardiovascular care, ultrasound, neonatology, oncology, intensive care, ophthalmology and diagnostics are under development in collaboration with leading organisations. HTIC also works to develop human resources in healthcare technology in the country through various channels including innovation fellowships, IITM students and interns. Going forward, we envision HTIC becoming a national asset of global standards in affordable healthcare technology innovation, creating impact in healthcare.

http://htic.iitm.ac.in/

**Resilience Design and Research Labs**

Resilience Design and Research Labs (RDRL) focuses on resilience-building solutions for emerging markets. RDRL’s product design and research activities are in health, agriculture, livestock and catastrophe insurance. The Labs’ policy advocacy effort involves data backed market analysis to support equitable and efficient delivery of safety net solutions. It is an active member of the Global Microinsurance Network.

http://resiliencedesignlabs.org

**Dhoopa Ventures**

Dhoopa Ventures LLC is a strategic consulting company in California focused on innovation discovery and futures research. Dhoopa Ventures advises organisations about emerging technology innovation, upcoming changes in the marketplace and potential risks in the next two to five years. Dr. Brinda Dalal, the Founder and President, previously served as a research director in the technology and health horizons programmes at the Institute for the Future in Palo Alto, and prior to that worked as a research scientist at Xerox and Xerox PARC.

The study was supported by the International Development Research Centre (IDRC) as a part of a larger grant to Villgro for ‘Learning from Pro-Poor Market-Driven Innovation.’
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIIMS</td>
<td>All India Institute of Medical Science</td>
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<tr>
<td>ASHA</td>
<td>Accredited Social Health Activist</td>
</tr>
<tr>
<td>AYUSH</td>
<td>Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy</td>
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<tr>
<td>BCC</td>
<td>Behaviour and Cultural Change</td>
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<td>BIG</td>
<td>Biotechnology Ignition Grant</td>
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<td>BIRAC</td>
<td>Biotechnology Industry Research Assistance Council</td>
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<td>BISS</td>
<td>Bio-Incubator Support Scheme</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<tr>
<td>BPL</td>
<td>Below Poverty Line</td>
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<tr>
<td>CAMTech</td>
<td>Consortium for Affordable Medical Technologies</td>
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<td>C-CAMP</td>
<td>Centre for Cellular and Molecular Platforms</td>
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<td>CHC</td>
<td>Community Health Centre</td>
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<td>CM</td>
<td>Chief Minister</td>
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<tr>
<td>CSC</td>
<td>Common Service Centre Scheme</td>
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<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research</td>
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<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<tr>
<td>DALY</td>
<td>Disease Adjusted Life Years</td>
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<tr>
<td>DBT</td>
<td>Department of Biotechnology</td>
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<tr>
<td>DeitY</td>
<td>Department of Electronics and Information Technology</td>
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<tr>
<td>DMHP</td>
<td>District Mental Health Programme</td>
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<tr>
<td>DST</td>
<td>Department of Science and Technology</td>
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<td>GBD</td>
<td>Global Board of Disease</td>
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<td>GCE</td>
<td>Grand Challenge Explorations</td>
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<td>GCI</td>
<td>Grand Challenge India</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GRAMSAT</td>
<td>Rural Satellite Programme</td>
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<td>HMRI</td>
<td>Health Management and Research Institute</td>
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<td>HMIS</td>
<td>Health Management Information Systems</td>
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<td>HTIC</td>
<td>Health Technology Innovation Centre</td>
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<td>ICGEB</td>
<td>International Centre for Genetic Engineering and Biotechnology</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IEC</td>
<td>Information, Education and Communication Initiative</td>
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<td>IKP</td>
<td>ICICI Knowledge Park</td>
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<td>INSAT</td>
<td>Indian Satellite System</td>
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<td>IP</td>
<td>Intellectual Property</td>
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<td>IPR</td>
<td>Intellectual Property Rights</td>
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<td>IRDA</td>
<td>Indian Insurance Regulatory and Development Authority</td>
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<td>IRS</td>
<td>Indian Respiratory Syndrome</td>
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<td>ISB</td>
<td>Indian School of Business</td>
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<td>ISRO</td>
<td>Indian Space Research Organisation</td>
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<tr>
<td>LMIC</td>
<td>Lower Middle Income Country</td>
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<tr>
<td>MBBS</td>
<td>Bachelor of Medicine, Bachelor of Surgery</td>
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<tr>
<td>MEMS</td>
<td>Micro Electronic Mechanical Systems</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>MIS</td>
<td>Management Information System</td>
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<tr>
<td>MMR</td>
<td>Maternal Mortality Rate</td>
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<tr>
<td>MOOC</td>
<td>Massive Open Online Course</td>
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<tr>
<td>MUDRA</td>
<td>Micro Units Development Refinance Agency</td>
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<tr>
<td>NCD</td>
<td>Non-Communicable Disease</td>
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<tr>
<td>NCL</td>
<td>National Chemical Laboratories</td>
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<tr>
<td>NCR</td>
<td>National Capital Region</td>
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<td>NEA</td>
<td>New Enterprise Associates</td>
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<td>NEHA</td>
<td>National e-Health Authority</td>
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<td>NFHS</td>
<td>National Family Health Survey</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<td>NHM</td>
<td>National Health Mission</td>
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<td>NOFNP</td>
<td>National Optical Fibre Network Programme</td>
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<tr>
<td>NREGS</td>
<td>National Rural Employment Guarantee Scheme</td>
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<tr>
<td>NRHM</td>
<td>National Rural Health Mission</td>
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<tr>
<td>NSTEDB</td>
<td>National Science and Technology Entrepreneurship Development Board</td>
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<tr>
<td>NTD</td>
<td>Neglected Tropical Disease</td>
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<tr>
<td>NTP</td>
<td>National Telecom Policy</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
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<td>PCR</td>
<td>Polymerase Chain Reaction</td>
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<td>PHC</td>
<td>Primary Health Centre</td>
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<td>PHFI</td>
<td>Public Health Foundation of India</td>
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<td>POC</td>
<td>Point-of Care</td>
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<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
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<tr>
<td>RACHIS</td>
<td>Rajiv Aarogyrasi Health Insurance Scheme</td>
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<tr>
<td>RDRL</td>
<td>Resilience Design and Research Labs</td>
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<tr>
<td>RGCB</td>
<td>Rajiv Gandhi Centre for Biotechnology</td>
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<tr>
<td>RSBY</td>
<td>Rashtriya Swasthya Bima Yojana</td>
</tr>
<tr>
<td>RTBI</td>
<td>Rural Technology and Business Incubator</td>
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<tr>
<td>SAFAR</td>
<td>System of Air Quality Forecasting and Research</td>
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<tr>
<td>SBIRI</td>
<td>Small Businesses Innovation Research Initiative</td>
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<tr>
<td>SCA</td>
<td>Service Centre Agencies</td>
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<tr>
<td>SCTIMST</td>
<td>Sree Chitra Tirunal Institute for Medical Sciences and Technology</td>
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<tr>
<td>SDA</td>
<td>State Designated Agency</td>
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<tr>
<td>SIB</td>
<td>Stanford Industrial Biodesign</td>
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<tr>
<td>TBI</td>
<td>Technology Business Incubator</td>
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<tr>
<td>THSTI</td>
<td>Translational Health Science and Technology Institute</td>
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<tr>
<td>TNHSP</td>
<td>Tamil Nadu Health Systems Project</td>
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<tr>
<td>TPA</td>
<td>Third Party Administrator</td>
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<tr>
<td>USOF</td>
<td>Universal Service Obligation Fund</td>
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<tr>
<td>VC</td>
<td>Venture Capital</td>
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<tr>
<td>VIA</td>
<td>Visual Inspection with Acetic Acid</td>
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<tr>
<td>VLE</td>
<td>Village Level Entrepreneur</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>YLL</td>
<td>Years of Life Lost</td>
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Health – physical and mental well-being – has become increasingly synonymous with development.\(^1\) Six of the eight broad targets for the Millennium Development Goals and more than a quarter of the Sustainable Development Goals are directly related to health. Development economist Angus Deaton’s (2013) *The Great Escape* focused on health, at least as much as on wealth, as the mark of progress and dimension of ongoing inequalities.\(^2\) Health is also highly correlated with happiness. The World Happiness Report (2013) found that even crude indicators of a country’s health level such as life expectancy at birth explained significant cross-country differences in subjective well-being, and mental health is the single most important determinant of happiness globally.\(^3\)

India is no exception. India’s achievements are often reported in terms of economic growth, poverty reduction, changes in inequality, or even the global reach of its major corporations. But in the end, the conversation about progress often comes back to health and the health context: the air quality in Delhi, the chagrin that preventable and curable diarrheal diseases continue to kill large numbers of children, the figures on childhood malnutrition and maternal deaths all make the headlines along with the financial figures.

Health is starting to emerge on political agendas and in popular debates. A High Level Expert Group on Universal Health Care Coverage for India was convened in 2010, producing a widely cited report a year later. Two parties – Congress and Aam Aadmi – framed healthcare as a ‘right’ in their manifestos for the 2014 elections, while the Bharatiya Janata Party (BJP) made more specific reform promises including a ‘National Health Assurance Mission’; reorganisation of the Ministry of Health and Family Welfare to converge departments that deal with healthcare, food and nutrition, and pharmaceuticals; a push for Indian systems of medicine such as Ayurveda; and establishment of top-class medical colleges in every state. (Chatterjee, 2014)\(^4\)

The healthcare system, defined here as ‘institutions, facilities, and actors involved in delivering healthcare services’,\(^5\) has also taken significant strides in the past decade. Government has made steady advances over several administrations, including the advent of the National Rural Health Mission, investments in training hundreds of thousands of front-line workers, expansion of national and state insurance schemes, policy measures to protect access to essential medicines, and support for domestic manufacturing of medical devices. Public investment has not increased as much as had been expected in the 2015-16 budget, but the draft National Health Policy 2015 does emphasise the government’s long-term commitment to improving access to health.\(^6\) India’s first-ever National Mental Health Policy was released in October 2014.\(^7\)

Various forms of private finance for healthcare for low-income India have increased. Health, along with education, accounts for the bulk of Corporate Social Responsibility (CSR) expenditures, a pool of funding that is poised to grow as the new regulations in the Companies Act 2013 are enforced.\(^8\) Healthcare start-ups, including models focused on low-income households, have also attracted increasing private equity and venture investment, as we discuss in subsequent chapters. Social enterprises, for-profit businesses with a commitment to social impact, are also increasingly active in the healthcare space – setting up ventures ranging from low-cost hospitals and clinics to innovative diagnostic and treatment devices.
The health system, a much wider range of institutions and actors who directly or indirectly influence and affect health in a society, is also changing, with a national law aimed at providing food security, increasing attention to air and water quality monitoring and management, and high-tech, high-profile experimentation with community-based preventive measures.

However, there is much to do. The opportunities to achieve wide-ranging social impact by improving India’s health systems and extending access to them are enormous.

These are not easy challenges to resolve, but the solution space is also changing in ways that open enormous possibilities for social enterprises – innovative for-profit businesses with a commitment to social impact – to change the health system for the better. New technologies are emerging daily and disseminating more rapidly than ever. Information and communication technologies that allow easy, frequent communication and data sharing across distances and enable new, distributed work teams are becoming more common and cell phones, nearly ubiquitous. The costs of diagnosis for some of India’s critical diseases are dropping and the speed of insight is increasing. Treatment protocols and technology are developing to enable lower-skilled people in more remote environments with weaker infrastructure to respond to health crises more effectively. India’s population is slowly urbanising and population densities in rural areas are also increasing, tipping more geographies into viable catchment areas for market-based models alongside traditional public and philanthropic approaches.

This report is designed to help social entrepreneurs make sense of emerging possibilities and identify signs that new pathways for the evolution of the health system (both positive and negative) are forming.

We focus primarily on opportunities that have the potential to be financially viable as businesses, but we have drawn the boundaries loosely in order to recognise the importance of innovative hybrid and non-profit models in delivering healthcare, as well as to flag important areas for financial viability to be tested.

Social enterprise and technology incubators, Villgro Innovations Foundation and Healthcare Technology Innovation Centre, IIT Madras, came together with Okapi Research and Resilience Design and Research Labs along with Dr. Brinda Dalal of Dhoopa Ventures out of a common interest in understanding where opportunities for social entrepreneurs in India were heading.

We also sought to provide a provocative piece of research to challenge all stakeholders in the healthcare sector to think critically about how India’s health system might be evolving.
India has a long tradition of using futures research to generate important debates about societal issues and to shape national strategy. This report, in part, aims to integrate futures thinking and pluralistic perspectives into discussions about health and social entrepreneurship in India.

Anticipating the future involves understanding and planning for multiple, even divergent possibilities rather than a single, dominant one. Given that the future is inherently uncertain, and that India has a unique set of socio-economic, geopolitical and historical characteristics, this report will not be making normative predictions. Instead, our goal is to highlight a variety of options and encourage social entrepreneurs who are working in India or wish to enter the Indian market to explore an array of prospects and choices as they design products and services for individuals and communities living in low-resource settings.

The intent of our collaborative research was to discover potential opportunities and identify upcoming uncertainties and challenges in healthcare, and to help stimulate ideas and innovations for social enterprises in India. The research team drew on methods from futures studies to think systematically and creatively about healthcare innovation in the next five to ten years. These include horizon scanning and developing future scenarios and alternative futures (each of which will be briefly described below).

The key findings and provocations in the report are based on primary and secondary research. Primary research included seeking expert opinions (a list of those consulted is in Appendix A), conducting site visits and interviews, and observing interactions in the field in different cities and villages across the country. We visited primary healthcare clinics, accompanied mobile health vans into different areas, and spoke with dozens of practitioners, managers, forerunners and experts who form national policy, lead and assess organisations and spearhead local programmes.

Interviews solicited people’s views on the current and future state of healthcare. We explored perceptions about new technologies, care delivery and standards, and probed debates about financing and other topics. At workshops, experts shared their views on barriers to effective healthcare and opinions about macro and micro trends. They also developed scenarios and discussed how socio-economic, technological, environmental or political factors might affect the future of the healthcare industry. We would like to thank everyone who has participated in the research, without implicating them in our findings.

Secondary research involved surveying market reports, studying academic literature and conducting horizon scanning. Here, we searched for directional shifts in healthcare, as well as factors outside the healthcare industry such as demographic trends, that could influence it. We gathered examples of new innovations, incipient practices and trends from within India and around the world, focusing in particular on lessons from contexts analogous to those found in India.
Our research team analysed signals, expert insights and data from primary and secondary sources and identified clusters of key research themes through half-day workshops. Themes were written up in the form of idea briefs, which formed the foundation for this report. In addition, we created three scenarios to immerse readers in different possibilities for the future. They offer insights into a variety of situations in a plausible manner, and describe emerging trends, threats and – for this report – areas for health innovation. They invite us to anticipate different risks and prospects, provoke our imaginations, and plan for multiple futures.

Horizon scanning or environment scanning is a strategic forecasting method that involves perusing a wide range of online and offline sources to look for emerging patterns and changes occurring in society. Typically (and also in our case) this means scanning for weak and strong signals, as well as wild cards. Signals help you to identify indicators of the future that exist today. They appear in many forms, as technology prototypes, a breakthrough business idea, new values or practices being adopted or an outlier concept. Signals can demonstrate emerging trends and offer a tangible glimpse into what future(s) can be. They can also be a one-off innovation, a discrepancy or exception that may or may not pan out a few years from now. ‘Weak signals’ are precursors or early examples of changes that occur in society or in an industry today. They help us anticipate and prepare for surprises. They are also highly uncertain, providing only partial, fragmentary insights. A convergence of weak signals can sometimes flag an emerging trend, but not always. Thus, signals should be observed over time to see the directions in which they develop. The reason to use weak signals is not to predict the probability of future events, but to open one’s thinking to a range of new possibilities. Our horizon scanning exercise was conducted individually and in pairs and then reviewed by a third person.

Similarly, it is helpful to track ‘strong signals’. These provide evidence of changes taking place across – not just within – different domains in society. They often denote trends, counter-trends and even influential shifts in cultural values. Finally, wild cards, a concept similar to Nassim N. Taleb’s notion of black swans, are low-probability events that can have a substantial impact on society if they occur (such as a tsunami or a meteor hitting the earth).

Scenarios are like narratives: they describe a postulated set of events and actions in the future. Each of our scenarios explores different variables, assumptions and actions that may occur in the future. Reflecting on the volatile and complex nature of our economy and society, they attempt to shine a light on divergent possibilities in the next five years.

We developed three scenarios that are loosely based on an ‘alternative futures’ framework. They offer a trajectory of plausible ideas, depicting futures where economies grow, collapse or are constrained. While one can create any number of potential futures, we follow methodology developed by Professor Jim Dator to condense clusters of ideas into a few representative archetypes that illustrate different points of view in a comprehensive way. The archetypes are not meant to predict, but rather to provoke ongoing consideration of diverging possibilities and the ways that entrepreneurs may both shape and be shaped by change.
The first archetype, ‘Growth’, focuses on the possibilities for expansion of business as usual. A growth scenario might offer assumptions about financial progress, where for example, due to actions and a convergence of circumstances, GDP rises year after year, businesses and incomes expand in certain sectors and help to raise the national standard of living, and governments remain fairly stable. Dator warns, however, that not all assumptions about continued growth are positive. As wealth disparities widen, income inequalities can deepen, and social instability move to the fore. The point here is not to predict factors that guarantee perpetual growth, but to explore various and even contradictory factors within the scenario, as well as the different directions for the future.

‘Discipline’ or ‘Constraint’ futures, the second archetype, assume that some form of boundary or limit will be reached that shapes the way the system evolves. This may also be fiscal: for example, organisations or states may be looking to cut costs and increase efficiencies across the system. In so doing, new possibilities for innovation arise. Jugaad innovations are examples of constraint scenarios.

‘Collapse’ scenarios, the third archetype, anticipate potential failures and breakdowns and their impacts on society. Understanding how unusual weather events affect public health is one example. Similarly, community resilience to unexpected events is a topic often addressed in futures of collapse.

In ‘Transformation’, the final archetype, societies are irrevocably changed as a result of disruptions. The invention of penicillin and the advent of personal computing are examples of transformation – developments that led to fundamentally new practices, expectations and possibilities.
Each of these futures captures distinct characteristics. By keeping the diversity of these archetypes in mind, simultaneously, strategic plans can be enriched and innovations become more compelling.

Given the relatively short timeline of our horizon – five to seven years – our report offers three scenarios that blend elements of the archetypes: ‘The Rising Tides’ bridges collapse and constraint scenarios to look at the implications of a crumbling health system faced with increasing disease burdens. ‘The Social Surge’ combines growth and constraint scenarios to highlight the possibilities that arise with expanded health literacy, patient agency and awareness of the economic importance of well-being. ‘All Wired Up and Somewhere to Go’ combines growth and transformation to explore developments in a world with much greater data liquidity and many stakeholders seeking to leverage the information for varying purposes.

In the scenarios, as well as the analysis leading up to them, the report attempts to capture the most prominent, promising and provocative ideas for the future, to stimulate social innovations in the healthcare sector in low-resource settings.

The report proceeds as follows: Chapter 2 provides a brief overview of India’s health system, describing both the burden of illness (the ‘demand’ side) and the state of the system (the ‘supply’ side). It establishes a baseline of the status quo for those who aren’t familiar with the terrain. Chapter 3 discusses emerging platforms for innovation, particularly focusing on social enterprise activity. Chapter 4 focuses on critical factors, or dynamic aspects of the context that are important determinants of the shape of the future. Chapter 5 presents three illustrative scenarios. Chapter 6 concludes with a discussion of emerging opportunities for social entrepreneurs.
Endnotes

1 According to WHO, the definition of HEALTH is: ‘Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.’ http://www.who.int/about/definition/en/print.html


4 Chatterjee, Patralekha. (2014). Manifestos for health: what the Indian political parties have promised, BMJ 2014;348:g2703 Retrieved from doi: http://dx.doi.org/10.1136/bmj.g2703 (Published 9 April 2014)


Chapter 2: India’s Health System

An Overview

This chapter provides a broad overview of India’s health system. The first part starts with a summary of India’s major health challenges and an overview of healthcare infrastructure as it stands today. The second half of the chapter turns to the broader economic context for the health system, and the roles that the public sector, private business and communities are currently playing.

Many of the challenges we describe are well known, long-standing and difficult to change overnight, even with unlimited financial resources. Some of India’s current health challenges are linked to long-term gaps in infrastructure for water, sanitation and energy, for example. These are slowly narrowing, but will certainly remain a part of the context for the horizon that this report discusses. Behavioural change can take years, even generations, for practices intertwined with cultural norms. Skilled health workers take time to train, and they are essential resources to retain in today’s global labour market. Hospitals are more than just buildings, but also collections of processes and protocols, all of which settle into place over time and in interaction with new technologies and social expectation. They also depend on supply chains that need to be built for drugs, instruments, diagnostic tools and other supplies. Health literacy – the background of knowledge and access to information that allows one to be an informed, discerning consumer of health services – increases gradually over time and, in a world of increasingly complex and specialised medicine, may never be a substitute for expert oversight from within the medical profession. But every change starts somewhere.

We hope that the following chapters will highlight some emerging points of leverage for social entrepreneurs to shape the future of India’s health system.

India’s Health Challenges: Demand Side

India’s health needs have shifted over the past decades from a predominance of communicable to non-communicable diseases. The 1999 World Health Organization (WHO) Report found that about half of the more than 260 million Disease Adjusted Life Years (DALY) lost in India was due to communicable diseases, followed by non-communicable diseases (33%) and injuries.¹ A decade later, according to figures compiled in the World Bank’s World Development Indicators, the cause of death by communicable diseases, maternal, prenatal and nutrition conditions was just 36% of total deaths, while the cause of death by non-communicable diseases and injury rose to 53% and 10% respectively.² By combining maternal deaths with communicable diseases, these figures underestimate the shift in the disease burden. India’s Maternal Mortality Ratio (MMR) remains high, at 212 per 100,000 live births.³

This shift in the burden of disease from communicable to non-communicable is not unusual among developing countries, but we highlight it because it has important implications for the nature of healthcare required. The health system must not only be capable of identifying and limiting outbreaks of infectious disease and providing curative care for diseases that may build up drug resistance over time (such as tuberculosis - TB); but it must also be capable of pre-empting chronic and often costly illness. This preventive care is wide-ranging and necessarily integrated with programmes that focus on providing a cleaner environment (in terms of air, water and
surroundings) as well as promoting healthier lifestyles and early diagnosis and monitoring of potential illness. The former relies on the general programme implementation capacity; the latter poses the additional burden of more frequent interactions between people and health workers, even when they are ostensibly healthy.⁴

Even as the health system gears up to manage widespread diabetes and its effects, deadly vector-borne diseases are on the rise: dengue cases have more than doubled between 2010 and 2013 with a 38% increase in the number of deaths, while cases of Japanese encephalitis have risen by 73% with a 68% increase in the number of deaths.⁵ India is one of the global hotspots for emerging infectious disease incidents, many of which are zoonotic.⁶,⁷

The Global Burden of Disease Study 2010 and 1990 (GBD 2010)⁸ illustrates the continued importance of communicable diseases in terms of the causes and risk factors for Years of Life Lost (YLL). It also highlights three other important factors for today’s health system to consider.

**Figure 1**

**Causes for Years of Life Lost (YLL)**

<table>
<thead>
<tr>
<th>1990 Mean rank (95% UI)</th>
<th>2010 Mean rank (95% UI)</th>
<th>Median % change (95% UI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 (1-2) 1 Diarrheal diseases</td>
<td>1 Preterm birth complications 2.0 (1-5)</td>
<td>-31% (-49 to -8)</td>
</tr>
<tr>
<td>2.0 (1-3) 2 Lower respiratory infections</td>
<td>2 Lower respiratory infections 2.5 (1-4)</td>
<td>-45% (-54 to -33)</td>
</tr>
<tr>
<td>3.0 (2-4) 3 Preterm birth complications</td>
<td>3 Diarrheal diseases 2.8 (1-5)</td>
<td>-56% (-66 to -43)</td>
</tr>
<tr>
<td>5.2 (4-7) 4 Tuberculosis</td>
<td>4 Ischemic heart disease 3.0 (1-4)</td>
<td>66% (38 to 87)</td>
</tr>
<tr>
<td>5.6 (4-10) 5 Neonatal sepsis</td>
<td>5 COPD 5.5 (5-7)</td>
<td>2% (-11 to 15)</td>
</tr>
<tr>
<td>6.2 (4-9) 6 Protein-energy malnutrition</td>
<td>6 Neonatal sepsis 5.9 (5-7)</td>
<td>-23% (-51 to 29)</td>
</tr>
<tr>
<td>6.9 (5-9) 7 COPD</td>
<td>7 Tuberculosis 6.5 (2-12)</td>
<td>-32% (-54 to -10)</td>
</tr>
<tr>
<td>8.5 (7-10) 8 Ischemic heart disease</td>
<td>8 Self-harm 7.8 (5-11)</td>
<td>154% (15 to 253)</td>
</tr>
<tr>
<td>9.4 (612) 9 Neonatal encephalopathy</td>
<td>9 Road injury 8.5 (5-14)</td>
<td>63% (20 to 171)</td>
</tr>
<tr>
<td>10.3 (3-27) 10 Measles</td>
<td>10 Stroke 9.5 (7-12)</td>
<td>54% (16 to 77)</td>
</tr>
<tr>
<td>11.7 (10-15) 11 Meningitis</td>
<td>11 Neonatal encephalopathy 10.2 (6-14)</td>
<td>-17% (-49 to 45)</td>
</tr>
<tr>
<td>13.4 (8-21) 12 Tetanus</td>
<td>12 HIV/AIDS 12.5 (1015)</td>
<td>6147% (605 to 17785)</td>
</tr>
<tr>
<td>13.9 (11-17) 13 Stroke</td>
<td>13 Fire 13.9 (921)</td>
<td>19% (-31 to 88)</td>
</tr>
<tr>
<td>14.1 (10-19) 14 Maternal disorders</td>
<td>14 Congenital anomalies 14.7 (11-19)</td>
<td>4% (-38 to 46)</td>
</tr>
<tr>
<td>15.2 (12-20) 15 Road injury</td>
<td>15 Protein-energy malnutrition 15.9 (11-21)</td>
<td>-66% (-76 to -52)</td>
</tr>
<tr>
<td>16.7 (10-23) 16 Malaria</td>
<td>16 Cirrhosis 16.5 (14-22)</td>
<td>84% (21 to 131)</td>
</tr>
<tr>
<td>16.8 (11-20) 17 Congenital anomalies</td>
<td>17 Meningitis 17.2 (14-21)</td>
<td>-38% (-52 to -17)</td>
</tr>
<tr>
<td>17.3 (13-22) 18 Fire</td>
<td>18 Diabetes 19.3 (16-23)</td>
<td>92% (48 to 121)</td>
</tr>
<tr>
<td>17.9 (14-21) 19 Encephalitis</td>
<td>19 Measles 19.7 (8-38)</td>
<td>-63% (-78 to -31)</td>
</tr>
<tr>
<td>19.6 (13-23) 20 Self-harm</td>
<td>20 Drowning 20.5 (15-24)</td>
<td>1% (-20 to 38)</td>
</tr>
<tr>
<td>22.6 (20-27) 21 Drowning</td>
<td>21 Encephalitis 22.0 (19-25)</td>
<td>-35% (-48 to -14)</td>
</tr>
<tr>
<td>26.6 (24-30) 27 Cirrhosis</td>
<td>23 Maternal disorders 24.0 (19-29)</td>
<td>-54% (-68 to -38)</td>
</tr>
<tr>
<td>31.0 (2834) 31 Diabetes</td>
<td>36 Malaria 36.5 (23-56)</td>
<td>-71% (-90 to -42)</td>
</tr>
<tr>
<td>77.2 (39-101) 78 HIV/AIDS</td>
<td>44 Tetanus 43.7 (26-59)</td>
<td>-84% (-92 to -67)</td>
</tr>
</tbody>
</table>

(Source: Global Burden of Disease, visualisation from [http://www.healthmetricsandevaluation.org/](http://www.healthmetricsandevaluation.org/))
Figure 2
Risk Factors for Years of Life Lost (YLL)

<table>
<thead>
<tr>
<th>1990 Mean rank (95% UI)</th>
<th>2010 Mean rank (95% UI)</th>
<th>Median % change (95% UI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 (1-1)</td>
<td>1 Dietary risks</td>
<td>1.0 (1-1)</td>
</tr>
<tr>
<td>2.0 (2-2)</td>
<td>2 Household air pollution</td>
<td>2.3 (2-4)</td>
</tr>
<tr>
<td>3.8 (3-7)</td>
<td>3 Suboptimal breastfeeding</td>
<td>2.9 (2-4)</td>
</tr>
<tr>
<td>4.2 (3-5)</td>
<td>4 Smoking</td>
<td>3.9 (3-5)</td>
</tr>
<tr>
<td>4.3 (3-6)</td>
<td>5 Childhood underweight</td>
<td>5.5 (4-8)</td>
</tr>
<tr>
<td>6.5 (5-8)</td>
<td>6 Ambient PM pollution</td>
<td>5.9 (5-7)</td>
</tr>
<tr>
<td>7.3 (6-9)</td>
<td>7 High blood pressure</td>
<td>7.5 (6-9)</td>
</tr>
<tr>
<td>8.7 (4-18)</td>
<td>8 Sanitation</td>
<td>7.7 (5-11)</td>
</tr>
<tr>
<td>9.0 (7-11)</td>
<td>9 Occupational risks</td>
<td>9.4 (7-11)</td>
</tr>
<tr>
<td>10.7 (6-14)</td>
<td>10 Vitamin A deficiency</td>
<td>9.8 (7-12)</td>
</tr>
<tr>
<td>11.2 (9-14)</td>
<td>11 Alcohol use</td>
<td>10.2 (8-12)</td>
</tr>
<tr>
<td>11.6 (9-14)</td>
<td>12 High fasting plasma glucose</td>
<td>13.2 (11-18)</td>
</tr>
<tr>
<td>12.5 (8-17)</td>
<td>13 Zinc deficiency</td>
<td>13.9 (11-23)</td>
</tr>
<tr>
<td>13.9 (10-19)</td>
<td>14 Unimproved water</td>
<td>14.0 (12-17)</td>
</tr>
<tr>
<td>14.2 (12-15)</td>
<td>15 High total cholesterol</td>
<td>15.0 (13-17)</td>
</tr>
<tr>
<td>15.8 (14-17)</td>
<td>16 Iron deficiency</td>
<td>15.3 (12-19)</td>
</tr>
<tr>
<td>17.5 (15-19)</td>
<td>17 Sanitation</td>
<td>17.4 (14-21)</td>
</tr>
<tr>
<td>17.8 (16-19)</td>
<td>18 High body - mass index</td>
<td>18.4 (14-24)</td>
</tr>
<tr>
<td>18.4 (17-19)</td>
<td>19 Childhood sexual abuse</td>
<td>19.7 (17-23)</td>
</tr>
<tr>
<td>20.1 (19-21)</td>
<td>20 Drug use</td>
<td>19.8 (17-22)</td>
</tr>
<tr>
<td>21.3 (17-22)</td>
<td>21 Iron deficiency</td>
<td>20.3 (17-22)</td>
</tr>
<tr>
<td>22 Unimproved water</td>
<td>20.8 (16-24)</td>
<td>20.8 (16-24)</td>
</tr>
<tr>
<td>23 Drug use</td>
<td>23.0 (21-24)</td>
<td>23.0 (21-24)</td>
</tr>
</tbody>
</table>

(Source: Data from Global Burden of Disease, visualization from [http://www.healthmetricsandevaluation.org/](http://www.healthmetricsandevaluation.org/))

First, the ‘health system’ is intertwined with the environment, infrastructure and other contextual factors that may be outside of the control of a narrowly defined healthcare agenda. Environmental factors, for example, are an important concern. The high incidence of respiratory infections highlights the importance of attention to air quality. Outdoor and indoor air pollution in India is recognised as a significant contributor to illness. In fact, an estimated 1.5 million deaths occur in India annually due to indoor and outdoor air pollution. Indoor air pollution is the second highest risk factor for life years lost, and ambient air quality is the sixth highest risk factor. The GBD 2010 estimates over 2.1 million premature deaths and 52 million years of healthy life lost in 2010 due to ambient fine particle air pollution in Asian countries, 712,000 of which were in South Asia. Chronic exposure to air pollution not only leads to respiratory infections and cardiovascular diseases including cancer, but can also disrupt the reproductive system. A recent study estimated that 660 million people residing in areas of India where the PM2.5 concentration level exceeds the National Ambient Air Quality Standards (NAAQS) would experience an increase in their life expectancy by an average of 3.2 years if the concentration level complied with NAAQS.10
Infrastructure also matters. Diarrheal diseases have consistently been among the first three ranks in the GBD report over a period of 20 years. In 2006, the World Bank’s Water and Sanitation Programme report, ‘The Economic Impacts of Inadequate Sanitation in India’, estimated that 6.4% of the Gross Domestic Product (GDP) would be the total economic impact of inadequate sanitation. The study, which focused on the safe management of human excreta and associated hygiene behaviour, valued the health-related impacts (premature death, cost of treatment, productive time lost, etc.) of inadequate hygiene at ₹ 1.75 trillion. The report also found that the poorest 20% living in urban areas bear the highest per capita economic impacts of inadequate sanitation. In addition to this, diarrhoea in children under the age of five contributed to 47% of the total health-related economic impacts. Spears (2013) finds that the level of access to sanitation explains a substantial portion of the cross-country variation in chronic malnutrition (as measured by height), suggesting that India’s water and sanitation infrastructure may contribute as much as its food system in the continued incidence of malnutrition. Open defecation, a common practice in developing countries, causes environmental enteropathy (a condition arising from frequent intestinal infections from faecal contamination) and reduces nutrient absorption resulting in malnutrition, stunting and cognitive defects.

India continues to lag behind its peers in Lower Middle Income Countries (LMIC) in access to sanitation and, in some cases, even behind Low Income Countries (LIC). Addressing these gaps will require more than infrastructure development – behaviour change is also important. Increased toilet coverage in Orissa, for example, has not led to significant documented health impacts – suggesting that infrastructure alone cannot solve the health problems of the country. Even without additional infrastructure, hand washing, fly and mosquito control, and safer practices in food preparation and water storage can all make a significant difference to health outcomes.

![Figure 3](Access to Improved Sanitation Facilities, 2012)

(Source: World Bank, 2015 (World Development Indicators))
The increasing prevalence of traffic injuries and fires as causes of life years lost also reiterate the importance of taking a broad look at infrastructure.

Second, the health system cannot be disentangled from food policies and markets. Diet-related issues are the leading risk factor for life years lost in India. Though the life years lost due to protein energy malnutrition has decreased in rank from 3 to 15 in the span of 20 years (1990-2010), malnutrition and particularly childhood malnutrition continue to be prevalent. The percentage of children under three with a low weight-to-height ratio in India rose from 16% to 19% between 1999 and 2006. Nearly half (46%) of children under three were undernourished and a third of adult women have a Body Mass Index (BMI) lower than 18.5, a level commonly associated with chronic energy deficiency.\textsuperscript{17} The poorest seem to live on less than 1500 calories a day, compared to a norm of over 2000.\textsuperscript{18}

The National Family Health Survey’s (NFHS) last two rounds (NFHS-2 in 199-93 and NFHS-3 in 1998-99) provide additional evidence of gaps in nutrition: In the 1998-99 survey, only 55% of adult women in India consumed milk or curd at least once a week, 33% ate fruits at least once a week and 28% had an egg. The 2005-6 NFHS found similar results: Milk or curd was consumed daily by 40% of women and weekly by 16% of women, but 11% never consume milk or curd, and 33% consume milk or curd only occasionally. The fourth round of the survey (2014-15) is currently underway.

Third, mental health must be seen as an integral part of the challenge for India’s health system. A recent WHO report has stated that by 2020, the number of mental health cases in India is likely to rise by 20%. ‘Self harm’ has risen sharply from a rank of 20 to 8 as a cause of life years lost in India. More generally, 6-7% of the population is thought to have some form of mental disorder, with no clear distinctions between rural and urban India.\textsuperscript{19} Over 90% of mental disorders are estimated to go untreated.\textsuperscript{20} Many constraints contribute to these treatment gaps. On the demand side, cost considerations, sociocultural beliefs, stigma and overall lack of health literacy are all barriers to formal mental health seeking.

On the supply side, resources remain limited, even as India’s first-ever Mental Health Policy 2014 promises to improve access to mental health services for all, including the poorest, increase incentives for the mentally ill to seek treatment by decriminalising suicide and enforcing peoples’ right to not be institutionalised, and assign specific responsibilities to levels of government. The Mental Health Policy, years in the making, follows on the 1982 National Mental Health Programme’s call to integrate mental health into healthcare structures. It has important gaps to fill: Primary care systems almost uniformly omit mental health services. Almost none make psychiatric drugs, including anti-depressant or anti-anxiety medications, available. The 1992 District Mental Health Programme (DMHP) called for decentralising mental health services across the healthcare spectrum, but so far only a fifth of all districts offer ‘even a highly diluted version of the District Mental Health Programme’.\textsuperscript{21} Human resource constraints prevail across the board. Private services are available in India, but they are expensive, hard to access, particularly for rural populations, and largely unregulated. Mental health is also not covered by any Indian insurance plans. This is clearly an area for impact. The extent to which mental health can be delivered by market-based social enterprise models is not clear, but the report and scenarios explore emerging possibilities.
India’s Health Challenges: Supply Side

India’s health system has improved its performance relative to middle-income country peers in some areas, such as immunisations (Figures 4 and 5) but the human capital, physical infrastructure and public financial support for sustained attention to the emerging health demand is still lacking. At 1.3% of GDP, India has one of the world’s lowest levels of public health expenditures.

The part of this section focuses on the traditional indicators of healthcare to establish a sense of the magnitude of the gaps in physical infrastructure as well as human resources that remain to be addressed through policy, philanthropy, entrepreneurial effort and partnerships among these groups and communities. The remainder discusses some initiatives in promoting broader health literacy and behavioural changes affecting health outcomes. A full catalogue of the health system, including capacity for air quality management, sanitation, nutrition and other factors referred to above is beyond the scope of the report.

**Figure 4**

**Immunisation in 2005**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Low and Middle income Country</th>
<th>Low Income Country</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>68</td>
<td>59</td>
<td>69</td>
</tr>
<tr>
<td>Pol3</td>
<td>55</td>
<td>55</td>
<td>72</td>
</tr>
<tr>
<td>Hib3</td>
<td>13</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>HepB3</td>
<td>37</td>
<td>40</td>
<td>71</td>
</tr>
<tr>
<td>DPT</td>
<td>71</td>
<td>67</td>
<td>71</td>
</tr>
<tr>
<td>BCG</td>
<td>79</td>
<td>78</td>
<td>78</td>
</tr>
</tbody>
</table>

(Source: World Bank 2015 (World Development Indicators))

The percentage of one-year-old children who have received BCG immunisation in India (78%) was lower than the average of LIC (82%) and LMIC (79%) for 2005. In 2012, however, the state of immunisation improved as evidenced in the table. It was higher than the LIC and LMIC average. In the cases of DPT, polio, hepatitis B and measles, the percentage of immunisation has been lower than the average LIC and LMIC for the 2005 and 2012 period. The percentage of one-year-old children who received hepatitis B immunisation was as low as 8%, much less than the 37% average of LMIC.
The tallies of India’s formal health infrastructure vary across sources, but both domestic and international figures concur that India has less than one bed per thousand people, compared to an average of 1.4 beds per thousand in other lower middle income countries. Public hospitals are stretched thin across the board, though beds per number of people ranges from 1 bed per 300-550 people in smaller states/territories such as Puducherry and Lakshadweep to 1 per 7000 people in Bihar. Despite mandates of having a public health facility within 2 kilometres of an average household, the average distance is 9 kilometres.

Data on access to private providers are not available.

(Source: World Bank 2015 (World Development Indicators))

(Source: Government of India, Ministry of Health and Family Welfare.)
Unavailability of sufficient numbers of doctors and nurses is another pressing issue in India as depicted in Figure 7. India has only 0.7 doctors per 1000 population and 1.1 nurses per 1000 population; both these figures are well below the Organisation for Economic Cooperation and Development (OECD) average of 3.2 doctors per 1000 population and 8.8 nurses per 1000 population. However, India’s figures are roughly equivalent to those for LMICs (0.8 physicians per 1000 population and 1.8 nurses and midwives per 1000 population).\textsuperscript{25}

The gaps in India’s mental health infrastructure are also striking. The country had just 25,000 beds in mental hospitals (both public and private) in the entire country as of 2002.\textsuperscript{26} While more than a decade has passed since these data were collected,\textsuperscript{27} even a 50% increase in these facilities would provide an average of 2 beds per 100,000 compared to a global average of closer to 8 per 100,000.\textsuperscript{28}

![Figure 7](image)

\textbf{Figure 7}

\textbf{Doctors and Nurses per 1000 population, 2012}

(Source: Jain (2014))\textsuperscript{29}

The gaps are especially acute at the primary care level. Of the approximately 30,000 new doctors and 10,000 medical specialists who graduate from India’s approximately 400 medical institutions each year, most of them end up working in towns and cities, or overseas. New graduates prefer to pay stiff fines than complete mandatory service in rural areas. There is a growing demand for English-speaking trained professionals in higher-wage countries. Barring a committed minority (who often experience burnout\textsuperscript{30}), new medical graduates face a scarcity of medical equipment, laboratories and medical infrastructure in low-resource settings. Absenteeism is also a perennial problem – a 2003 study based on random spot checks found absenteeism of 40%, higher than Bangladesh (35%), Uganda (37%) and Peru (23%). Medical Outreach Work (37.6%) and Authorised Leave (24.4%) were the most commonly stated reasons for absence.\textsuperscript{31} Banerjee and Duflo (2006) find that the absentee rates in the rural sub-centres (45%) are higher than the larger centres (36%), a serious challenge since the rural sub-centres are often run by just one person.\textsuperscript{32} Doctor absenteeism is a primary reason for patients in underserved areas to seek private health services. This nearly doubles their costs for care when compared to public sector hospitals.
In spite of extensive regulation (Box 1.1), malpractice persists. Interviews with 78 doctors in private practice in some of India’s metropolitan cities (Bangalore, Chennai, Delhi, Kolkata, Mumbai and Pune) revealed that kickbacks for referrals, irrational drug prescribing and unnecessary intervention resulting in the treatment of patients as revenue generators were commonplace.

**BOX 1.1**

**MEDICAL COUNCIL OF INDIA**

The Medical Council of India is a national-level statutory body for doctors of modern medicine, constituted following the enactment of the Indian Medical Council Act 1933. There are approximately 17 laws governing the commissioning of hospitals, 10 governing the qualification/practice and conduct of professionals; 12 governing management of patients; 24 laws governing the employment and management of manpower; 5 for medico legal aspects; and 14 for the safety of patients, public and staff within the hospital premises. Apart from these, there are also licences and certification that have to be renewed from time to time and medical and legal reports that have to be submitted frequently to different agencies. Laws like the Clinical Establishments (Registration and Regulation) Act 2010 have been adopted by a few states (Arunachal Pradesh, Bihar, Himachal Pradesh, Jharkhand, Mizoram, Rajasthan, Sikkim, Uttar Pradesh and Uttarakhand) and all union territories, but have not been implemented since the rules are yet to be notified.

National and state efforts to address these gaps are gaining some traction. The National Rural Health Mission (NRHM, now the National Health Mission – NHM), for example, has succeeded in training over a million new health workers including nearly 150,000 doctors and nurses, as well as over 900,000 female community health activists (Accredited Social Health Activists – ASHAs). The NRHM/NHM has also been instrumental in upgrading and operationalising public healthcare centres as 24/7 facilities, and establishing specialty newborn care and stabilisation units.

The government is also experimenting with and piloting innovative health information dissemination projects to augment the physical presence of health workers. For instance, the Government of Bihar has launched ‘Kilkari’ or ‘Baby’s gurgle’, a voice message campaign that delivers health advice (on vaccination and nutrition supplements) to pregnant women and mothers, while another initiative ‘mobile academy’ relays recorded health messages to train health workers. Behaviour change has become an integral component of health interventions across the country. While many of these are led by non-profit agencies, including philanthropic organisations, aid agencies, not-for-profit organisations, research institutes and grass-roots-level non-governmental organisations, the government plays an equally important role in promoting Information, Education and Communication Initiatives (IEC). The Ministry of Health and Family Welfare and the National Health Mission have various programme or disease or component (maternal/child) specific strategies and materials in place, including national health schemes like the Integrated Child Development Scheme. The Ministry of Drinking Water and Sanitation has placed behaviour change at the top of its agenda to ensure better health outcomes (in this case increased toilet usage); they are attempting to change this through technology and mass media campaigns.
The Scope for Market-Based Models in Improving Health Systems for Low-Income India

The scope for market-based models in improving health systems depends largely on the extent to which low-income households and/or the agencies that serve them become an addressable market: Who are the customers? Low-income households are unlikely to acquire sufficient purchasing power through income growth alone, but policies such as direct benefit transfers or publicly funded health allowances and health insurance programmes could increase their effective purchasing power as a market. Similarly, the public health system could become a potential customer base if public health funding increases and procurement reform allows new and smaller companies to sell to the government clinics, hospitals and other entities that are still the country’s most pervasive healthcare system.

It is also important to acknowledge that not all market-based models will improve the health system. Businesses that prey on peoples’ fears to sell unnecessary diagnostics or treatments are obviously viable, for example, but do not contribute to ‘improving’ the system overall. Relying on market-based models to deliver health services may also involve opportunity costs. Social entrepreneurs might be viable, but not optimal, providers of health services. Just as in other areas of infrastructure and services, private providers might meet needs at costs that the poor are willing to pay, but that are still higher than those the public health system could be capable of providing. The private options relieve the pressure for the public sector to innovate and achieve its full potential. There is substantial global debate about the ‘best’ shape of a health system and the appropriate roles of market and policy, public and private sectors. This report focuses on emerging opportunities for social enterprises, but it does not assume in any way that they will meet all health needs.

Overall, India’s healthcare industry is currently estimated at US$60 billion with US$32 billion attributed to healthcare delivery, US$20 billion in pharma and biotech, US$4.4 billion in medical technology, and US$3.7 billion in medical insurance. As Asia’s fourth largest medical device market and a global top 20 market for medical devices, the Indian market for medical technology is expected to grow to US$7.8 billion by 2016, a compound growth rate of over 15%.

That said, the main customers in the health market continue to be households: private health expenditure of 2.7% of GDP is more than double public expenditure on health. Most of these households are poor. India is a lower middle income country with an average per capita income of approximately US$1500 per year. A fifth of the country, and as much as 40% of the population of some states, lives below the official poverty line. About a third of the country (32.7%) lives below the World Bank-defined poverty line of US$1.25 (Purchasing Power Parity) a day. Over half of the country, 56%, lives on less than ₹1336/month, or ‘the level of consumption required for an individual to fulfil his/her basic need for food, energy, housing, drinking water, sanitation, healthcare, education and social security at a level sufficient to achieve a modest standard of living.’
To put this in perspective, a caesarean section starts at ₹20,000 and an angioplasty costs ₹50,000 in the general ward of the Narayana Health multi-specialty hospital, renowned for Dr. Devi Shetty’s efforts to significantly bringing down the cost of cardiac care. Open-heart surgeries can range from ₹100,000-200,000. Most of these costs are likely to be paid out of pocket (see below), and just one emergency procedure can quickly topple a family into poverty.46

Costs are also rising. Healthcare inflation, commonly estimated at 15%, is double overall inflation of 6-7%, and these rising costs have been a factor in political debates. It is not clear how this inflation is distributed across income groups, but it appears to be fairly consistent across different types of procedures including essential ones (see Table 1). Innovations can reduce the costs of particular treatments, but they may increase the range of possible treatment, and this may increase the total cost of healthcare.

**Table 1**

*Healthcare Inflation*47 (General Insurance Public Sector Association Rates)

<table>
<thead>
<tr>
<th>Procedures</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
<th>2010-11</th>
<th>2011-12</th>
</tr>
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<tbody>
<tr>
<td>Kidney Transplant</td>
<td>147,231</td>
<td>144,741</td>
<td>194,352</td>
<td>157,825</td>
<td>200,180</td>
</tr>
<tr>
<td>Total Knee Replacement</td>
<td>175,986</td>
<td>163,385</td>
<td>166,862</td>
<td>173,674</td>
<td>167,706</td>
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<tr>
<td>Liver Transplant</td>
<td>-</td>
<td>250,000</td>
<td>142,599</td>
<td>140,650</td>
<td>192,881</td>
</tr>
<tr>
<td>Mitral Valve Replacement</td>
<td>144,111</td>
<td>126,327</td>
<td>160,921</td>
<td>179,053</td>
<td>152,351</td>
</tr>
<tr>
<td>PTCA</td>
<td>150,535</td>
<td>139,817</td>
<td>148,728</td>
<td>145,736</td>
<td>150,258</td>
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<tr>
<td>CABG</td>
<td>139,846</td>
<td>138,005</td>
<td>144,301</td>
<td>151,077</td>
<td>144,043</td>
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<tr>
<td>Total Hip Replacement</td>
<td>129,414</td>
<td>122,889</td>
<td>116,500</td>
<td>129,697</td>
<td>115,376</td>
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<tr>
<td>Pacemaker Implantation</td>
<td>115,275</td>
<td>117,460</td>
<td>116,925</td>
<td>115,125</td>
<td>120,107</td>
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<tr>
<td>Pacemaker Implantation</td>
<td>42,375</td>
<td>44,109</td>
<td>43,578</td>
<td>50,662</td>
<td>51,842</td>
</tr>
<tr>
<td>TURP</td>
<td>37,361</td>
<td>41,790</td>
<td>47,995</td>
<td>52,886</td>
<td>56,054</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>35,137</td>
<td>34,649</td>
<td>38,922</td>
<td>39,837</td>
<td>37,528</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>32,189</td>
<td>29,516</td>
<td>31,243</td>
<td>32,046</td>
<td>32,627</td>
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<tr>
<td>Dialysis</td>
<td>23,788</td>
<td>23,628</td>
<td>24,470</td>
<td>23,321</td>
<td>19,128</td>
</tr>
</tbody>
</table>

All figures in ₹; Source: TTK Healthcare
Health expenditures have pushed nearly 63 million people into poverty every year, even as the prospect of greater expenditure has excluded people from care that they need. A 2012 Lancet study found that 30% of rural households and 20% of urban households remained untreated due to financial constraints in 2004. Financial hardship is one of the major reasons for poor uptake of maternal healthcare services in India. For example, in Bihar, one of India’s poorest states where over 80% of births are home deliveries, approximately 50% of women reported financial concerns as the reason for not opting for institutional care. Maternal healthcare services are ostensibly provided free of charge in public health facilities in India, but informal payments for antenatal, delivery and postnatal services appear to be common practice.

In 2010, 66% of the total spending on health was in the form of out-of-pocket expenditure (WHO Atlas 2012). This figure rose to 86% in 2012 according to the World Development Indicators (World Bank 2014). Though all Indians are eligible for public health services, their direct out-of-pocket expenses have been among the highest in the world (WHO Report 2013).

According to the High Level Expert Group Report of the erstwhile Planning Commission almost 74% of private out-of-pocket expenditures today are on drugs.

**Figure 9**

**Out-of-Pocket Health Expenditure (as a % of Total Expenditure on Health)**

(Source: Jain (2014))

The out-of-pocket expenditure on drugs as a percentage of total spending on health varies across states. The highest is in Himachal Pradesh (87.95%), followed by Uttarakhand (87.75%), Bihar (84%), Rajasthan (83%), Uttar Pradesh (81.86%), Chhattisgarh (81.38%), Delhi (74%), Madhya Pradesh (71%), Tamil Nadu (66%), West Bengal (65.80%), Karnataka (65%) and Maharashtra (60%).
In an effort to minimise this portion of out-of-pocket expenditure, the Indian Government has proposed the expansion of Jan Aushadhi stores and provision of generic drugs without brand names.\textsuperscript{57} Initially, the government had proposed to provide 348 generic unbranded drugs for free under this programme, but this has gradually been reduced to 50 owing to the reduced health budget for 2014-15.\textsuperscript{58} In the first phase, these drugs will be available at around 800 chemists, mostly across Delhi.\textsuperscript{59} Some states such as Kerala, Maharashtra and Rajasthan have much more expansive plans and are already providing over 500 free drugs. Both national and state efforts to ensure access to low-cost medicines will also have to overcome challenges in implementation. Government outlets have, in principle, been selling unbranded quality generics at no more than 50% of the prevailing maximum retail price for some time.\textsuperscript{60} However, according to the World Health Statistics (2011 and 2012), the median availability of selected generic medicines between the period 2001 and 2009 was only 20.5% in the public health clinics and 75.4% in the private health clinics.\textsuperscript{61, 62} This figure increased to 22.1% in the public clinics and 76.8% in the private clinics when the median years were 2001-2012.\textsuperscript{63}

The future prospects for market-based models for improving the health system will depend on the implementation of plans to provide Universal Health Coverage. The High Level Expert Group on Universal Health Coverage called for a substantial increase in public funding, to 2.5% of GDP in the current Plan Period (2012-17) and to 3% by 2022. The draft National Health Policy 2015 calls for an increase in public health expenditure to 2.5% of GDP. The Budget 2015-16 has not substantially increased the health expenditure budget, (Figure 11) focusing instead on reducing waste within the current allocation, but many analysts expect increases in health expenditure to feature in future budgets.

The way in which this additional public expenditure is routed – as support to public hospitals, insurance schemes and health allowances that allow patient choice or other forms of distributing funding – will play a significant role in the evolution of India’s healthcare system. We discuss this factor further in the coming chapters.
Figure 11
Public Health Expenditure as percentage of GDP

(Source: Government of India, Economic Survey 2014-15, India)
Endnotes


2 The data are from different sources but are reasonably comparable. In the World Development Indicators, communicable diseases and maternal, prenatal and nutrition conditions include infectious and parasitic diseases, respiratory infections and nutritional deficiencies such as underweight and stunting. Non-communicable diseases include cancer, diabetes mellitus, cardiovascular diseases, digestive diseases, skin diseases, musculoskeletal diseases and congenital anomalies. For WHO, infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of animals that can cause disease when transmitted to humans. Non-communicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression. The four main types of non-communicable diseases are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes. Retrieved from http://www.who.int/topics/en/

3 The Millennium Development Goal is to bring down this number to 109 per 100,000 live births by 2015.


13 According to the 2011 Census, 53.1% of all Indian households do not have a toilet or a latrine, indicating the widespread practice of open defecation. (3.2% of Indian households use public toilets, while 49.8% defecate in the open.) Source: (NA) (2012) India Census: Half of homes have phones but no toilets. BBC News. [Online] Available at: <http://www.bbc.com/news/world-asia-india-17362837> [Accessed 18 March 2015]

14 Income classifications are those of the World Bank.


We use figures from the Central Bureau of Health Intelligence (2012) National Health Profile, a report produced by the Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India unless otherwise indicated. International comparisons are based on figures reported in the World Bank World Development Indicators.


Central Bureau of Health Intelligence, India. (2012).

A These are reported as the latest figures in the latest available publication of the GoI Ministry of Health and Family Welfare.


Five charts that explain India’s healthcare crisis. *LiveMint*. [Online] Available at: <http://www.livemint.com/Politics/pHCS4KW8ZnFqiUqRIllVFN/Five-charts-that-explain-Indias-healthcare-crisis.html> [Accessed 19 March 2015] [Source of infographics - OECD Economic Survey 2014 pertaining to 2012, WHO, World Bank, Credit Suisse AG. Doctors – Physicians qualified in either allopathic medicine or other forms of medicine like Chinese traditional medicines, ayurveda or homeopathy. Nurses – Persons who have completed a programme in basic nursing education and are qualified to provide nursing care.]


41 Public health spending in India’s peers (lower middle income countries), by way of reference, spent 1.7% of GDP on healthcare; low-income countries spent an average of 2% of GDP on healthcare. Private spending on healthcare is about double the public expenditure in both cases.

42 ₹ 60,972 as reported by the Government of India, US$1503 as reported in the World Bank World Development Indicators, or US$5138 adjusted for Purchasing Power Parity.


64 Available at http://indiabudget.nic.in/es2014-15/estat1.pdf
Chapter 3: Innovation Ahead

India's health system needs are clearly significant. The country has multiple burdens of disease (chronic, known and common infectious diseases, and emerging new threats to human health), a sparse public health infrastructure of varying quality, a large and dispersed low-income population, and still-limited public expenditure on health. It is hard for any health venture not to have some kind of impact in this setting; but, at the same time, it is equally challenging to identify points of leverage that can have a significant impact while being financially viable as businesses. The analysis and scenarios in the following chapters of this report seek to provide some frameworks to help entrepreneurs identify such opportunities to transform the health system. This chapter completes the discussion of context with a look at the state of the social enterprise ecosystem around health.

There is clearly an entrepreneurial buzz around healthcare in India, at least part of which is focused on low-income India. Healthcare is one of the fast-growing sectors for impact investing, with funds being channelled into a variety of sub-areas – from hospitals and clinics to innovative diagnostic tools and medical devices designed for low-resource settings. As of 2013, healthcare has received a cumulative investment of US$24.8 million in first-round funding (excluding the outlier US$100 million deal in Narayana health) and US$51 million as follow-on investment. Most of the investments have been made in hospital chains in Tier II and Tier III cities, primary health clinics, ICT in healthcare and a few low-cost product innovation companies.\(^1\) Within healthcare, ophthalmology has been receiving a lot of investor attention.\(^2\) The majority of the impact investments come from foreign investors.\(^3\)

This section of the report focuses more on healthcare than the health system in order to keep the chapter readable and finite, but the same kind of buzz appears to be emerging in the broader health system. Areas such as nutrition, water access, cleaner cooking technologies and other contributors to health are gaining some traction among investors in addition to continued support from philanthropists.

The first part of this chapter describes the landscape for financing social enterprises in health. Looking ahead, however, building up the social enterprise ecosystem to support new ventures in health in a complex context requires more than just investment. This is a risky space, in which entrepreneurs may have to build their own market infrastructure – supply chains, maintenance support and trained professionals – as well as devote time to discover customer preferences and undocumented details of the health system as it is. While some of them may benefit from the growing investor, incubator and policy support for health and life sciences start-ups, the enterprises focused specifically on the needs of low-income India tend to have to spend more time in the blueprint and validation stage given the uncertainties of the market.\(^4\) This is a challenging sector and many moving parts need to come together efficiently for successful responses to the kinds of opportunities that this report highlights.

Moving to the scale stage – ‘Beyond the Pioneer’ to borrow the title of Koh et al. (2014)\(^5\) – requires industry-level facilitation that addresses common barriers to scale such as value-chain logistics, public awareness of the personal value of solutions, and regulations that inhibit firm growth or affect collaboration with the public sector.

The second part of this chapter thus discusses some of the emerging industry-level platforms for facilitating innovation and helping health social entrepreneurs to start to scale. We see innovation as the process of developing a solution for an unmet need and applying it on a large scale to make a significant difference to the community of end users. The process of innovation goes beyond the initial invention and is
often very complex. It may be divided into various phases, including, for example: identification of an unmet need, assessment of the potential impact of a solution, iterative development of a prototype or a process, deployment of the final solution for validation, and eventually up-scaling and commercialisation.

The various platforms discussed here play an important role in bringing together networks of collaborators who can better match solutions with problems. Both ‘technology push’ – finding uses for promising new technologies that may not have an obvious and articulated demand – and ‘demand pull’ – innovation that fills an existing and articulated gap in the market – require communication and interaction between various parts of the healthcare value chain.

Innovation in the area of healthcare is particularly difficult because of its long and complex value chain, which includes care seekers (patients, general population), care providers (doctors, nurses, health workers), hospital administrators, service providers, manufacturers, traders, distributors, retailers, regulatory bodies, policymakers, and so on. A deep understanding of this value chain is necessary to drive the process of innovation.

The Entrepreneurial Buzz

Entrepreneurs have stepped into this market. With investors from all areas putting increasing amounts of capital into the sector – including mainstream venture capital and private equity, corporate investors, angels and impact investors – there is growing interest in the private sector’s potential to provide progressive delivery models combined with innovative technologies that can bring down the cost of care while improving accessibility and quality.

Current Funding Landscape

Between 2008 and 2015, 94 early-stage venture capital investments were made totalling an amount of US$289.63 million. The spike in investments in 2013 can be attributed to Peepul Capital’s investment of US$13.5 million in Rhea Healthcare (maternity care clinics), OrbiMed’s US$9.04 million investment in Surya Child Care (clinics), and Seedfund and Asian Healthcare Fund’s US$9 million investment in myDentist (dental care).

![Figure 1: Early Stage VC Investments, 2008-2015](source: Data from Venture Intelligence)
During the same period, 55 deals worth US$409.76 million were made in growth stage venture capital investments. In 2013, Sequoia Capital India and Matrix Partners India together invested US$16.3 million in Cloudnine (clinics). 2008, 2012 and 2014 saw individual investments of US$20 million each in Sai Advantium Pharma (CRO), YLG Salon and Spa (wellness), and Alivira Animal Health (animal health pharmaceuticals) respectively, with investments coming from MPM capital, Everstone & Helium Ventures and Ascent Capital.

A sector analysis of both early and growth stage investments has revealed that maximum investments have been made in the hospital sector (26%), clinics (19%) and pharmaceuticals (12%). Investments have also been made in alternative medicine, particularly ayurvedic medicine.

The following chart provides the breakdown by sub sector. (Average deal size is highest for biopharmaceutics because the sector received one big funding of US$15.73 million.)
Perfint Healthcare (medical devices sector) has received the maximum amount of funding, totalling US$27.55 million, followed closely by YLG Salon and Spa (wellness sector) at US$27.35 million and Cloudnine at US$26.3 million.

Some of the top investors, who have individually contributed to more than US$25 million in funding, include Sequoia Capital India, Matrix Partners India and OrbiMed.

Since 2014, more venture capital investments are being channelled into life sciences and medical companies; in fact IKP Knowledge Park, Hyderabad alone has incubated or provided research grants to 150 start-ups, most of which focus on generics or services as opposed to products. One of the largest research and development deals (US$555 million) was recently struck between Curadev Pharma in India and Roche, forming a cancer immunotherapy alliance.

The sector is still in its early days overall. There have been only 10 exits between 2008 and 2015 with a total deal size of US$47.26 million; of these the top two were strategic sales, while the third largest deal was a secondary sale. Exits and deals in the healthcare and life sciences sector have generally been low.

Investment in early-stage healthcare companies with social impact appears to be growing. There have been 16 angel investment deals in the healthcare and life sciences space since 2008, with the maximum number of deals (4) in 2012. Many of the hospitals, clinics and even devices that are attracting such investment, however, are catering to lifestyle and chronic diseases, which tend to rise with incomes. Less investment has been going towards solutions for communicable diseases. This may be an indicator that such financially sustainable innovations in delivery models can only set their prices low enough to cater to lower middle class populations. Grants from foundations or Corporate Social Responsibility (CSR) are required to fund initiatives in communicable disease detection, prevention and treatment (i.e. significant funding towards tuberculosis through organisations such as the Gates Foundation or the WHO).

In terms of hotspots for such entrepreneurial activities, the traditional cities that have fostered their growth have been the National Capital Region (NCR), Mumbai, Pune, Hyderabad, Bengaluru and Chennai. However, these are likely to expand to Tier II cities like Bhubaneswar, Ahmedabad, Indore, Kochi, Mohali and Jaipur. The incubators in these cities are usually the IITs, IIMs and other regional institutes engaged in research and development. It remains to be seen where the healthcare and life sciences start-ups are likely to move to among these new options.
<table>
<thead>
<tr>
<th>Name of the company</th>
<th>What it does</th>
<th>Funder / Investor</th>
<th>Investment details</th>
<th>Investment made in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye Q</td>
<td>A speciality eye-care chain in Delhi and neighbouring states that is committed to high quality, affordable eye care</td>
<td>Song Investment Advisors, Helion and Nexus Venture Partners</td>
<td>US$1.6 million, US$7.2 million</td>
<td>May 2010, October 2011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helion and Nexus</td>
<td>US$4.5 million</td>
<td>January 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>International Finance Corporation; Nexus Venture Partners; Helion Venture Partners</td>
<td>US$9.7 million</td>
<td>February 2015</td>
</tr>
<tr>
<td>Nova Medical Centers</td>
<td>Day-care, Multi speciality surgical centers at affordable prices</td>
<td>GTI Capital Group</td>
<td>Capital injection of US$ 3.5Mn</td>
<td>2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing Investors</td>
<td>US$10.5 million</td>
<td>July 2014</td>
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<td></td>
<td></td>
<td>Apollo Hospitals acquire Nova Medical’s surgical unit</td>
<td>US$24 million</td>
<td>January 2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aavishkaar and Bamboo Finance</td>
<td>(Undisclosed)</td>
<td>October 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DaVita, Inc. acquires Nephrolife Care; NEA remains an investor</td>
<td>US$31.94 million (DaVita, Inc.’s total investment to date)</td>
<td>January 2015</td>
</tr>
<tr>
<td>One Breath</td>
<td>Low-cost, portable, mechanical ventilator</td>
<td>Incubated by Villgro in 2013</td>
<td>With initial seed capital</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventureast</td>
<td>US$ 3Mn</td>
<td>2014</td>
</tr>
<tr>
<td>Forus Health</td>
<td>Low-cost affordable medical technology and solutions business, 3nethra (ophthalmology solution)</td>
<td>Accel Partners and IDG Ventures India</td>
<td>With initial seed capital</td>
<td>2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asian Healthcare Fund, along with Accel Partners and IDG Ventures</td>
<td>US$3 million</td>
<td>2014</td>
</tr>
<tr>
<td>Name of the company</td>
<td>What it does</td>
<td>Funder / Investor</td>
<td>Investment details</td>
<td>Investment made in</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Perfint Healthcare</td>
<td>Medical equipment company</td>
<td>IDG Ventures India and Accel Partners (then Erasmic)</td>
<td>US$3.5 million</td>
<td>2007</td>
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<td></td>
<td></td>
<td>Norwest Venture Partners, along with IDG Ventures and Accel Partners</td>
<td>Series B US$7.2 million</td>
<td>July 2010</td>
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<td></td>
<td></td>
<td>Norwest Venture Partners</td>
<td>US$11.04 million</td>
<td>2012</td>
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<td></td>
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<td>Expected investment US$ 40-50 million,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>final amount not disclosed</td>
<td></td>
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<td>Biosense</td>
<td>Medical engineering and design firm developing diagnostics</td>
<td>Global Super Angels</td>
<td>US$150,000</td>
<td>March 2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GSF India and Insitor Fund</td>
<td>US$500,000</td>
<td>March 2013</td>
</tr>
<tr>
<td>Embrace</td>
<td>Provider of affordable healthcare devices — manufactures low-cost infant</td>
<td>Khosla Impact, Other participants: Biocon’s Kiran Mazumdar-Shaw, Manipal</td>
<td>(Unknown)</td>
<td>August 2013</td>
</tr>
<tr>
<td></td>
<td>warmers targeted at premature and low-birth-weight babies</td>
<td>Hospital’s Ranjan Pai and Zynga General Manager Steven Lurie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windmill Health</td>
<td>Creates low-cost technology innovations for healthcare sector – Neobreathe</td>
<td>Villgro Innovations Foundation</td>
<td>(Undisclosed amount)</td>
<td>May 2013</td>
</tr>
</tbody>
</table>
Corporate Venture Funding

Corporate venture funding is the investment of corporate funds into external start-ups. Companies tend to engage in this for two broad reasons: to identify and exploit synergies between the two companies, such as access to new markets, technologies, resources or distribution channels, or for financial returns. Corporate venture capital funds in health tend to be larger in pharmaceutical and biotech than other sectors. A survey by Global Corporate Venturing indicated that the top 75 corporate Venture Capitalists (VCs) in healthcare are more influential and larger than many independent VCs.

The practice of corporate venture funding is still nascent in India, but shows signs of emerging as a channel for innovative start-ups to go to market. Just three of the 75 most influential healthcare corporate VCs mentioned in the Global Corporate Venturing report were based in India: Ajay Piramal Group (India Venture Advisors, ₹4 bn), Dr. Reddy’s Labs (I-VenPharma, US$56 mn) and ZydusCadila. However, the overall practice of acquisition as a means for expansion and consolidation of intellectual property (IP) is starting to become more common across other sectors and the number of smaller start-ups with IP but without the infrastructure to go to market appears to be increasing. With big pharmaceutical companies stepping back from research and development for the discovery of new drugs, for example, start-ups like Bugworks and Vitas Pharma have filled this gap. Ajay Piramal’s Piramal Enterprises is in negotiations with Apollo Hospitals to acquire a majority stake in the healthcare software venture Health Super Hi-Way (where big data is applied to healthcare). Dr. Reddy’s Labs recently launched Somazina (a drug used to treat patients who have suffered from strokes) by partnering with Spain’s Ferrer International SA; Dr. Reddy’s is attempting to gain a foothold in the neurology segment. Cadila healthcare is preparing to acquire Claris Lifesciences Ltd. (a generic sterile injectables business); the injectables business is valued between ₹3100 crores and ₹3400 crores. Some of the other institutional investors and capital funds in biotechnology or biopharma include Axon Partners.
Repeated exits are seen as a necessary prerequisite to attract the interest of the venture capital community into the country’s biotech industry; also, VCs in the US are more likely to invest in new areas compared to their Indian counterparts, who prefer to invest in known and established areas. Two of the largest healthcare-only venture capital funds are GlaxoSmithKline’s SR One and Novartis’ Venture Fund; however, they have not made any investments in India yet.

Public Funding: Make in India

The current government has introduced the ‘Make in India’ campaign with the aim of turning India into a manufacturing hub and enabling the country to improve its innovation capabilities. The 2014 Budget significantly emphasised start-ups, entrepreneurship and innovation through initiatives including the allocation of ₹100 billion to promote start-ups focusing on delivery of products and services to small and medium-sized businesses, ₹2 billion to establish a technology centre network to promote innovation and entrepreneurship in agri-business, ₹1 billion for a rural entrepreneurship scheme, and ₹2 billion for developing young entrepreneurs from underprivileged backgrounds. The 2015 budget continued the support to entrepreneurs and small businesses with proposals for increasing access to finance through the Micro Units Development Refinance Agency (MUDRA) Bank as well as investment in training and various measures to improve the overall business environment.

Union Minister Ananth Kumar emphasised the government’s focus on medical devices as an important element of the Make in India campaign, noting that ‘Unfortunately we are an importing country as far as medical devices go, with our domestic industry accounting for 2% of the global industry which stands at US$250 billion. This is what we are aiming to change over the next five years under the leadership of Prime Minister Narendra Bhai Modi as we align with his vision to “Make in India”.’ There are plans to set up two research and development parks for medical devices in Gujarat and Tamil Nadu.

The policy and public investment support has the potential to reduce a number of gaps in the start-up and social enterprise ecosystems across the country. At the same time, however, there are challenges in implementing the budget effectively. For instance, it is unclear how to create the capacity to implement and run incubators and accelerators effectively across the country, and simultaneously build on local strengths.

Likewise, entrepreneurs often stress that existing financing schemes from the government are difficult to access, especially for young start-ups with limited assets, and that payment of subsidies, grants or loans is generally delayed, which can have a severe impact on a start-up.

Overview of Emerging Platforms

The landscape of early-stage funders in the form of incubators and accelerators is rapidly expanding in India, and creative platforms are beginning to emerge to promote and uncover entrepreneurial activity.

Organisations such as Stanford India Biodesign and Grand Challenges Canada (both discussed in more detail later in the chapter) are taking on the challenge of introducing companies at the blueprint stage. They are helping to define precisely where the needs are and giving entrepreneurs both the tools and the funding...
necessary to design for these challenges. There is room for similar organisations to enter the landscape, possibly through more academic and philanthropic partnerships, as grant funding is likely to be required at this stage.

Start-ups often make the mistake of trying to skip the validation stage altogether and go directly from blueprint to mass commercialisation. In doing so, they may find that their design or model is not quite what the market demands and have to go back to the drawing board after significant failures. By strengthening resources at the validation stage, start-ups are enabled to ‘fail quickly’ and enter the commercialisation stage with a more appropriate product. In the medical technology sector, validation is particularly crucial as product failures can have detrimental outcomes. Unfortunately, the lack of regulation in India means that there are few formal, established processes in place to offer rigorous product validation. Buyers look to their competitors, peers, global organisations such as the WHO or global product standards such as FDA approval (which is expensive and may not be necessary for Indian products at this stage) for validation. This limits the scope for start-ups to displace existing products. While start-ups are discovering their own creative ways to validate their product, there are opportunities for players to emerge to address this concern and help speed up product validation, particularly in the device sector.

At the market preparation stage, the challenges include distribution, customer awareness and changing customer behaviour and attitudes on the demand side, while improving capabilities of suppliers, designers and manufacturers, and promoting indigenous manufacturing on the supply side. Distribution of medical devices, for example, is highly fragmented. Established distributors are often unwilling to work with single product companies, and many new devices are being developed for low-resource settings that are not reached by distributors. In addition, many innovators are bringing down costs by developing low-margin, high-volume products, which distributors do not want to take up until it has been proven that minimum volumes are attainable.

Grand Challenges

‘Grand challenges’ aim to set out a specific problem and thereby focus research efforts and to capture the imagination of the world’s best researchers, inspiring them to come up with the solutions. Modelled on this idea, many public funding agencies and charitable organisations with a global presence have conceptualised grand challenge competitions to solve some of the pressing problems in global health.

The Grand Challenges India (GCI) programme was launched in New Delhi in March 2013 by the Department of Biotechnology (DBT), Ministry of Science and Technology of India, and the Bill & Melinda Gates Foundation with the Biotechnology Industry Research Assistance Council (BIRAC) as the implementing agency for the grand challenges framework. It encourages applications from Indian researchers or entities from academia, research institutions, medical institutions, for-profit companies and not-for-profit organisations. It also encourages partnerships with researchers in other countries where the opportunity exists to build on established collaborations.

Grand Challenges India has rolled out two successful initiatives already and has now announced a third. These comprise: Achieving Healthy Growth through Agriculture and Nutrition, a programme that seeks
to target the relationship between agriculture, nutrition and health in order to reduce the high incidence of low birthweight and early stunting and wasting among India infants; the Reinvent the Toilet Challenge, which seeks to improve processing of human waste and control environmental contamination more effectively by expanding the use of toilet and sanitation technologies that do not connect to a sewer; and third, All Children Thriving, a programme that seeks to ensure that all children are on a trajectory to live healthy, productive lives, and focuses on innovative tools and approaches that will drastically alter the public health landscape, improve maternal nutrition status, reduce low birthweight, child stunting and wasting, reduce micronutrient deficiencies, and improve cognitive development for children by piloting new approaches through a combination of interventions.

The Government of India Science and Engineering Research Board (Department of Science and Technology) and the Indo-US Science and Technology Forum have also ventured into health-related work with the India-US Grand Challenge on Affordable Blood Pressure Measurement Technologies for Low-Resource Settings to encourage collaborative research between and within both countries.

Another funder, Grand Challenges Canada, aims to support ‘Bold Ideas with Big Impact™’ in global health by funding innovators in low- and middle-income countries and Canada. The programme has funded 64 innovations in India, with a total investment of C$13.8 million since 2008. Previous grand challenge competition themes include: Stars in Global Health (strong emphasis on supporting social enterprises), Saving Lives at Birth, Saving Brains, Global Mental Health, Hypertension in Low- and Middle-Income Countries, and Point-of-Care Diagnostics. Grand Challenges Canada and the Department of Biotechnology, Government of India, signed a Programme of Cooperation in research and innovation in February 2014, and will jointly promote the development of long-term cooperation in the fields of global health, early child development, women and children’s health, and mental health between Canada and India.

The ICICI Knowledge Park (IKP) Grand Challenges Explorations (IKP-GCE) seeks to identify, fund and nurture revolutionary ideas that address global health challenges by encouraging entrepreneurship in India with the focus on creating drugs, vaccines, diagnostics, devices and delivery systems that will address health issues like malaria, HIV/AIDS, pneumonia, polio, enteric and diarrheal diseases, tuberculosis, maternal, neonatal and child health, nutrition, family planning, neglected and other infectious diseases.

This initiative is by IKP in partnership with the Bill & Melinda Gates Foundation. It will work closely with the chosen candidates, providing them technical and business strategy advice, access to synergistic networks within the nation and outside, factors that would be critical to making an innovation a medical and commercial success. Seed funding of US$100,000 is provided for a period of 18-24 months, and successful projects have the opportunity to apply for a follow-on grant of up to US$1 million from the Bill & Melinda Gates Foundation.

**Incubators**

Business incubators work hands-on with an entrepreneur or start-up to provide a range of support services to help a company grow. They typically are semi-long-term engagements (1-3 years) and may or may not provide funding support in the form of debt or equity. They often seek to work with companies...
that are developing novel products or have unique, untested business models. The stage of companies they work with often range from prototype development to the early stages of commercialisation. The types of support incubators offer include (but are not limited to) financial, fundraising, networks, lab facilities, media and recruiting. As incubators expand their networks and gain exposure to greater numbers of start-ups, the shared knowledge creates a pool of information that can be leveraged to help new incubatees navigate common start-up challenges more efficiently.

Villgro
Villgro Innovations Foundation is one of India's oldest and foremost social enterprise incubators, supporting innovators and social entrepreneurs during their early stages of growth. Since 2001, Villgro has incubated 103 such enterprises, generated around 4000 jobs, secured ₹873 million in follow-on funding, and touched over 6.8 million rural lives.

Healthstart
Launched in 2013, HealthStart is India's first accelerator programme dedicated to supporting start-ups, and it believes in ‘frugal innovation’ in the healthcare industry through funding, mentorship and other requisite support. Healthstart focuses primarily on digital healthcare companies, med-tech companies, wellness and disease management and those start-ups that improve access and affordability of healthcare services and products. They have two different funding approaches – incubation programmes and angels investment.

RTBI
Rural Technology and Business Incubator (RTBI) of IIT Madras incubates start-ups, which focus on creating an impact in rural and underserved societal segments. It was established in 2006. For the optimal delivery of healthcare services in India, RTBI collaborates with government bodies, healthcare institutions and private companies, all of whom work together towards a shared vision of sustainability and scalability.

SeedSurge
The eHealth Technology Business Incubator (TBI) programme, SeedSurge, provides a platform for budding entrepreneurs through wide-ranging services such as mentoring, seed funding, marketing and branding, IPR plugin, product design and prototype conceptualisation. SeedSurge is focused on applications of ICT in healthcare.

IKP Knowledge Park
IKP Knowledge Park, India’s premier science park, is facilitating business driven R&D for a decade and a half. It provides ready-to-use infrastructure such as modular wet laboratory blocks, along with shared facilities and support services. It has incubated or provided research grants to 150 companies over its lifetime, including Laurus Labs, GVK Bio and Sai Life Sciences.

Venture Centre
National Chemical Laboratories (NCL), a long-established and renowned laboratory of the Council for Scientific and Industrial Research (CSIR), India, is hosting a not-for-profit company entrepreneurship development centre under the trademark the Venture Centre. It is located in Pune, India (about 150 km from Mumbai).
It was started with the objective to foster technology and knowledge-based enterprise by leveraging the scientific and engineering capabilities of the institutions in the Pune region. The Venture Centre is an initiative of NCL under CSIR’s ‘scheme for setting up incubation centres in CSIR laboratories’. Among other sources of funding, it is supported by the National Science and Technology Entrepreneurship Development Board (NSTEDB) of the Department of Science and Technology (DST), Government of India. Focus areas of the Venture Centre include healthcare, specialty chemicals and nano-materials, and energy and environment.

HealthStart-DLabs
DLabs is a business incubator set up by the Indian School of Business (ISB). The ISB supports the activities of DLabs through its faculty and research expertise by providing mentorship and knowledge to the incubatees. In partnership with HealthStart, DLabs has started an acceleration programme focused on healthcare. Five start-ups have been selected from the first round of applications for the 20-week programme, which includes mentoring, extensive hands-on support and seed funding of ₹ 20 lakhs. Both HealthStart and ISB will leverage their academia and industry networks to make introductions to potential beta customers, partners and future investors, and also to recruit new talent. Focus areas include digital healthcare, diagnostics and devices, and general health.

Accelerators / Hackathons

Accelerators are shorter-term engagements than incubators, often offering services ranging from a weekend to one year. They tend to be structured programmes with a series of courses or assignments to help budding entrepreneurs design, develop and prototype more quickly. Many incubators host accelerator programmes to help build a strong pipeline for their incubator, where they get a chance to see how the entrepreneur thinks and gain more insights into whether they would be a good fit as an incubatee.

Hackathons are ‘super accelerators’ which are meant to bring together people from a variety of backgrounds, including design, engineering, medicine and business, to leverage their experiences and begin designing solutions over the course of a weekend with the advice of mentor investors and experienced entrepreneurs. For example, Glocal Healthcare, in collaboration with the Boston-based Consortium for Affordable Medical Technologies (CAMTech), MIT and Harvard Medical School, launched a ‘Jugaadathon’ in January 2014 in Kolkata. The Bengaluru Hackathon followed in July 2014 with over 200 participants, 70 mentors and 30 clinicians working together in teams to turn innovative ideas for improving reproductive, maternal, newborn and child health into realistic prototypes. The winner of the Hackathon, Babysteps, won a cash prize from CAMTech-USAID for developing a unique and integrated mobile application for early diagnosis of developmental delays in children across India; first and second runners-up were Pel-Dia (easy and early diagnosis of cephalopelvic disproportion in pregnancies after 37 weeks by any healthcare worker) and Pregmatic (a wearable device that reminds pregnant women in resource constrained settings about important milestones to receive critical care during pregnancy), respectively. Three overarching themes were provided to participants: emergency and critical care, maternal and child health, and mobile health, with nine specific contextual examples and problem statements from which participants chose one to develop.
Public Private Partnerships (PPP)

BIRAC was founded in 2010 out of the Department of Biotechnology as a non-profit company to ‘facilitate and mentor the generation and translation of innovative ideas into biotech products and services by the industry, promote academia-industry collaboration, forge international linkages, encourage techno-entrepreneurship and enable creation and sustainability of viable bio enterprises.’ Today, biotech in India is nascent, with a market size of US$5-7 billion, compared with Pfizer India’s budget of US$7 billion. BIRAC has funded over 40 companies, with a goal of funding 200 by the end of 2015. They have piloted several programmes to attract innovators, and see themselves as facilitators and ecosystem builders to bridge the gap across industry, government and non-profits, while forging partnerships with incubators for mentoring and guidance.

Projects have included the University Innovation Centre in partnership with Sam Pitroda, where they strategically decided not to work with India’s top universities, selecting regional institutes to provide fellowship opportunities, conferences and interactions with industry professionals to give exposure to the students. Another upcoming initiative is SPARSH through which they plan to blend social innovation with biotechnology. The programme is designed to run over the next 15 years, focusing on both product development and delivery. The concept is that participants will be accepted into an 18-24-month intensive programme, with support from incubation and mentor partners across India. Successful participants will receive ₹500,000 and incubation support following the programme. As opposed to accelerators and hackathons, which aim to achieve lofty goals in a short period of time, the SPARSH programme takes the view that up to two years of intense support is required for entrepreneurs to fully understand problems in the biotech industry and begin the design process.

Examples of PPPs include the Biotechnology Ignition Grant (BIG), a programme targeted at potential entrepreneurs from academia, start-ups or incubatees (researchers, PhDs, medical degree holders and biomedical engg. graduates). The programme supports promising early-stage high-risk ideas or concepts by providing mentorship and initial funding. Each awardee gets a grant of up to ₹ 5 million for a period of up to 18 months. The scheme aims to foster ideas with commercialisation potential, provide funding support for proof-of-concept validation and upscaling of ideas, and encourage researchers to take technology closer to the market through a start-up. BIRAC manages this scheme through five partners across India who provide mentoring and monitor progress of the innovators.

Another PPP, the Small Business Innovation Research Initiative (SBIRI), was launched in 2005 to boost public-private partnership efforts focused on innovation broadly in the area of biotechnology. The scheme aims to provide support for early-stage research by industry, support development of new indigenous technologies related to societal needs in healthcare, food and nutrition, agriculture and other related areas, and assist new enterprises in forming linkages with academia and government. It allows applications by industry either on its own or jointly with national R&D organisations. Funding support for the project of up to ₹ 5 million is provided by the scheme as grant-in-aid and the remainder is contributed by the industry. Funding support to the academic collaborator is in addition to the grant-in-aid given to the industry.

The Bio- Incubator Support Scheme (BISS) was initiated to strengthen and upgrade existing bio- incubators and establish new ones. The incubators provide the required space, support services ranging from equipment, mentorship, IP and technology management, and networking platforms to start-up companies for their initial growth. They facilitate interaction between industry and academia for translation of knowledge
from academia to industry. So far twelve existing incubators across the country have been strengthened under this scheme and approx. 70,000 square feet of incubation space has been created to support start-ups.

Academia

Creating a successful healthcare innovation requires knowledge and skills from very diverse disciplines such as medicine, science, engineering and technology, business, law and social sciences. Traditionally, training in these disciplines is provided by academia through degree programmes at undergraduate and graduate levels. Premier academic institutions in India in these disciplines are world-renowned: we have IITs, IIMs, AIIMS and PGIMER, TIFR, NLS, TISS, and so on (acronyms intentionally not expanded). Graduates of all these institutes are highly sought after in industry and academia all over the world. Apart from education and training, many of these premier institutes have also contributed significantly to R&D in the country, albeit in their own specialisation areas.

However, as we discussed earlier, innovation in healthcare requires a multi-disciplinary approach. University models in which many different departments, research centres, institutes, and even start-up companies are housed in the same campus, create multi-disciplinary ‘ecosystems’ that enable innovation through dialogue and close collaboration between students, researchers and academics from different disciplines. While geographic proximity can be seen as the reason for this natural enablement, the cross-fertilisation of ideas that happens from the most junior level of undergraduate students is equally important. The work culture of a multi-disciplinary approach is an integral part of education and training in this university model.

In the absence of such naturally developed university-based innovation ecosystems, India needs to focus on creating ecosystems by forming collaborations across different institute, including in the form of a collaborative platform with resources such as a skilled workforce, equipment, workspace and a network of experts shared between different collaborations.

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), declared as an institute of national importance by the Government of India in 1980, has played an important role in bringing medicine and technology together. The most well-known example of its contribution is an indigenously developed artificial heart valve. IIT Kharagpur, one of the leading technology institutes in India, started the School of Medical Science & Technology in 2001 with the objective ‘to provide a platform of interdisciplinary teaching and research in diverse areas of medical science and technology.’ The school runs a three-year interdisciplinary graduate-level programme in medical science and technology, one of a kind programme in the country, where MBBS doctors are trained in a technology institute. More recently, the Translational Health Science and Technology Institute (THSTI) was started by the Government of India to create biomedical innovations through translational research. THSTI houses many research centres in the areas of paediatric biology, vaccine and infectious diseases, bio-design and diagnostics, and drug development, among others. These centres undertake translational research in public health areas of national priority.

While the examples in the preceding paragraph show an approach of starting new academic institutes or starting new academic programmes in existing institutes, a new type of academic collaborative platform has started to emerge in the past few years which deviates markedly from the traditional academic models. These new platforms strategically focus on activities related to entrepreneurship and industry partnership from their inception.
Stanford India Biodesign (SIB) is a collaboration among the All India Institute of Medical Sciences (AIIMS), IIT Delhi and Stanford University which aims to identify brilliant engineers, doctors and scientists, and provide the appropriate experiential training for frugal innovation in healthcare for the Indian context. There are typically three to four fellows per year, and the programme starts with a six-month period at Stanford where fellows participate in Stanford’s biodesign curriculum and learn to identify unmet clinical needs. Fellows work in teams on this needs-finding exercise where they identify as many as 100 unmet needs, filtering them down to 10 or fewer with potential for high impact as well as strong market potential. They then begin to prototype ideas until they decide on a single concept to follow through with. The second six-month phase happens in the SIB Centre at AIIMS in Delhi, where fellows continue to develop and prototype their technologies while going through an intense immersion process in both urban and rural locales, shadowing doctors, nurses and staff, and deeply observing common practices.

Dr. Balram Bhargava, programme director and cardiologist at AIIMS, has identified this as one of the most important components of the programme. While the training at Stanford is important in order to learn design techniques and needs analysis, a programme that removes itself from the local context loses its applicability. Anirudh Chaturvedi, 2013 SIB fellow, who has created a company called Brun to develop a wearable foetal monitoring device, identified the mentoring relationships as an important programme component. At Stanford, fellows receive access to three core mentors once a week, in addition to industry experts, and even ‘team therapists’ who help them to navigate team dynamics. However, while the mentoring network at Stanford was strong, on returning to India he found that there were far fewer entrepreneurs in the medical device space and has largely relied on previous fellows for mentoring.

SIB is considering expanding the India component to give fellows even greater access to local mentoring and more immersion time. The second year of the fellowship is for further development, refining, testing and fundraising. Unlike other ecosystem players (funders, incubators, etc.), who tend to be more risk averse and focus on identifying strong concepts with market potential, the SIB programme uniquely starts with identifying the right talent and guides them towards development, even before the concept stage. This approach is certainly expensive, costing roughly US$200,000 per fellow, and it requires the right partners that can provide extensive amounts of knowledge and capacity building, but the success rates seem promising. For example, Mecmann Healthcare, a Delhi-based manufacturer of medical devices, has licensed three products from the 2012 and 2013 intern and fellow batches. Incubators and funders are starting to forge tight relationships with SIB as it is becoming recognised as a very strong pipeline.

Healthcare Technology Innovation Centre (HTIC) of IIT Madras is an R&D centre established through a joint initiative of IIT Madras and the DBT, Government of India. HTIC was started in 2011 with the vision ‘to develop technologies that create impact and drive innovation in healthcare, and be a leader known for technical excellence and collaborative spirit.’ Over the past few years HTIC has evolved into a unique and leading med-tech innovation ecosystem in the country, bringing together more than 20 medical institutions, industry and government agencies. Through highly dynamic collaborations with some of the leading organisations in the country, HTIC is developing affordable healthcare technologies for unmet clinical needs in areas of cardiovascular care, ultrasound, neonatology, oncology, intensive care, ophthalmology and diagnostics. Strong industry participation is one of the defining characteristics of HTIC. A wide range of industries, from large companies to early-stage start-ups, are partnering with HTIC to develop affordable
healthcare technologies. HTIC also undertakes capacity building activities to develop skilled human resources in healthcare technology in the country through various channels including innovation fellowships, IIT Madras students and interns.

Centre for Cellular and Molecular Platform (C-CAMP)\textsuperscript{[3]} is a Government of India initiative with the goal ‘to act as an enabler of successful bioscience research and entrepreneurship.’ C-CAMP provides support to academic and industrial scientific research in the country through services offered in the form of access to high-end platform technology facilities and expertise. As a partner in the national-level scheme started by the government, BIG, C-CAMP provides support to young innovators and entrepreneurs in taking their ideas to the next stage.

Located near IIT and AIIMS, Delhi’s Medtech Row is a strip of five to ten start-ups that have conveniently set up shop in the vicinity to take advantage of the relationships and expertise that can be gained from these institutions, as well as the nearby Bill & Melinda Gates Foundation and the Programme for Appropriate Technology in Health. By being in close proximity, a unique culture is being forged and more med-tech start-ups are beginning to flock there. In addition to the expertise from the neighbouring institutes, companies located here gain access to small batch manufacturing nearby. This model was largely influenced from the top down – the research institutes have encouraged a local ecosystem, and brought together like-minded individuals who are beginning to create a community and culture around India’s med-tech innovation.

Biosense Technologies, a medical diagnostics start-up in Mumbai, won second prize at the 2008 IIT Bombay Tech Fest for their non-invasive anaemia testing device. Since then, the company has stayed in close proximity to IIT Bombay and has proactively continued tapping into the human and lab resources offered. The relationship has largely been influenced from the bottom up, with the start-up relying heavily on the institute for its hiring needs. Rather than relying on the university to promote entrepreneurship, Biosense saw an opportunity to handpick and try out students through internships and projects before giving formal offers – this has worked out well for the company which has become highly reliant on IIT Bombay graduates for their hiring needs.

Through these new models, Indian academia has started responding to the evolving needs of innovation in healthcare.

What Lies Ahead?

India has become known as a global leader in ‘frugal innovation’,\textsuperscript{[34] with multinationals such as Unilever and GE adapting these techniques to produce low-margin, high-volume products that are adapted for the Indian context. The approach is being hailed across the world as a new wave of design thinking. MIT, Stanford and Santa Clara University in the US all have programmes, courses and labs in frugal engineering, and are primarily looking at India for inspiration. This is clearly an important moment for social entrepreneurs in India to work on the cutting edge of global innovation trends. We must also seize this moment to innovate for a rapidly evolving healthcare system.
Endnotes


6 Source of data for this section is ‘Venture Intelligence’.


9 A buyout in the for-profit start-up sector.


14 Global Corporate Venturing. (June 2010). ‘Most Influential Healthcare Corporate Venturing Divisions’.


Frugal innovation, broadly speaking, refers to the strategy of developing for constrained, low-resource settings and removing unnecessary product components in order to produce a basic, low-cost, no-frills, durable, easy to use product that simply solves a common problem.


The concept of the grand challenge was introduced over a century ago by a German mathematician, Dr. David Hilbert, who issued 23 challenges in mathematics and inspired a generation of mathematicians to devote their attention to these issues. Retrieved from http://www.grandchallenges.ca/grand-challenges/

Retrieved from http://www.birac.nic.in/index_cgi.php
Retrieved from http://www.birac.nic.in/index_cgi1.php
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Retrieved from http://www.dlabs.in/healthcare.html
Frugal innovation, broadly speaking, refers to the strategy of developing for constrained, low-resource settings and removing unnecessary product components in order to produce a basic, low-cost, no-frills, durable, easy to use product that simply solves a common problem.
Chapter 4: Critical Factors

Looking ahead, there are several developments that will be particularly important determinants of the shape of India’s health system. This is not a comprehensive analysis of everything that matters for the health system, but it is an attempt to pick out some of the most important factors that will influence the opportunities for social entrepreneurs to improve the health system for low-income India. In particular, we focus on developments that may allow opportunities for social impact to become openings for financially sustainable businesses as well. Changes in household health purchasing power, or greater awareness and demand for health as a service, for example, may create new opportunities for social enterprises. On the supply side, we look at changes in technology, regulation and economic geography that could enable new operational models and approaches to delivering affordable services.

We consider two groups of target customers: first, patients and potential patients; second, service providers and vendors along the healthcare value chain, including health advice and consulting, diagnostics and medication supply chains. Among these, state and national government and public health institutions are particularly significant potential customers for businesses seeking to reach low-income households.

As discussed in the introduction, the critical factors for opportunities for social entrepreneurs in low-cost healthcare have been distilled from a series of consultations with experts from government, regulatory bodies and industry associations, academia, the social sector and the private sector to understand what developments are ‘important’. We refined these through secondary research and the team’s analysis of primary data, and then further narrowed the set of ‘important factors’ to ‘critical factors’ for this report by focusing on developments where we could see significant change by 2021.

The human resource constraint, for example, is an important consideration and we discuss it in Chapter 2 in the overview of the context, but it is not a ‘critical’ factor in this chapter since it is unlikely to change substantially in the five to seven year time horizon. The potential set of adaptations to the human resource constraint will certainly evolve under pressure. Community health workers, for example, may be asked to step in to fill more gaps in medical care; or non-medical staff may be brought in to help manage non-communicable diseases and preventive efforts as a means of reducing the burden on trained medical responders. The fact of limited numbers of formally trained medical professionals will remain.

Similarly, the challenges of implementing good ideas and scaling up promising innovations are important, but they tend to be perennial in India and elsewhere in the world. The challenges of building and scaling institutions, in the broadest sense of norms, processes and rules, as well as organisations and policy, are likely to continue to be thorny issues well beyond the futures horizon for this report. Several of the critical factors may change the nature of implementation challenges and offer new possibilities for rapid increases in scale, but these will not be silver bullets.

Box 4.1 summarises the critical factors, which can be loosely grouped into three categories:

- Broad Context: urbanisation, demographics and economic growth;
- Data Liquidity: information generation, digitisation and the physical and institutional infrastructure for data interchange;
- Patient Agency: health literacy and health finance.
**Context** factors depend on broader economic, social and policy developments, in contrast to those that can be shaped more substantially by social enterprise activity. The trajectories for India’s demographics and urbanisation are relatively predictable, for example. While social entrepreneurs may shape the consequences of these developments for the health system, they are unlikely to affect the trends themselves. Similarly, the country’s economic growth path is an important aspect of the context for market-based models, but also largely exogenous to social enterprise activity.

**Data liquidity** often refers to the use of common terminology or standards that allow information to pass seamlessly across individuals, organisations and contexts. We use a broader definition here that encompasses the whole process of data creation, conversion to digital forms that can be shared across electronic networks, and the state of networks, as well as data governance that allows digital information to flow and integrate. We believe that this most accurately reflects the state of health information in India – where basic vital signs are not always measured, paper ledgers co-exist with fully digital health management information systems (HMIS), access to broadband remains limited, and the discussions about data standards are nascent.

**Patient Agency** refers to patients’ ability to identify, seek out and obtain the kinds of attention and care that they need. It is influenced by a variety of factors, ranging from the level of ability that the average citizen has to monitor their own health and diagnose illness to their ability to access care and attention from experts, as well as their ability to evaluate the quality of care that they receive and be a forceful voice in demanding better treatment. Patient agency is an important determinant of the opportunities to meet healthcare needs through market-based models since it contributes to the extent and location of addressable demand for health services.

### Box 4.1: Critical Factors

**Context**

- **Demographics**: India has a relatively young population along with large numbers of the elderly, a combination that opens up a number of potential avenues for social entrepreneurs. The younger population may have new attitudes, expectations, knowledge and capacities for engaging with the evolving health system. However, there is a large and growing need for ongoing care of chronic conditions and vulnerabilities associated with ageing.

- **Urbanisation**: India’s cities are growing, and urban-like population density is increasingly common even in rural areas. This has implications for both health risks as well as entrepreneurial opportunities that leverage economies of scale.

- **Economic Growth**: Most analysts project a growth acceleration over the coming years, but substantial economic risks remain. It is also not clear how much and where this growth will be geographically and socially concentrated. These spatial and social patterns of economic growth in India will affect the extent to which market-based models can deliver health services to households at the lower end of the income distribution.
Data Liquidity

- **Data creation**: Individuals’ vital signs, health status, risk exposure, interactions with the health system, social networks, and other information relevant for understanding well-being are increasingly measurable at declining costs. The value of information for the lowering costs and increasing efficacy of treatment is becoming clearer.

- **Digitization**: In what circumstances and at what scale can the information being generated about individuals and their interactions with the health system be converted into formats that can be shared over electronic networks? Digitisation is a bottleneck in the efforts to deliver improved care at lower cost; potentially one that can fuel businesses.

- **Infrastructure**: What will be the pace of expansion and improvement of India’s information pipelines? This contextual factor will impact the prospects for businesses relying on some form of disintermediation of medical services.

- **Data Interchange**: Analytics rely on scale. A combination of commercial incentives, state and national policy, and technology standards will affect the evolving prospects for integration of health information and value-added analytics.

Agency

- **Healthcare Finance**: Economic growth may determine the broad health budget, but the institutional arrangements for healthcare finance will affect who calls the shots. Will patients, insurers, lenders, the state or some other voice drive the demand side?

- **Health Literacy**: Health literacy, or patients’ ability to manage and improve their own health and navigate the health system to secure the care that they need, affects both the scale and nature of demand for healthcare. Information ranging from general education to specific results of diagnostic tests enables patients to advance from being recipients of healthcare to becoming informed and engaged participants. Increased health literacy also has the potential to drive a compliance and certification industry of businesses that meet consumers’ demand for authentication of the health services on offer.

It is clear that information matters for the health system at all levels: patient to doctor, financier to policymaker, public health prioritisation to private clinic tactics. How organisations can systematically collect, share and use that information is critical to patient agency and the improvement of health outcomes in the long run. The IT revolution is reshaping health systems around the world by enabling telemedicine, digital health and more widespread health literacy. Some observers have argued that these changes are nothing short of revolutionary – a process of ‘creative destruction’, according to Dr. Eric Topol, for example. While these developments are shaped by policy, they create a new playing field for entrepreneurs.
Box 4.2: Information & Medicine

According to WHO, telemedicine is ‘the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities.’

Digital medicine is healthcare built around a much more granular and personalised sense of the patient enabled by digital representation and the analytics that such representation allows.

Health literacy is patients’ capacities to be informed consumers of healthcare as well as stewards of their own health, among other changes.

These three aspects of information in medicine are intertwined: Telemedicine provides a ‘platform’ to overcome challenges of accessibility and availability of workforce; digital medicine organises evidence of patient treatments, outcomes and care so that patterns can be spotted; health literacy brings ‘awareness’ – participation and cooperation by the general population, without which it is not possible to improve care delivery. Each of these can contribute to more personalised, targeted medicine.

The evolution of patient agency also rests on a mix of policy and entrepreneurial influences. Public policy around healthcare finance as well as general economic growth will affect who is paying for healthcare. But social entrepreneurs can affect customers’ capacity, by building demand for improved quality of service and better value for money. Patients themselves are also potentially important contributors to the health system, through their own lifestyle choices as well as the proactive search for preventive care and contribution of information about their present health status.

Broad Context

Demographics

India is the second most populated country in the world. Over 1.21 billion people – or about a sixth of the global population – live within its borders as of 2011. With an approximate 1.4% annual rate of change in population during the period 2005-10, India’s population is projected to surpass that of China’s by 2025 to become the world’s largest. India’s proportion of younger people is also among the most sizeable worldwide, with just over 30% of the population in the 0-14 years age group, and more than 50% in the 0-25 years age group. In 2020, the average age of an Indian will be 29 years. At the same time, over 5.5% of people are above 65 years of age as of 2011 and this number is rising steadily. Life expectancy in 2011-15 is 68 years for women and 65 years for men.

India’s demographics have significant implications for health system requirements. India’s young population is often taken as a sign of a ‘demographic dividend’ for economic growth, but the productivity of this workforce depends on good health among other factors. That will mean addressing broad problems including a rising
incidence of non-communicable diseases and illness due to exposure to environmental risks such as indoor and outdoor air pollution or poor sanitation.

They also create opportunities for social impact. For example, as mentioned above, school-aged children will be an influential group, and health literacy interventions targeted at this demographic group could have far-reaching consequences for health markets in the future. Approximately 114 million children will pass through primary school, and another 114 million through secondary school every year between now and 2025. The social gains from ensuring that these students graduate with the skills to maintain their own health, seek out diagnostics and care, and become more informed consumers of health services are potentially enormous. While health literacy services are likely to remain an area for public sector or philanthropic models to pursue (though it is plausible that insurers, state health systems and others with substantial exposure to the costs of healthcare could become willing customers for interventions), greater awareness of the personal value of health services has the potential to open up new forms of demand for health services including preventive care and wellness.

Older people in the 50-70-year-old range will account for over 240 million people in 2025: a giant cadre of Indians still in the workforce, facing health concerns and wishing to stay healthier longer. Finally, 65 million Indians will be above 70 years old in 2025, and most will require ongoing healthcare. Social entrepreneurs can play an important role by addressing the specific needs of these different groups.
We outline a few opportunities that respond to these demographic shifts in the final chapter of the report.

(Source: United Nations, Department of Economic and Social Affairs, Population Division, Population Estimates and Projections Section)
Urbanisation

Urbanisation has two sets of implications for the health system. First, it affects the geography of illness in several ways. Cities are hotspots for air pollution and some forms of water pollution (though pesticide run-off and natural hazards such as arsenic occur in rural areas). They are also potential flash points for outbreaks of contagious diseases including transmission and scale of zoonotic varieties. Second, and importantly for health social entrepreneurs, it affects the areas where health providers are able to achieve economies of scale in treating broad health concerns as well as particular conditions. Urbanisation is also a focal point for infrastructure development, including telecommunications, electricity, transport, linkages, solid and liquid waste disposal, and drinking water access that can change the costs of establishing and operating all forms of health insurance.

India is urbanising, and two aspects of its pattern of urban growth are particularly relevant for looking ahead at opportunities for social entrepreneurs. First, much of the projected growth in India’s urban population is expected to take place in the smaller cities. Figures 3 and 4 show projections for urban and rural populations from the United Nations World Urbanization Projections 2014.\textsuperscript{10}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{urban_rural_population.png}
\caption{Urban and Rural Population, India}
\end{figure}

(Source: World Urbanisation Prospects (2014).)\textsuperscript{11}
Second, there appear to be substantial portions of the population that live in areas that are not officially designated as urban but are urban-like in terms of density and population size if not underlying infrastructure access. According to the official 2011 Census count, just over a third of India lives in cities, but as much as half of the population lives in officially rural areas with population density that many countries would consider urban. These urban-like rural areas may be sufficient to support market-based models that require economies of scale. Figure 5 compares the official figures for urbanisation with data on the extent of population living in urban-like conditions as of the 2001 Census (the most recent data for which it is possible to perform the density analysis).
Economic Growth

India’s macroeconomic trajectory will obviously shape the health system and prospects for market-based models. Each year’s budget allocation is fixed, but the projections and implicit future commitments for public health expenditure are in terms of percentage of GDP so that the actual amounts vary between growth scenarios of 5% and 9% annually. The second important question for social entrepreneurs is ‘where’? Where within India are incomes and the potential for health expenditure likely to increase?

Figure 6 summarises some of the public projections for India’s growth rate over the coming years.\textsuperscript{14} There are few available projections for the longer time period between now and the end of the decade. Industry estimates, such as the Dunn and Bradstreet (2011) India 2020, tend to cite optimistic estimates (9% in that report’s case) with many caveats.\textsuperscript{15} Growth projections have become more optimistic since the May 2014 elections, but the older projections cannot be discounted since these were based on the same infrastructure, social and economic context other than political leadership.

Credible sub-national growth projections are not currently available, but some researchers have attempted to identify emerging ‘hot spots’ for economic activity. McKinsey’s report on ‘India’s Economic Geography by 2025’, for example, identified eight high-performing states that will account for a little more than 50\% of the incremental GDP between 2012 and 2025. The same report also pinpoints 49 clusters\textsuperscript{16} that will provide access to 77\% of the incremental GDP during the same period.\textsuperscript{17} The report states that there will be 15 more metropolitan cities by 2025 and India is also likely to be 38\% urbanised (according to the official definition) by 2025.

Data Liquidity

The various aspects of data liquidity for India’s health system are intertwined: devices and protocols for diagnosing illness and measuring health status can produce information that is useful for immediate decision-
making, but the impact of this information on system learning depends on whether it can be aggregated and analysed. Aggregation and analytics require digitisation at a minimum, and some kind of standards for interchange to be effective. ‘Digitisation’ takes place in an increasing variety of ways, from the obvious digitisation of patient health records and digital capture of patient interactions with healthcare providers, to more subtle changes that allow information generated from diagnoses to be captured and shared beyond the moment of measurement.

These pieces of digital information may or may not ever come together with contextual information such as feeds from air or water quality sensors, or social networks, to form a unified dataset for analysis. If incorporated into such a dataset, they may never become widely accessible. The potential to aggregate and share information – and to offer these kinds of services to low-cost healthcare providers – depends on the IT infrastructure as well as the industry, legal, policy and other support for data interchange.

The data pipelines are usually taken for granted in much of the literature on the future of medicine, but this cannot be assumed in India, particularly in remote areas. The distribution of access to broadband or reasonably fast data streams is also likely to play an important role in the relative health literacy of the formal healthcare system and patients and communities – will high-speed data be available in remote rural areas at all in the next five years? And if so, will it be confined to particular ‘centres’ or will people be able to access it from their homes or mobile devices at their convenience? Emerging technologies offer the potential for rapid expansion of access to information, but seizing this potential will also require regulatory and policy change.

The current decentralisation of health and health-relevant information is a natural consequence of the ‘each to his own’ regime of data collection that prevailed in the early days of integrating IT into health systems and data management, but it is also maintained in part by strategic interest in controlling the basis for valuable insights. Potentially important databases already exist. Pharmaceutical company representatives, for example, accumulate spatially referenced data on illness and morbidity as part of their work, and the state and natural insurance programmes discussed later in the report also have records that could provide insights into the burden of disease, treatment patterns and efficacy, and other information useful for the health system and entrepreneurs within it.

The question is how and whether these datasets will start to move towards a level of interoperability that enables deeper market insight and healthcare planning but also poses new risks to privacy as well as inclusion. What perspective will start to create pressure to erode the boundaries: Population-level analytics driven by providers or financiers? Or patient-centric efforts to understand genetic, environment or other health risks and different outcomes for individuals who are aware of options and seeking the best care? And how will India’s policymakers, health system professionals and population manage the risks that such insights pose?

Data Generation

Health information comprises a broad set, ranging from person-level data such as health status, symptoms, body functions or genetic profiles; transactional records of patient interactions with the health system; and quantification of the context in which people exist – ambient air quality or water quality, for example. Each of these pieces of information is a potential contribution to the kinds of maps of system-level and individual health needs and health dynamics for a given area.
Diagnostics, a broad term used to describe information about particular individuals’ vital functions and health status, are important information for a range of decisions in the health system: collaboration in treatment between local workers and specialists who can now understand more about the patient faster; sorting of patients to leverage expert resources more efficiently; and faster and more precise responses to vague symptoms, including early responses to potentially life-threatening conditions – many of these diseases can be prevented or controlled effectively if detected in time, and the additional economic burden on the health system could be averted. It is no surprise that many prominent impact investors and social entrepreneurs are focusing on innovations that enable healthcare providers to detect medical conditions earlier, more accurately and at lower cost. Diagnostics are also a necessary (but not sufficient) contributor to larger-scale datasets that can shed greater insight into disease burden, treatment effectiveness and other information for public health planning.

The individual-specific information flow coming in through diagnostics is undergoing two shifts that are likely to influence the nature and scope of information becoming available for health system entrepreneurs to work with for these and other business models.

First, there appears to be a general shift towards more competition and new entrants into the diagnostics industry. In recent times, India has seen the emergence of large laboratory chains, especially in metropolitan cities and urban areas. Pre-emptive checks have become more common with higher availability of information related to healthcare and increasing awareness about disease conditions and well-being. Many laboratory chains and hospitals, particularly in urban areas, have started offering annual health check-up packages, with growing numbers of subscribers and lower entry prices.

Most industry reports predict double-digit growth for the diagnostic services market in India, although much of this growth is based on predicted demand from the middle class and wealthier patients. Although only about 10% of the laboratories were organised and had proper accreditation in 2013, a landscape study by PATH projected that this share would triple by 2015 and grow to 50% in the next 10 years.¹⁸ As of April 2015, there were 1335 accredited testing laboratories, 581 accredited medical testing laboratories and 486 accredited calibration laboratories¹⁹ among an estimated 100,000+ diagnostics labs of varying sizes (estimate from PATH, 2013).

The anticipated shift into organised diagnostics laboratories is expected to be driven by increasing government oversight, industry consolidation as small laboratories become franchisees of the larger ones, and an increased formal market as national insurance schemes are expected to expand and to have a provision for reimbursing for diagnostic tests provided by private laboratories. Apart from conventional sources of income, some laboratories also generate revenues by managing laboratories for hospitals, undertaking clinical trials, and conducting preventive health check-ups for corporate clients.

Most of the big laboratory chains currently follow the ‘hub-and-spoke’ model, where resource intensive activities are undertaken at a small number of reference labs with comprehensive diagnostic capabilities (hubs), and activities such as sample collection and basic laboratory services are undertaken at peripheral laboratories or collection centres (spokes). Hubs are usually located in metropolitan cities. They are equipped with automated high-throughput machines with built-in quality control functions. In this way, the big laboratory chains capture economies of scale. However, this high-end equipment requires large capital investment. Over the years, the ‘printer and cartridge’
approach, wherein the diagnostic equipment manufacturer rents out the equipment (the printer) for three to five years and recovers the cost by charging for consumables (cartridges), has become more common. Laboratories then do not need to invest large amounts up front, but can still offer the latest tests to their customers. Further evolution of business models is inevitable. The last chapter of this report discusses potential opportunities for social entrepreneurs as the diagnostics industry moves into serving more remote areas and lower-income groups.

Second, there is a concerted effort to develop new ‘point-of-care’ diagnostic devices that integrate with health delivery practices to provide rapid, actionable, point-of-care information. (Box 4.3)

**Box 4.3: Point-of-Care Testing**

Point-of-care (POC) testing involves conducting screening or diagnostic tests outside the conventional laboratory setting. In certain types of POC testing, called rapid testing, outcomes of the test could even be known in a short period of time, say half an hour, instead of waiting for hours or days. Well-known examples of POC testing include kits for glucose monitoring and pregnancy indication. In countries like India, where the burden of infectious diseases is still significant, kits for infectious diseases such as HIV, malaria and dengue are being used. There is active research going on all over the world to detect markers through POC tests for chronic diseases such as cancer and cardiovascular diseases. Another important area of interest is to detect markers through POC tests in urine and faeces samples, as these samples are relatively easy to obtain compared to blood samples, and self-collection is possible. As screening and early detection becomes important in the resource constrained setting of India, we will need to undertake R&D in designing our own POC tests that meet the constraints and challenges posed such as affordability and non-expert operability without sacrificing quality.

POC testing that can be done in homes and community centres in addition to clinics, labs and hospitals could have a truly transformative effect on the delivery of healthcare in low- and middle-income countries. Having a point-of-care test that can be used at home by non-experts, for example, can facilitate better monitoring and management of disease conditions. Self-administered tests offer greater privacy and confidentiality, for example, attributes that are especially valuable for diseases that carry any form of stigma. Even if complete point-of-care testing is not feasible due to non-availability of an appropriate test, samples could be self-collected at home and then taken to the nearest place where testing of the sample could be done. Self-collected vaginal HPV-DNA tests for screening cervical cancer are an example of this, where those women who are not willing to undergo the screening test in a community setting due to cultural barriers may choose to self-collect samples in home settings.

In community settings, minimally trained health workers often undertake the task of screening, early detection and prevention. Tests that do not require skilled human resources and are not infrastructure intensive can increase the efficacy of this type of outreach. Rapid diagnostic tests for communicable diseases such as HIV/AIDS, malaria and dengue are examples of POC tests, which can be undertaken in a community setting. POC tests for communicable diseases are especially useful when there are sudden outbreaks of a disease. POC testing has also been used in screening camps for non-communicable diseases such as diabetes, hypertension and cancer. Technologies that allow non-experts to perform any part of the testing cycle more reliably, from sample collection to transport, can be beneficial for effective healthcare delivery.
Screening and prevention in rural areas has traditionally been carried out through camps, with referrals for separate treatment. In these settings, low-cost diagnostics are being used to increase the volumes and accuracy of screening by sorting cases that require specialist attention. (Box 4.4)

Box 4.4: Diagnostics for Leveraging Expertise

Forus Health, a Bangalore-based company, has developed an affordable and portable, easy to use, camera for examining the eye fundus (the interior lining of the retina). This eye fundus camera can be used to detect five major causes of preventable blindness. Eye images taken by non-experts using this camera could be sent from remote locations to secondary or tertiary care centres to perform screening for eye diseases remotely, and only those who require immediate attention could be referred to the eye specialist.

Similarly, the Tamil Nadu Health Systems Project (TNHSP) runs a cervical cancer screening programme, where trained female doctors and paramedics perform a screening test known as visual inspection with acetic acid (VIA) at primary health centres. No specific device is used for this – the only equipment required is an adequate light source, and some degree of magnification can increase accuracy. Only test positive women are triaged for the more resource intensive colposcopy examination, which is performed by a gynaecology specialist.

Technologies designed with the intended application as POC testing can also be useful for clinics, peripheral laboratories, hospital OPDs, or even in main laboratories in low- and middle-income countries with limited infrastructure. For example, test platforms with molecular diagnostics capabilities may offer POC testing, but due to cost and infrastructure constraints, they may be more appropriate in clinics, hospital OPDs or laboratories. The Xpert MTB/RIF test, for example, is a cartridge-based test that can detect TB and its multidrug-resistant form in less than two hours. This technology can potentially be used in sub-district-level clinics and laboratories, reducing delays in diagnosis that lead to misdiagnosis and complicate follow-up with patients. The careHPV test that enables detection of HPV-DNA for screening of cervical cancer at the point of care is another test that could be useful at home as well as in laboratories and hospital OPDs.

The ability to test quickly at the point of care or in easily accessible community settings may also help convince people to take the first step in medical care. It is not always easy to convince the general population to participate in screening programmes when they do not see any symptoms of disease, particularly when participation in these camps requires cost and effort. There is a very ‘small window of opportunity’ between the subject showing willingness to undergo the screening test, conducting the test, and convincing the test positive subjects to follow up for further confirmatory diagnostic tests or treatment. Missing this window of opportunity means the subject is lost to the follow-up, thereby rendering the whole effort of screening and early detection futile. In this context, point-of-care testing is an increasingly important element for both market-based models as well as public health goals. It is also a major business opportunity for entrepreneurs and more established businesses alike.

While the level of investment in technologies and tests demonstrates the extent of enthusiasm and hope around new technologies for POC diagnostics, a note of caution is in order. It is not the technology per se, but the successful use of it and the response to the information that will decide the effectiveness of the diagnostic test and health benefits delivered by it. Therefore, downstream factors to integrate the test within the health system, such
as financing, pricing, alignment of incentives for various stakeholders, training of personnel, data communication and a business model for scale-up, must be kept in mind at the time of innovation. The best POC technology without a good business model is likely to face barriers for uptake and adoption by the health system.

Other supporting technologies such as those for information transfer and communication can greatly facilitate integration of POC diagnostics within the health system. For example, growing coverage of mobile telephone networks and expansion of mobile phone subscriber bases can enable telephonic reporting and counselling after diagnosis, data transfer, quality assurance, proficiency testing and decision support for minimally trained health workers. Creating solutions and services that can facilitate these tasks can provide further business opportunities.

Technology and devices for health monitoring in non-clinical settings are also potentially important new sources of information. These were primarily driven by the needs in the sports and fitness space. The focus was on creating wearable devices that can be used during exercise, fitness training and in routine life. While technology components for connectivity, display and computing were often borrowed from the rapidly developing consumer electronics market, shortcomings in core sensing technology and practical constraints limited the capability of devices to a minimal set of clinically relevant parameters such as heart rate, body temperature and breathing rate.

These technologies further evolved into devices for use in home monitoring and wellness that offer value added services by leveraging connectivity options provided by a smartphone/tablet device, along with support for data storage and analytics via an online server system. The limitations of the core sensing technology in capturing clinically relevant parameters were alleviated by supplementing devices with motion sensing technologies, using accelerometers to offer additional parameters such as activity monitoring, and sleep cycle detection. While most of these devices are not yet available for purchase in India, there is increased awareness and interest towards these technologies, albeit mostly among people in the socio-economic upper strata of the population. The ability of performing continuous monitoring and logging of vitals offers the promise of long-term health records, while the minimally obtrusive nature of measurement offers the possibility of using such technology for screening, triaging and primary diagnosis.

Measurements of the environmental conditions that affect health are also becoming more common, cheaper and easier to use in clinical and non-clinical settings. Governments around the world have committed to invest in more detailed, higher-resolution air and water quality monitoring as both have become more salient political issues as well as obvious contributors to ill health. Even though air quality data is notoriously poor in most Indian cities, the System of Air Quality Forecasting and Research (SAFAR) initiative under the Ministry of Earth Sciences, for example, has established high-resolution air quality monitoring systems in Delhi and Pune, and similar networks are underway in Mumbai, Chennai, Kolkata and Ahmedabad. The Water Quality Assessment Authority was established in 2001 under the Ministry of Water Resources, and protocols for measurement were established in 2005. The Ministry of Urban Development also established service-level benchmarks for water quality.

The costs of measuring air and water quality have fallen over time and private initiatives have started to complement and challenge public data around the world. The costs and accuracy of personal monitors for ozone precursors as well as fine particulate matter have dropped to the point of being affordable for individuals in higher-income countries and civil society organisations elsewhere. The WaterCanary, a relatively low-cost water testing device (about US$100) also allows people to transmit their findings. Similarly, mWater is a mobile application that enables communities to survey and monitor local water quality. Information can be updated and shared with others
online. It seems reasonable to expect the level of information about health risk factors to improve over the coming years, opening new opportunities for enterprises that assess, manage and warn against risks as part of their services.

**Digitization**

‘Digitisation’ comprises both mechanical and human processes. On the one hand, an increasing number of diagnostic or health measurement devices may generate, store and transmit information in digital form as part of the measurement process. On the other hand, digitisation of existing paper records – doctors’ notes, hospital archives, logs of screening camps – is part of an organisational process and is aided by technology. These activities may take place in distinct settings, enabled by particular technology advances, and motivated by particular models of profit or organisational goals, but they are all avenues for converting streams of information into a form that can both enable new kinds of medical practice as well as create new risks for healthcare providers, patients and businesses.

The impact of information on the health system depends on various factors. First, is the information captured as part of a closed, defined system or a more open-ended resource? In the case of the closed loop (Figure 7), digital capture may be ephemeral – a flash on a screen or a coloured light, designed to be seen by the patient and the healthcare worker at that point in time, to inform a specific decision. The momentary existence of the data may be by design – to protect privacy or conserve resources in low-cost devices, for example – or it could simply mean that nobody has thought about the value of the information. This information is useful for a known case, but requires additional investment to create more options such as through richer personal health records or multi-patient datasets that could inform clinical practice, business models or public understanding of health dynamics.

In the second, more open-ended case (Figure 8), the technology would be designed to store and share information across time, place, organisations or individuals in some format. Channels that enable information capture – a link to a database onsite or in the cloud, the capacity to transmit information, protocols for storing the information – would exist. The channels may or may not allow the flexibility to integrate these data streams with others.
Second, the influence of new information on health system outcomes over the coming years depends on the evolution of the market for health data. The development of a clear market for information will pull information from the ‘closed loop’ regimes of episodic communication between patients and healthcare providers into datasets and information resources that guide strategy, practice and innovation. This is already happening to some extent as an increasing number of diagnostic devices explicitly involve digitisation and transmission of information, generally with an eye to specific use cases that require coordination over longer distances based on shared information.

Moves from closed to open loop information flow are significantly aided by the increasing range of data services along with the dropping costs of smartphones in the Indian market. Global majors LG, Samsung and Motorola as well as start-ups such as Obi and local companies such as Lava are all launching models in the ₹5000–8000 range this year and competition is likely to drive costs even lower. Mobile Internet usage has driven Indian Internet usage in recent times.\textsuperscript{30} Smartphones outsell personal computers and have more computing power than NASA did when it put man on the moon in 1969; they offer greater connectivity and by being digital census takers offer more real-time information than ever before.\textsuperscript{31} With digital information increasing tenfold every five years, quantity of data is growing at a rate that is faster than the ability of the network to carry it.\textsuperscript{32} Cisco estimated that India is likely to have 348 million Internet users and Internet traffic of 2.5 exabytes\textsuperscript{33} per month by 2017.\textsuperscript{34} Apart from mobile phones, tablets have also taken the market by storm. Boxes 4.5 and 4.6 discuss several examples of diagnostics designed for digitisation and transmission of information – potential signals of more to come.
Swasthya Slate, developed by the Public Health Foundation of India (PHFI), can perform 33 diagnostics tests. The Slate is a portable device that allows Android-based tablets and cell phones to carry out wide-ranging tests such as blood pressure, sugar, ECG, body temperature, water quality, foetal Doppler, routine blood grouping and typing, rapid pregnancy tests and malaria checks. The test results can be digitally captured and transferred to the data cloud via an Internet connection. Doctors and public health officials can access both individual tests and aggregated tests results, remotely. The Slate can enable front-line health workers and doctors to provide screening and remote diagnosis in PHCs and CHCs. It also has the potential to simplify referrals, follow-ups and reporting.

The Health Management and Research Institute (HMRI) based in Hyderabad, India leverages cutting-edge information and communication technologies to cut costs to deliver affordable and accessible healthcare to all segments of the population, especially the most vulnerable. HMRI designed Dox-in-Box technology specifically for remote areas to digitally capture, store and transmit eight vital signs. HMRI uses this technology for its diabetes management programme in Assam.

These kinds of data are also potentially helpful to develop a broader understanding of the health system – and as discussed below, health financiers may be eager customers for such information. The market for data, however, will also raise new risks and demand safeguards against use of the information for discrimination, violation of privacy and other damaging applications. Careful management of these risks will be essential to prevent a backlash against information collection.

Third, the impact of information on the health system will depend on the pattern of digitisation and development of standards for medical information. Digitisation of transactional data, the interactions of individuals with the healthcare system, is currently happening in a piecemeal fashion. On the one hand, some of India’s private hospitals catering to higher-income and international clientele have award-winning health management information systems and processes for managing patient histories. On the other hand, field screening camps, some public health clinics and private primary care providers still rely on paper logbooks with perhaps much-delayed recording of these data into some form of dataset that may or may not include patient identifiers that allow for the construction of patient histories or the return of profiles to patients themselves. In the middle, hospitals drowning under the weight of paper records kept for compliance are literally scanning files to save space. The resulting databases of images of handwritten notes record patient histories for posterity, but cannot be used for large-scale analysis without extensive further processing.

We were unable to quantify the relative prevalence of these three settings in the healthcare system that is accessible to low-income India. However, there is clearly a move towards greater digitisation of transactional data that is linked to the move to increase public spending on health and public support for insurance
programmes. The National Health Mission is currently the largest single implementation of an open-source health information system in India, involving hundreds of thousands of health workers serving hundreds of millions of patients.\textsuperscript{37} Several state insurance schemes have also moved to digital patient records, a move that could drive similar change among private providers if empanelled as service providers. (Boxes 4.7-4.11)

**Box 4.7: Tamil Nadu\textsuperscript{38}**

Funded by the State Government of Tamil Nadu and the World Bank, the Health Management Information Systems (HMIS) began in 2005 with the initial period being 2005-10, later extended to 2013. It aims to improve data collection, availability and standardisation in order to save time and validate improvements in health outcomes for the poor. The services that are computerised are: online registration of outpatients and inpatients; doctors’ services for outpatients including diagnosis, prescriptions and lab requests entered online (real time); reporting of the lab test results online; online indents and issues (for drugs); online ward transfers; linen, diet and biomedical waste management-related transactions; and online day end/periodic report generation, saving significant time for end users in collation and consolidation of data and discharge summary. The final disease diagnosis is mapped to the International Classification of Diseases. Online access is provided to all end users/primary data entry owners to input data directly into the online system with no data entry support.

In 2012, the Chief Minister’s Comprehensive Health Insurance Scheme was launched to provide free medical and surgical treatment in government and private hospitals to the members of any family whose annual family income is less than ₹ 72,000 (as certified by the Village Administrative Officers). Carrying of smart cards became mandatory under this scheme in 2013. New Health Insurance identity cards with biometrics are being issued to all members who held smart cards under the earlier scheme. The earlier smart (Health) cards remain valid until the new cards are issued. For others, fresh cards were issued. This provision has been made to reduce time delays in treatment and to streamline the process of disbursing claims.

The TNHSP has also rolled out the HMIS in all government medical colleges and one dental college in the state to provide college, hospital and management information systems, along with university automation systems.\textsuperscript{39}

**Box 4.8: Orissa\textsuperscript{40}**

The All India Institute of Medical Sciences, Bhubaneswar, decided to launch an electronic health card in February 2014. The call for tenders includes provisions similar to that of the Tamil Nadu HMIS. The proposed card will store individual patient records from registration, primary consultation, diagnosis, pathological and other diagnostic tests, and medicines prescribed during every visit to the hospital. Since the first phase is starting off with students and faculty members of AIIMS-B suffering from chronic illness, the tender has also included a separate provision for AIIMS-B students and staff. The next phase is to make these smart cards available to the general public. It is also planned to make the smart card part of the integrated hospital information management system network being implemented across the six new AIIMS in the country. This would enable seamless consultation and treatment of patients between the institutions.
The Karnataka State Health System Resource Centre project was created under the National Health Rural Mission which was in charge of developing the HMIS in Karnataka. As of 2013 the HMIS was still in the development phase. The main objective of the programme was to integrate all the other national health programmes. Besides this, the Karnataka Government implements the Rashtriya Swasthya Bima Yojana (RSBY) which provides health insurance cover for the population living below the poverty line. The plan is to provide cashless insurance cover up to ₹30,000 per year for hospitalisation by paying ₹30 per month. Medicines and tests which are not related or do not lead to hospitalisation need to be paid by the beneficiary. This programme issued smart cards with up to 32 Kb space and in 2012 this was increased to 64 Kb. The smart cards were issued to enable the beneficiaries to get cashless health insurance benefits across the country. The issue of smart cards was done to maintain a record of the beneficiary’s health information. As of July 2012, 17.5 lakh residents have been provided with smart cards in the state of Karnataka. The card memory was increased to make it into a multi-purpose card, allowing it to be used for housing, life and disability cover, and public distribution systems.

Apart from the three states in the text boxes, some of the other Indian states are also moving towards electronic health cards. For instance, in the latest budget, the Government of Kerala has promised to provide smart health cards to BPL families so that they can avail healthcare facilities in private and government hospitals.

The Government of Andhra Pradesh implemented the RAS, a community health insurance scheme, in 2007 to provide financial protection to families living below the poverty line. This covers serious ailments requiring hospitalisation, surgery and therapy, providing the necessary medical support through an identified network of healthcare providers. Beneficiaries of the scheme, members of BPL, are listed in their BPL Ration Card and the Civil Supplies Department Database and can avail of a total reimbursement of ₹150,000 (along with an additional ₹50,000 as a buffer) on a floater basis. All transactions are cashless, and the BPL beneficiaries can visit the hospital for any medical procedure covered under the scheme without having to make any payment. High-end treatments like hip and knee replacements, cardiac and liver transplantations, etc. are not covered by the scheme, while some others like TB, HIV/AIDS and other infectious diseases are covered by national schemes.

To operate the scheme in a professional and cost-effective manner, private public partnerships have been promoted between insurance companies, private enterprises and state agencies. Aaraogyasri Healthcare Trusts have been set up for coordination with state health departments and other government personnel. However, the scheme has faced criticism because of its focus on catastrophic illnesses, ignoring other health problems like fever and gastrointestinal problems. Also, corporate hospitals, which tended to handle the biggest share of these cases, did not cater to outpatients for everyday illnesses, failing to reduce the financial burden of illness on BPL families. A recent study further highlighted that despite universal access to the scheme, uptake of surgeries was still quite poor as the scheme does not cover the procedures to be undertaken prior to surgery; the report suggests that scaling up of surgery should be viewed as a cost-effective investment as the costs of inaction are higher.
Box 4.11: Rashtriya Swasthya Bima Yojna (RSBY)

RSBY is a national health insurance programme launched by the Ministry of Labour and Employment in 2008 (eventually transferred to the Ministry of Health and Family Welfare in 2015) with the objective of protecting BPL families from financial shocks (that accompany hospitalisation) through an empanelment of private and public hospitals. The majority of the financing for the scheme (75%) comes from the Central Government and the remainder is borne by the respective state governments (except the North Eastern States and J&K where the Central Government bears 90% of the financing). BPL families are identified and enrolled based on definitions and figures provided by the Union Planning Commission, with ultimate responsibility for the list lying with the respective state governments. Using the RSBY smart card, a beneficiary will be able to utilise healthcare services across any of the empanelled hospitals, thereby making transactions cashless. Those opting for the scheme can claim hospitalisation expenses up to ₹30,000 for ailments covered under this scheme. Treatment for mental disorders is not covered.

In 2011, World Bank and the United Nations hailed the RSBY as one of the best health insurance schemes in the world.

As of April 2014, 479 districts with over 37 million BPL families have been covered across 29 Indian states under the RSBY; 10,311 hospitals (private and public) have been empanelled under the scheme. West Bengal is the Indian state with the highest number of RSBY smart card holders.

For the financial year, 2015-16, state governments have not renewed contracts with insurers or issued new tenders, and the Central Government has not taken any decision on extending the implementation of the scheme. It is likely that the scheme will be managed by a trust involving only public sector insurers.

Fiscal constraints and the popular wave for ‘good governance’ could both accelerate digitisation efforts given the prevalence of public funding for the healthcare system. Full conversion of health provider information into open or even analysable data formats is a powerful weapon against fraudulent claims, and the production of this useful information is a potential service for social entrepreneurs to provide.

In any case, these data are one step closer towards forming a basis for analytics that could find a market among healthcare providers and insurers as well as the programmes that currently mandate digitisation. Whether the data become widely available for integration, analysis and real-time decision support in clinical practice depends on the physical and institutional infrastructures that we discuss in the following sections.

IT Infrastructure: How Far, How Fast, and How Cheaply?

Health system change can move faster than general infrastructure. Telemedicine practice, for example, started gaining roots in India relatively late, in the late 1990s and early 2000s, before any general-purpose physical infrastructure for data transmission was available. The Indian Space Research Organisation (ISRO) started building a satellite-based telemedicine network through the Indian Satellite System (INSAT) in 2001 under the GRAMSAT (rural satellite) programme. What started as a pilot project continues to expand and now includes 382 hospitals with the telemedicine facility, 306 district hospitals and rural health centres, and 16 mobile telemedicine units connected to 60 super-specialty hospitals located in the major cities.
However, the main growth in telemedicine rests on expansion of telecommunication facilities available to the general population. These have grown rapidly over the last decade, due to the arrival of mobile phone technology, participation of the private sector in creating and delivering telecommunication services to a larger segment of the population, and favourable government policies. The number of telecom subscribers has increased more than tenfold in a decade, between 2004 and 2014.

Figure 9
Growth in Telecom Subscribers/Connections 2004-2014

(Source: Performance Indicators Report – Telecom Regulatory Authority of India.)

The total number of Internet subscriptions stands at 254.4 million, of which only 18.7 million are wired subscriptions. Teledensity is also higher for urban areas compared to rural areas.

Figure 10
Teledensity for Urban and Rural Areas

(Source: Performance Indicators Report – Telecom Regulatory Authority of India.)
While the number of connections has grown at a high rate, one should be aware that this may not lead to the transaction of high amounts of information; for example, while there were 254.4 million internet connections in September 2014, only 75.73 million were broadband connections which could transfer higher amounts of data over the connection. Also, the definition of broadband connection was considered as minimum download speed of 512 Kbps, lower than international norms and insufficient for some applications.

Continuing with this growth and with the objective of making it equitable, the Government of India formulated the National Telecom Policy (NTP) 2012 with the vision ‘to provide secure, reliable, affordable and high-quality converged telecommunication services anytime, anywhere for an accelerated inclusive socio-economic development’. This commitment has been reiterated in nearly every development manifesto from Budgets to party platforms in the 2014 elections.

As part of this effort, the Department of Electronics and Information Technology (DeitY) has approved, launched and established 100,000 Common Services Centres (CSCs) serving 600,000 villages in India. The Scheme aims to combine the provision of IT-based and non-IT-based services across agriculture, education, health, financial inclusion, entertainment, utilities and other commercial services by aligning the interests and activities of the government, private enterprises and local NGOs. A three-tier framework has been adopted for its implementation, consisting of Village Level Entrepreneurs (VLEs), Service Centre Agencies (SCAs) and finally, a State Designated Agency (SDA). The health services provided include telemedicine, health check-ups and medicine. States are also being encouraged to take up the execution of the National Optical Fibre Network Programme (NOFNP), networking 2.5 lakh villages. The Government of India has also launched the Digital Indian Initiative to transform India into a ‘digitally empowered society and knowledge economy.’

Policy commitments aside, technological change is also opening up new opportunities to lessen and bypass the challenges of extending and leveraging India’s existing network. Data compression for moving more information over networks with limited bandwidth is an active commercial area. Facebook is testing solar-powered drones (where the drones will use laser technology to beam an Internet connection to the ground) flying between 60,000 ft and 90,000 ft (at altitudes that present new regulatory challenges) to improve web access in remote areas. Project Loon is a similar project undertaken by Google where Internet-beaming balloons are used to bring Internet to the underserved areas of the world. The Government of India plans to utilise funds from the Universal Service Obligation Fund (USOF) to provide incentives for improving broadband connectivity and coverage. The USOF is expected to enable rural and remote area connectivity with active participation from the private sector as well.

Data Interchange: Who will share what with whom?

Information creation and digitisation are necessary foundations for generating an information base for building knowledge to improve the health system, while the physical infrastructure for moving data around affects the inclusiveness of the knowledge in terms of underlying data points as well as breadth of access to insights and decision support.

But the softer infrastructure of protocols and standards for the way that health records are coded, stored and retrievable are the linchpin for a transition to full data liquidity from the current status quo of institutional islands. Each of the national and state insurance schemes mentioned above, for example, produces
large datasets of health records and potential insights into spatial patterns of morbidity. But will these datasets ever be merged? Beyond the public sector, will public and private records ever become linkable?

Full national data liquidity is a complex policy challenge, potentially requiring new institutions to be established. ‘Ultimately, to achieve semantic interoperability, it is anticipated that multiple layers – network transportation protocols, data and services descriptions, information models, and vocabularies and code sets – will need to be standardized and/or harmonized to produce an inclusive, consistent representation of the interoperability requirements’, according to the 2013 report of the Expert Committee on Electronic Health Records established by the Ministry of Health and Family Welfare. Furthermore, “It is also recognized that a sustainable and incremental approach to the adoption of standards will require processes for harmonizing both current and future standards. This will allow the incremental updating of the initial set of standards, implementation specifications, and certification criteria and provide a framework to maintain them. The decision to adopt such updates will be informed and guided by recommendations from an appropriate authority akin to a National Health Information Authority.”

Policy is currently moving cautiously. The Committee’s September 2013 recommendations were ‘an incremental approach to adopting standards, implementation specifications, and criteria to enhance the interoperability, functionality, utility, and security of health information technology and to support its widespread adoption. It is to be kept in mind that these standards should be flexible and modifiable to adapt to the demographic and resource variance observed in a large and developing country like India’. The National Health Policy 2015 (Draft) also calls for the setting up of a National e-Health Authority (NEHA) to lead in the implementation of integrated health information systems, encourage the adoption of standards, and act as a facilitator for exchange of patient health records across different facilities in a safe and secure manner. NEHA is expected to act as a promotional, regulatory and standards setting organisation in e-healthcare and also enforce laws and regulations protecting patient privacy.

In the meantime, there are various market and political forces that could affect the de facto basis for data liquidity.

First, within the industry, health finance and health literacy (both discussed further below), are both sources of demand for standardisation as well as digitisation of data. Insurers require particular formats for patient transaction records, and private providers will be obliged to comply with these and thus, to some extent, standardise records. This could lead to some degree of segmentation between institutions focusing on higher-income clientele and those relying on public financing, particularly since both patient pools are large enough to justify development of distinct health records software products or customised solutions. It is also not clear whether this pull for standardisation would manifest as a demand among healthcare providers for information systems with particular features or as a growth area for third-party aggregators.

Health literacy and consequent interest in one’s own medical history creates a separate pull for interoperability since patients would need to aggregate information from the multiple institutions that they have visited. The move for standards need not come from the government. The United States ‘Blue Button’ initiative, a coordinated set of data management guidelines for healthcare providers and insurance companies
to enable patients to question their data, for example, originated in a series of consultations between the non-profit Markle Foundation and the healthcare and technology industries.

Apollo vice-chairman Sangita Reddy’s stated ambition to link health records to the Aadhaar number represents a similar impulse, though it is not clear how this would work given restrictions on linking the Aadhaar number to other information sets.65 Khosla Labs, in collaboration with NASSCOM, conducted an Aadhaar-based hackathon in January 2015; the winning team developed an application called ‘Aadhaaritory’ that ‘ties an individual’s Aadhaar number to their electronic medical records’,66 allowing doctors to update this information and enabling patient record portability across healthcare providers and regions.67

Social entrepreneurs are already finding opportunities to participate in building this infrastructure as well as opportunities based on leveraging it. In some ways, the current state of health information systems is like the early days of e-governance, when various distinct, customised implementations coexisted, each heralded as ‘cutting edge’ and ‘to be replicated’. These are yet to have one common format or link to be comparable.68 The underlying information structure and requirements of each client varied and so did the solution provided. Information standards, in this case National Municipal Accounting Standards, created an opening and a basis for scalable e-governance finance products rather than individual case-by-case implementation. The companies that worked on customised solutions found a reasonable market; those who saw the opportunities to productise found an even larger one.

Agency

The last two critical factors discussed in this chapter examine two dimensions of agency, or individuals’ capacity to advocate for and adjudicate on their own healthcare:

• The evolution of health finance: In particular, how much does the budget expand and who decides where it goes? What is the potential direction and speed of India’s evolution from private out-of-pocket expenditure as a dominant source of finance to pooled finance and/or some form of public finance? Will the expected increase in public finance be routed through public sector institutions or through patients who would be free to choose among public and private providers with some conditions? What role will insurance companies, public and private, play as patient advocates?

• Health literacy: How will the prevailing level of citizens’ awareness of their own health, treatment options and healthcare rights change? How might the level of health literacy change from access to information to an active integration of information amounting to decision-making changes? How will access to data flow enabled by improved telecom infrastructure encompassing a push concept move to a paradigm of data that is pulled in and absorbed due to genuine demand? Health literacy has its limitations – patients cannot be expected to replace specialists and policy-supported consumer protections in health decision-making – but it is likely to be an important force in the health system, one way or another.
Finance: Who ultimately writes the check?

Who will be the customers for healthcare? If the budget for healthcare for low-income Indians increases largely through expanded public commitment as expected, given the size of the gap between health costs and household income, then the way that the public funding is spent will substantially affect the market.

**Table 1**

Transition in health financing and insurance to Universal Health Coverage

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2017</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax financing</td>
<td>Relatively low</td>
<td>Increasing</td>
<td>Relatively high</td>
</tr>
<tr>
<td>Private financing</td>
<td>Relatively high</td>
<td>Decreasing</td>
<td>Relatively low</td>
</tr>
<tr>
<td>Employer-employee contribution</td>
<td>Relatively low</td>
<td>Increasing</td>
<td>Relatively high</td>
</tr>
<tr>
<td>Coverage</td>
<td>Mostly rich and targeted poor</td>
<td>Expanded coverage to include poor and other targeted communities</td>
<td>Universal</td>
</tr>
<tr>
<td>User fees</td>
<td>Prevalent</td>
<td>Eliminated</td>
<td>Eliminated</td>
</tr>
<tr>
<td>Central Government insurance schemes</td>
<td>Large numbers catering to different groups</td>
<td>Reduced in numbers; merged with the UHC system</td>
<td>None - and integrated fully with the UHC system (including CGHS, ESIS and schemes for the railways and other public sector institutions)</td>
</tr>
<tr>
<td>State government insurance schemes</td>
<td>Option open subject to state government financing</td>
<td>Option open to top up Central Government’s UHC-National Health Package (NHP) funding subject to state government financing</td>
<td>Option open to top up Central Government’s UHC-NHP funding subject to state government financing</td>
</tr>
<tr>
<td>Private (including community-based) insurance schemes</td>
<td>Large variety with option to individuals to top up government coverage</td>
<td>Large variety with option to individuals to top up government coverage</td>
<td>Large variety with option to individuals to top up government coverage</td>
</tr>
</tbody>
</table>

Will the public sector work through demand-side finance through financial support to patients and prospective patients? In principle, this is supposed to increase competition and efficiency, and it may also pull in new private healthcare providers and provoke innovation. Or will the approach be supply-side finance, with public funding for healthcare flowing directly to public providers? These funds could be managed to motivate innovation within the public sector, as well as accountability and competition, but it means that the funding increase will generate a different set of opportunities for social entrepreneurs. Rather than setting up institutions that compete with the existing three-tier system, they might see the increasingly well-funded and ideally well-run public institutions as customers for services, diagnostics and treatment devices.

There is currently a mix of supply- and demand-side public health finance. National programmes such as the National Health Mission are supply side. Existing Ministry of Health strategy documents suggest a continued commitment to the approach. Some national ministries’ programmes such as the Ministry of Labour’s RSBY are more focused on demand-side finance. States tend towards demand-side financing. The terms of demand-side finance vary across states so that social entrepreneurs seeking to establish medical institutions may have to develop distinct approaches for sub-markets across the country in order to benefit from any surge in public funding. The differences between the two state-funded programmes, Andhra Pradesh’s Aarogyasri and Tamil Nadu’s Kalaignar, are attributed to the health status of each state, suggesting that the product design is customised to respond to regional requirements. Aarogyasri in Andhra Pradesh initially only provided hospitalisation cover, but over the years its package expanded to include critical illness. Kalaignar, on the other hand, operates in Tamil Nadu which has a more robust and functional public health infrastructure, and consequently it only needed to cover critical illness. Karnataka’s Yeshavini invests less in identification technology, but all schemes rely heavily on electronic data collection and transmission and have fairly dynamic management information systems (MIS). RSBY and Kalaignar use biometric cards to control fraud; RSBY issues real-time health cards (at the enrolment camp) to improve customer service and control any rent seeking behaviour by the card-issuing agency.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Yeshasvini Cooperative Farmers Health Care Scheme</th>
<th>Weaver’s Insurance</th>
<th>Rajiv AarogyaSri Community Health Insurance Scheme</th>
<th>RSBY</th>
<th>Chief Minister Kalaignar Insurance Scheme for Life Saving Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Location</td>
<td>- Karnataka</td>
<td>- Multi-state</td>
<td>- Andhra Pradesh</td>
<td>- National</td>
<td>- Tamil Nadu</td>
</tr>
<tr>
<td>- Outreach</td>
<td>- 3 million lives</td>
<td>- 6.4 million lives</td>
<td>- 70 million lives</td>
<td>- 63 million lives</td>
<td>- 35 million lives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.6 million families)</td>
<td>(20.4 million families)</td>
<td>(23 million families)</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Ruchismita & Churchill (2012))
The recent change in government may mark a substantial shift from previous strategies, but it is too soon to assess likely directions. Here we discuss some of the key developments to watch for in health finance:

**Universal health coverage vs universal social protection?**

The national-level Ministry of Health’s focus on Universal Health Coverage is running parallel to the goal of a comprehensive social insurance package including health, life accident and pension. The latter approach, along the lines of what the erstwhile Andhra Pradesh has been delivering under *Indira Kranti Patham*, appears to have stronger backing in the Ministry of Finance.

**Accountability and oversight:**

Both demand- and supply-side finance create perverse incentives. Supply-side finance is seen as creating complacency since the main customer – the patient – has only indirect control through political accountability rather than ‘voting with their feet’. Insurance reimbursements, on the other hand, can encourage creative accounting and over-billing. Also, in settings with low reimbursement rates, hospitals may selectively reject patients for procedures that are less well reimbursed. What safeguards will be implemented to prevent and respond to such cases? These are not only normatively important for public health but also set the playing field for competition for well-meaning social entrepreneurs.

**Fiscal incentives:**

The financial incentive to manage risk can come in by a shift of responsibilities from the public to the private sector, from a shift in public sector incentives – introduction of so-called ‘hard budget constraints’ – or by changes in legislation or competition that reduce opportunities for profit among existing private providers of health finance.

**The demand for risk management** as well as information to feed into underlying analysis could come from several quarters, including:

- Stand-alone health insurance companies, through focused models around pools, either as employee benefits with corporates or larger government employee schemes.
- Large state- and centre-level insurance funded programmes. RSBY, for example, covers outpatient as well as inpatient services – the assumption being that timely outpatient treatment may reduce inpatient incidence.
- Quota-driven innovations: Insurance companies are required by the Indian Insurance Regulatory and Development Authority (IRDA) to originate a percentage of their portfolio in the ‘rural and social sectors’. Servicing these markets requires new approaches, potentially leading to significant innovations in risk management.
Box 4.12: What Does Health Literacy Mean?

As in education, some organisations emphasise reading and numeracy as their health literacy baseline. Can patients, for example, read and pronounce the names of medications; are they able to describe their diagnosis accurately; and how knowledgeable are they about medical compliance? If social enterprises were to assume functional literacy among customer segments, this would naturally raise the entry barrier for many communities.

Other definitions maintain that oral literacy, comprehension and clearer patient interactions with medical professionals are key. In these cases, products and services can be designed to probe whether patients grasp the information that doctors, nurses and health workers share with them. In addition, can patients easily and appropriately apply medical, nutritional or mental health advice after they leave the clinic or hospital? Yet another set of definitions emphasise patients’ cognitive ability to understand disease risk factors and apply those and other vectors to behaviour.

Different levels of health literacy can influence decisions at different scales, for example, decisions made for and by individuals or for groups, such as personal (digital) health assistants for people suffering from hypertension, in contrast to decision support systems for public health. Regardless of the preferred definition, the consensus is that new medical professionals should be trained to use appropriate communication with patients, in language that patients understand, in ways that are contextually relevant and take into account social and cultural variability. All of these dimensions, and myriad others, would greatly improve the quality of life of individuals and their families.

Research and consultation suggest that strategic public investments to extend health literacy beyond formal health services to include the empowerment of patients and community groups on a national scale could contribute significantly to a more inclusive healthcare sector.

Insurance and public support for health is only as good as peoples’ ability to access the benefits and leverage the support for health needs. The overall international evidence of the impact of health literacy on out-of-pocket expenditure is mixed, for example. In some cases, particularly for third-party payment programmes (when the government pays on behalf of the household), beneficiaries are often not even aware they are insured. In other cases, while insurance reimbursements for particular conditions may lead to additional care being given to households, it can also lead to warped provision – focusing on the type of care the hospital can provide rather than what the household really needs.

There are other good reasons to build a sense of urgency around health literacy as a foundation for more participatory healthcare. Societies are seeing a surge of communicable and zoonotic diseases cross international borders. Natural climate events may occur more frequently and with more ferocity. Beyond medication, behavioural changes and adjustments in lifestyle have a significant role in managing non-communicable diseases in India. Each of these underscores the importance of public health interventions, improved health awareness and personal agency.

Decades of studies show that healthcare outcomes can be significantly improved through patient education, awareness, personal agency and self-efficacy. In other words, it is entirely possible for laypeople to become more
informed about their health, be motivated about managing it, and build up confidence to make better health decisions. Research also points out the effects of peers and social contagion, where the health of your peers and family members may reflect your own state of health or have an influence on it. The consequences of low health literacy are significant. Patients have a higher risk of hospitalisation, readmissions and a lower rate of medical compliance. There may be a higher error with medication, and unhealthier decisions and behaviours. Health literacy is also a forerunner for participatory medicine, where patients play a far stronger role in understanding, advocating for and participating in their own health.

Health literacy, however, is not an end in itself. Health responsibility has to be equally shared between the doctor and the patient. Well-informed patients could sometimes be misinformed. Patients can quite easily get free advice on any web-based health forums and platforms, but many of them contain misleading information and even correct information can be misapplied. Improving health literacy, enabling participatory health, and balancing these new forces with sufficient patient protection is a global challenge.

India has made headway in addressing the health needs of her diverse population through affordable generics, improved access through different tiers of care, and investments in infrastructure, biotechnology and public health, but it is also clear that human resource and infrastructure capacity will continue to lag behind the needs of India's population. In this setting, extending healthcare into the community and engaging members of the community in its provision could be an important additional resource. The National Rural Health Mission's ability to train over 900,000 front-line health workers and volunteers at primary health centres demonstrates the strength and impact of political will (National Health Policy 2015, Draft). The successes and insights from such programmes have inspired similar attempts in slums and informal settlements in metropolitan areas, through the National Urban Health Mission. Various studies have argued that raising the standard of health literacy among citizens and immigrants can become a powerful vector for transforming healthcare in India. In pockets of India where food security, poverty and malnutrition predominate, the notion of basic health literacy and participatory medicine, which seeks to actively engage patients in medical decisions and care, may seem like a tall order. Without these efforts, however, vulnerable communities with inadequate access to basic services will continue to carry the greater burden of disease.

Health literacy also applies to the training of medical professionals to communicate more appropriately with their patients, and the setting of standards so that products, services, user interfaces and interactions are clearly understood by the people who use them. Within tertiary and secondary care institutions, few medical professionals have the time or skills to ensure that patients fully understand the implications of their diagnosis and medications, and how to improve their health day-to-day, let alone plan towards healthier futures. On both counts, large-scale networked initiatives on public health awareness and health literacy can address the gaps.

A growing number of organisations in India are addressing functional health literacy through visual media. For example, messages about public health or how to prepare and deal with natural disasters are communicated through graphical illustrations, comic books, the radio, television and even videos via mobile phones. These efforts are especially amenable to cross-sector innovation, where educators, designers and communities can work with health professionals to improve literacy.

Clearly, these ideas are not new. They have been promoted in India for years by National Policy programmes, institutions like the Public Health Foundation of India (PHFI), public sector organisations with interventions for targeted groups, and academic and private libraries such as the Health Education Library for People. Many
programmes address issues in the domains of public health, reproductive, maternal, child and environmental health. The foundations of research, policy and practice exist today. But the game changer is to shift health literacy from the periphery to the forefront when deliberating health policy, designing innovations and developing investments. A further question is how social enterprise can play a stronger role in accelerating and scaling up these goals. Two models of health ecosystems may be useful to keep in mind.

As demonstrated in Figure 11, PHFI envisions a number of critical components for driving health behaviour change, ranging from data sharing to advocacy. These include creating persuasive and pragmatic policies, building community ownership and agency, creating appropriate skills training, and finally, agreeing on systematic ways to communicate, implement and measure outcomes.

**Figure 11**

Framework for Improving Health-Seeking Behaviour

- Communication Strategies & Action Plans for National Programmes
- Education Training Skills - Building
- Community-led Health Literacy
- Community owned BCC
- Behaviour Change in Knowledge Attitudes, Beliefs and Practices
- Enabling Policy Environment Communication & Advocacy

(Source: Public Health Foundation of India (PHFI).)

The Sorenson et al. Health Literacy Model, (see Figure 12), which is being promoted by a large regional arm of the WHO, offers a slightly different framework. Here health literacy is integrated into the system-wide ecosystem of care. The scale of intervention extends from the individual – incorporating social and environmental determinants of health – to entire populations, examining disease prevention and health promotion measures. The framework starts from a realistic premise that ‘building personal health literacy skills and abilities is a lifelong process. No one is ever fully health literate. Everyone at some point needs help in understanding or acting on important health information or navigating a complex system … especially when a health condition makes them more vulnerable.’
In Short: Change is Underway

India’s health system stands at the intersection of changing demographics, disease burdens, economic geography and industry structure. Indians’ needs, wants and expectations of well-being are evolving, even as the technologies and practices available to improve public health for all change daily. The day-to-day reality of primary care facilities in remote rural areas seems far away from the global discussions of big data, quantified selves, personalised medicine and futuristic therapies – but these two worlds will meet sooner rather than later in ways that will generate great opportunities but equally pose significant risks. The next chapter explores some of the ways in which some of the critical factors described here could combine to form a range of responses to the health and well-being needs of low-income Indians.
Endnotes

11 Population Division, United Nations Department of Economic and Social Affairs
12 Population Division, United Nations Department of Economic and Social Affairs
16 The report defines metropolitan clusters as ‘groups of districts that have high economic potential, are contiguous such that each cluster represents a serviceable market, and have a metropolitan district as the nucleus. Boundaries of metropolitan clusters stretch beyond metropolitan districts to include adjacent high potential ones. Some of these adjacent districts often have relatively lower levels of urbanisation that makes them either semi-urban or transition districts, and highly suitable markets for expansion given their relatively lower levels of competitive intensity.’
Status according to the SAFAR Home Page: http://pune.safar.tropmet.res.in/Home.aspx
Retrieved from http://mwater.co/blog/category/blog/
1 exabyte = 1 million terabytes.
Retrieved from http://www.hmri.in/index.htm
http://www.cmchistn.com/features.html
Sources used in the textbox retrieved from
http://www.newindianexpress.com/states/odisha/AIIMS-Smartcard-to-Manage-Patient-Records/2014/02/26/article2078304.ece#.UxRbZ0KSzgo
http://www.aiimsbhubaneswar.edu.in/tenders/tender_250913223023.pdf
http://www.electroniccourts.in/privacylawsindia/?p=21
http://uhcforward.org/sites/uhcforward.org/files/05_RSBY_Connect_No5_June2012.pdf
53 http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx
54 http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx


http://www.thehindubusinessline.com/companies/apollo-working-on-linking-ehealth-records-with-aadhaar/article4400591.ece


This study (retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791647/) shows how varied sets of data collected are not comparable.

http://www.serpi.ap.gov.in/SHG/index.jsp


Chapter 5: Scenarios

Scenario 1: The Rising Tides

This scenario describes elements of collapse and constraint futures

With the rupee in freefall against the dollar, hospitals, clinics and medical professionals are seeing the prices of medical equipment and consumables skyrocket. In 2020, a recent update of the Drugs and Cosmetics Act created a new category for all medical devices and diagnostics, demanding a stricter approval process for equipment designed and manufactured in India. By 2021, private foreign and domestic capital begins to drain out of the burgeoning medical equipment industry as people anticipate facing countless regulations, administrative obstacles and informal payments for post-clearance certifications.

As equipment and consumables become more expensive to buy and maintain, hospitals continue to pass rising costs to their patients. For larger hospitals or those catering to medical tourism, costs are added to treatments. For smaller rural hospitals and clinics for lower-income populations the situation is punitive. They are unable to afford imported or domestic medical equipment. As a result, services for basic diagnostics dwindle, and it becomes harder for doctors to identify illnesses without asking patients to get tests done in larger laboratories at higher costs before prescribing medications.

Earlier, hospitals and clinics operating in Tier II and Tier III cities tried to reduce costs by bringing low-cost diagnostics and treatments closer to the patient’s doorstep. But a small glitch in equipment set back the entire industry. A much-touted pilot programme in Bihar gave pregnant women smartphone-enabled foetal monitoring devices. By wearing these, doctors no longer needed to manually check pregnant women’s vital signs as often as before. One batch of devices failed to sound a warning after several mothers’ blood pressures had dropped during labour, and resulted in a spate of maternal deaths. This unfortunate incident instigated a widespread media campaign cautioning doctors and patients against using medical technologies that decreased reliance on doctors. Now, around the country, patients are as hesitant to purchase and use such devices as clinics are wary of stocking them.

At the same time, there is little improvement in the scarcity of human resources. People living in low-resource settings continue to face a shortage of trained doctors, and nurse practitioners are highly restricted in what they can diagnose without oversight. Telemedicine consultations attempt to fill some of the gaps, but it is hard for patients to trust the opinions of a random specialist seen on the other side of a camera.

As a brief reprieve, public-private partnerships are forged to systematically expand training programmes for healthcare workers. There’s a greater push in Tier II cities to recruit nurses and medical technicians. The number of licensed nurses increases significantly. With greater awareness about the government’s new ‘best practice’ certifications, (which are heavily influenced by international standards), these workers are highly qualified in a competitive market hungry for new resources. Many of the new nurses speak and communicate in English, and are offered attractive salaries to work for overseas medical subsidiaries in Dubai, Vietnam and other Asia-Pacific countries. In India, with the growing concerns of rising healthcare costs, salaries of healthcare workers simply cannot keep pace with inflation.
Public health issues also escalate. New zoonotic diseases appear in unexpected places, and long dormant communicable diseases re-emerge, triggered by changes in the environment and adverse climate events. Pharmaceutical companies try to develop vaccines for new subtypes of flu but cannot produce them fast enough.

In addition, surveillance studies show dramatic spikes in food-borne pathogens that are resistant to multiple drugs. The pharmaceutical industry redoubles its efforts to understand local strains of pathogens found in outbreaks in South Asia. But the rate at which these adapt to human immune systems is faster than labs can develop responses.

Eight years after the Chennai Declaration of a roadmap for antimicrobial resistance, statistical reports show an alarming upturn of antibiotic resistance across public and private hospitals. Prescriptions for antibiotics are on the rise, and larger numbers of patients are not being cured of disease or are dropping their course of treatment. Antibiotics are either being overprescribed for non-bacterial infections, or there is a growing threat of multi-drug resistance.

With scores of migrant workers seeking opportunities in cities, the slums of India’s metros continue to grow. Public officials are unable to clean up the water supply or take appropriate sanitation measures. Seasonal outbreaks of water-borne diseases are rampant among slum dwellers, with new strains that are increasingly resistant to existing treatments.

While the government continues to fund public health initiatives and increasingly subsidise the cost of medications and vaccines, they do so at a great loss. Patients with co-morbid conditions bear a greater cost. Medicines are growing more expensive and patients in low-resource settings continue to buy cheap, substandard or counterfeit drugs. This fuels an increasing supply of fake medicines that is nearly impossible to track.

Regulatory agencies attempt to enforce standards and monitor quality control, but competing private interests and the nature of challenges and mismanagement across the health ecosystem turn regulatory efforts into a Sisyphean task. Agencies are unable to review institutional licences due to large private lobbies and a lack of funds for systematically pursuing fraudulent claims. The perception that private and specialty hospitals might be dropping their standards of care has a direct impact on medical tourism.

The pharmaceutical industry, too, is struggling. Previously, India supplied 20% of the world's generics. Since then, competing interests between companies with long, expensive drug development cycles and affordable generics have crippled the industry. The last decade was marked by an assault of intense lobbying, litigation around intellectual property, and bilateral trade agreements that focused on regulatory issues articulated as a business-friendly environment. These undercut production for all but the largest domestic pharmaceutical firms. With hundreds of millions of dollars spent on fines and essential upgrades of physical plants and equipment, small and mid-sized pharmaceutical suppliers are going bankrupt or being acquired. Larger players are under extreme pressure to sell controlling stakes to foreign companies. Firms that survive have fewer assets and capital for longer-term R&D. The ability to make long-term bets for new drug development and investments in vaccines has shrivelled. India loses its international competitive edge in low-cost, controlled production.
For the surviving pharmaceutical firms, there is a faint silver lining. International regulations encourage the local manufacture of pharmaceuticals. As a result, companies like Cipla have gone global. They expand across South East Asia and Africa through acquisitions, and develop state-of-the-art manufacturing plants. Their profit margins grow by continuing to supply generic versions of drugs like Viagra and Zoloft to western countries, while producing affordable generics at competitive rates for rural populations at home. Global expansion also allows these companies to hire leading R&D experts with more ease, and develop R&D for new orphan drugs and Neglected Tropical Diseases (NTDs).

The number of Indians suffering from rare diseases is estimated to be around 7 crores (more than the US and EU rare disease populations combined) and about a billion patients worldwide suffer from NTDs. Earlier, drugs to treat rare diseases were not accessible to most Indians as they were too expensive. They involved substantial development costs and target populations are perceived to be smaller than those who suffer from diseases considered more common in the West. But the Indian government has watched its traditional pharmaceutical sector drying up. And it sees foreign countries cutting back on their manufacture of orphan drugs, which, due to regulatory restrictions, are highly expensive to develop. The government makes a big bet on India becoming a central player in the production of orphan drugs worldwide. In part, India’s ability to develop know-how for highly personalised medical conditions offers a foretaste of precision medicine, a growing trend across the world. People anticipate an era in the near future when individualised treatments for different populations and drug regimes for rare and co-morbid conditions actually become the norm. With the approval of an Orphan Drug Act, tax benefits accrue and there’s greater regulatory leniency to develop orphan drugs in India for domestic and international markets.

Scenario 2: The Social Surge

This scenario highlights factors related to discipline and continued growth futures

Non-communicable diseases explode across India. Desperate families scramble for healthcare solutions, but most are overwhelmed by the costs and burden of extended treatment periods, and begin to spiral into poverty. Governments step in to run vertical programmes for lifestyle diseases such as diabetes and hypertension, and private hospitals offer healthcare financing and preventive care for well-to-do customers. But these solutions are incremental at best, and leave few options for resource-strapped families. Public interest groups lobby for governments to expand state-financed insurance plans beyond acute care to cover outpatient and chronic illness management, with patchy success.

Finally, patients realise their best and only option is to help themselves. Despite low levels of health knowledge and overcoming great odds, patients take steps to become more informed, discerning healthcare customers. Leveraging community health resources, education programmes and newly available e-health tools, they begin to take control of their health by becoming aware of public health issues and making personal changes in nutrition and lifestyle. Widespread use of consumer health devices prompts a shift towards participatory health, where healthcare workers and remote medical specialists play a larger role in helping patients’ self-care and tracking health outcomes.
Young people help drive this shift. Demographically, India has changed. While a large proportion of the population is elderly and requires chronic care management, the majority is young and has different expectations of the healthcare system. 60% are at risk from non-communicable diseases (NCDs). They are on average more literate, with aspirations to live longer and have a better quality of life than their parents. Most are versatile in adopting mobile and tele-health platforms to access healthcare and health information. They also begin to recognise links between health, productivity and future employment, and learn about risk factors for chronic disease. In time, they grow more diligent about abiding by medical directives and prescriptions. This generation is key to changes in health literacy.

Doctors and health officials view demographic changes in attitude with interest and some scepticism. While better informed Indians start to respond and shift their lifestyles to avoid and/or manage NCDs, medical professionals also notice worrying results. Since patients are informed but not experts, they continue to self-diagnose and self-prescribe medications, buying substandard generics over the counter with increasing frequency – often with dangerous consequences for their own health.

To stem negative outcomes, and to support a growing recognition that population health indicators are directly linked to the economy, the government creates its first national health literacy policy in 2020. Architects of the strategy have learned from the successes and failures of India’s general literacy programme over the past half-century. They have also gleaned lessons from China’s commitment to health literacy in rural areas, and ASEAN’s Regional Action Plans on Health Lifestyles.

Massive campaigns are rolled out to improve people’s knowledge and awareness of public and preventive health over the next 15 years. The healthcare sector realises that it must be part of the solution to accelerate healthcare compliance and improve health outcomes, as challenging and disparate as these are in India. Central and state governments, along with private industry partners, finance initiatives targeting urban slums, rural areas and schools. Public health information is distributed through Common Service Centres. Enriched training programmes are set up for ASHA, AYUSH and Anganwadi workers, with variable success.

Initiatives that formerly focused on maternal and child health programmes branch out into preventive care and public health literacy. With the help of social entrepreneurs, they work closely with health professionals to develop health education curricula for schools, design multimedia materials in local languages, and conduct health information camps. Social entrepreneurs collaborate with NGOs like Ananya to test and develop public outreach programmes. Others create metrics to measure and improve impact. Even television and radio producers begin to embrace healthcare themes in their programmes.

New cadres of college and university volunteers, schoolteachers and groups of municipal and public sector employees are coached as trainers to implement and assess health literacy programmes within communities where resources are scarce.

Schools are important vectors for policy implementation, and become pivotal to shifts in national nutrition. As part of the new health literacy policy, basic health education is introduced in secondary schools. Growing numbers of children across the country learn about health, wellness and nutrition. They take these messages home to their families, contributing some new voices for healthcare and preventive action.
The new policy also revises the national midday meal scheme so that children are given more nutritious meals. New research shows that ‘unhealthy diets are worse for health than tobacco’. This is not only important for children’s health and health literacy; it leads to a commitment to significant changes in India’s agricultural food production. An agricultural transformation seems poised to take place over the coming years, moving away from cash crops and mono-cropping, and returning to crop diversification. Multigrain, gluten-free crops and pulses eventually lead towards sustainable agriculture with higher yields. A percentage of these crops are set aside at wholesale prices for school lunch programmes. These seemingly incremental shifts set India well on its way to tackling an ever-increasing onslaught of NCDs and many other burdens.

Families in turn become more active and aware of preventive health. Homebound patients invite community health workers in to learn about medical compliance and monitor health conditions. Primary care centres are energised around new patient demands and build better links to preventive health services. Where doctors are absent, access is provided via tele-health. Traditional medicine and stress-management treatments are incorporated, including Ayurveda and yoga.

Through these approaches, facilitated by ASHA workers and AYUSH doctors, patients access mental health camps and disease screening sessions. Those at the very last mile use mobile clinic extensions to diagnose and manage illnesses ranging from diabetes and heart disease to glaucoma. Common mental disorders such as depression and anxiety – long neglected and stigmatised – are increasingly recognised as integrally linked to non-communicable and other diseases, and mental health services become small but important components of many primary health care (PHC) systems. Increasingly, psychosocial and behavioural interventions are integrated with health prevention programmes, helping people to manage chronic hypertension within families, and cope with stressful life events, crushing debt burdens and natural disasters. With preventive health programmes on the rise, secondary and tertiary care institutions hire psychologists and mental health professionals to help support patients to enhance their overall quality of life.

Revisions to the National Health Mission also require that clinics teach patients when to seek out healthcare, what options and treatments are available to them, and how to decipher symptoms. These include how to distinguish between somatic and psychic complaints and how to communicate these accurately to health workers and physicians. These classes help patients become more engaged with providers, holding ongoing conversations and collaborations with each other for diagnosis, treatment and preventive care.

As citizens learn to collaborate on and monitor their own health, they also begin to take proactive health decisions and make health-related demands. Higher-income families, keen on healthier meals, insist that shops supply appropriate grains and non-processed pulses in bulk and other ingredients. Growing demands lead to new businesses around food certification and branded packaging aimed at the middle class.

In slums, smaller towns and villages, people begin to organise themselves around health and public health issues. Knowledge about the importance of vaccines leads to increasing immunisations. Community-based committees are formed, some that demand training and part-time work, to track and monitor health targets for the region, including environmental toxicity and pollutants. Other efforts focus on women, adolescents and targeted health groups.
With more active involvement, people’s knowledge about public health improves over time, and may gradually lead to improvements in health indicators. However, community groups do not always consider all citizens’ needs or concerns. Women’s Panchayati leaders are often from the more powerful families in the area; their concerns do not always match with those of the general population. Accordingly, less prosperous citizens begin to lobby for wider inclusion and form their own groups.

Innovations in low-cost diagnostic tests and breakthroughs in biomedicine have galvanised the design and manufacture of mobile medical devices for the Indian market. Affordable monitoring devices extend healthcare delivery services beyond the walls of hospitals and clinics. Patients are empowered to use a proliferation of e-health tools and are directly or indirectly contributing to patient data aggregation. Across the country, Indians use mobile phone technologies to access health advice and directives, and to confirm the validity of medicines. Others, including those who can’t read, monitor blood sugar levels and other conditions on self-operated home devices. But technologies are not always administered correctly, leading to risky health outcomes.

Some of these technologies are networked and linked to local health systems and tertiary hospitals. They are important channels for data gathering and dissemination. For example, blood sugar monitoring devices can feed results back to a databank. Patients who use their mobile phones to check the validity of their medications are contributing data on usage, namely, which medications are being used and where, and who has prescribed or sold them. This data is aggregated, processed and channelled back to patients through health workers – further strengthening their knowledge and agency – or into predictive analytic systems. However, with the high prevalence of NCDs, some patients are getting paid small sums to contribute health data towards clinical trials, raising alarm bells about potential exploitation, not unlike illegal organ sales.

Massive banks of patient data are used to develop new insurance and payment plans. Insurance companies can now determine treatment costing information to design their plans. Social entrepreneurs develop tools to assess health risks. Mental health patients, long uninsured because rate sheets, points-of-care, and costing information about treatments were unavailable, now have access to payment plans for common mental disorders. Primary care services use data findings to fine tune health subscription plans and user-fee models.

Scenario 3 – All Wired Up And Somewhere To Go

This scenario addresses possibilities for growth and transformation futures

It’s 2021 and the health system is going the way of governance, with pockets of digitisation of records, e-governance interfaces and e-enabled processes amidst business as usual. Health identity cards are back on the table, and linked to electronic health dossiers for families. Workflows that started as isolated experiments driven by idiosyncratic goals have started to grow and, in some cases, converge into state and national physical, regulatory and policy infrastructures for moving information around. These information flows, in turn, open up new possibilities for contributing to the health system through market-based models.
It is the year 2020. Atul, a consulting radiation oncologist at Nalanda Hospital, is looking over his caseload and afternoon roster. One of his patients is losing ground and seems to have developed a second tumour in spite of a full regimen of radiation therapy. Atul makes a mental note to contact the diagnostics lab at the Shatrughan Sinha Hospital in Patna. He’ll ask them to run computer simulations to gauge how well his patient will respond to different treatments, based on genomic data and past medical history. Accuracy isn’t guaranteed but at least it gives him more evidence for treatment plans.

At the same time, hundreds of kilometres away in the capital, the Secretary of Health and Family Welfare is reviewing the rates of outbreaks of infectious diseases across Bihar. She notes that some kind of flu with joint swelling and brain haemorrhaging is showing up in the east. She informs the region’s Disaster Management Cell and orders a team of specialists to head out immediately, and she alerts the railways and civil aviation authorities in surrounding states to screen passengers. If specialists think it’s leading to an epidemic, they must contact local social franchising networks in Bihar to distribute and stock up on vaccines, and alert mobile call centres with appropriate public health information.

Next, the Secretary turns her attention to insurance payouts in Bihar. Purnea district stands out. Nearly 60% of insurance reimbursements for kidney dialysis are going to two centres. Either they are the masters of all kidney issues or something fishy is going on. Are the claims realistic or overblown? Are they caused by glitches between electronic records and insurance payment systems? Drolly, she remembers another case and its aftermath; ‘Thank god at least the strange insurance claims for men getting hysterectomies in Haryana have disappeared.’ Serious investment in data entry and cleaning took care of that issue!

Looking through the health dashboard is somewhat comforting after a morning spent with the nurses’ union in New Delhi. Nurses are demanding the retraction of a new performance bonus scheme based on targets for community fitness. The union was clever in their campaign for change. They didn’t argue that the government should reward performance that is based on community wellness metrics. They simply pointed out that performance metrics went beyond the control of medical service providers. How could their bonuses be tied to health outcomes if they have no control over air and water pollution, workplace hazards, road safety, alcohol and tobacco use, not to mention patients’ pre-existing conditions? Really, they were as bad as the teachers — arguing that test results were not their fault if they had some less intelligent students in the class.

The Secretary is briefly tempted to replace them with digital PHCs. The ministry’s pilot project to test several health ATMs in Assam was going well. Any adult or child who feels ill can walk into a health centre kiosk, get their vital signs scanned, tell their history to the automated assistant, and wait a few minutes to get a diagnosis or referral delivered. Automated dispensing machines stock over-the-counter medications and supplements (though they need to be manned by live guards to prevent theft). Especially popular with pregnant women concerned about anaemia, health ATMs allow women to measure their haemoglobin levels without having to draw blood.

Based on successful pilots, the government wants to experiment with using health ATMs and digital PHCs for preventive rather than curative health. People are encouraged, even paid, to go for routine check-ups when they aren’t ill. Family members develop personal health baselines by measuring their vitals on a regular basis. Younger kids take to health monitoring like ducks to water. In this way, the health ministry hopes to draw on these data to anticipate health risks based on people’s stage of life, occupation and other parameters.
Keen to build cohort studies and longitudinal health histories for families, the government also hopes to tie health information to genetic and environmental data. Epigenetics is far off, but data from health ATMs can be collected, anonymised and organised by hordes of medical researchers working on open data platforms for large clinical trials. These options are exciting but probably still distant and fraught with risks that challenge current health policy. The Secretary knows that integrated health systems are a good 20 years away, and may not happen before she retires.

Some of the risks of having all this information available are becoming apparent. Private insurers working through Third Party Administrators (TPAs), who network with hospitals and maintain client history, are now armed with much of the same data as the ATMs and use it to great effect to update their risk calculations and optimise their portfolios. The riskier individuals are increasingly denied coverage for one reason or another, and those who cannot afford to pay the higher premiums fall back into the state-supported pool.

All around, the health system is slowly and surely becoming a numbers game. And this is changing the playing field. Several factors converged to allow this to happen.

The India Respiratory Syndrome (IRS) debacle, which was not caught until it made its way to New Jersey and Australia, became a national embarrassment for public health surveillance. This resulted in a demand for data on patient profiles, disease progression, presentation/symptoms, and effectiveness of treatment.

India signed an MoU with the Swedish Ministry of Health and Social Affairs to build health information systems that can collect Family Health Records. Designed to support cohort studies, researchers can begin to track changes in health outcomes across multiple generations of immediate and extended family.

Rising costs of treatment, coupled with healthcare inflation and crumbling public facilities drove the need for big data and analytics to the top of the healthcare agenda. Public and private sectors were hungry for information and analytics. As growth in India slowed, the public sector was facing tight fiscal constraints. Entitlement spending increased, and domestic and international investors became wary of India’s debt. More transparent data, it is believed, can help to ensure system efficiencies across the board.

On the one hand, the private sector, eager for new markets in healthcare among the middle class, tried to lock in standards for data sharing as access to health data is considered a competitive advantage. The race for data aggregation systems, scale and venture capital went to the smartest. Islands of information curated by state insurance companies – the major buyers of healthcare – started to form. These datasets also open up a lucrative sideline in attracting pharmaceuticals and other partners for research and development.

On the other hand, the Central Government, under considerable fiscal pressure, tries to pry open corporate data silos through incentives for data sharing. Directives mandate that companies release data related to public health events and emergencies.

Initially, these developments occur in an ad hoc, decentralised way, with limited guidance about data standards. Like the early days of e-governance, there is a proliferation of experiments around the country. Every state has their databanks, as does every hospital chain and many NGOs. Savvy techies, sensing future
markets for data aggregation, try to stitch systems together. Entrepreneurs, having seen the success of EMC’s rapid digitalisation project in Karnataka, dive into digitising and integrating paper, voice and other forms of records. Social franchising networks build alliances across different organisations, coordinating efforts and offering a richer, more diverse set of health-related services to customers. They help patients understand different options for insurance, treatment or preventive care.

The scope of data collection and digitalisation extends into tracking factors that affect health on a larger scale. The government invites bids to install network monitoring systems on air and water quality and their impact on NCDs. Tamil Nadu, an overall pioneer in health systems standardisation, using its CM’s insurance scheme, is able to pull such data into its electronic health records, where it discovers detailed information on disease burdens and aligns initiatives to address key concerns.

Among the larger private players, companies and health systems that were once reluctant to share data have developed strategic alliances to exchange critical and preventive care information. Private hospitals align around state systems because of the cumulative purchasing power of health allowances. Reimbursement claims at scale require cross-institutional alignments.

The hype about big data has its detractors. And they have some tough questions: How to ensure data accuracy and system interoperability? How easy is it to clean inaccurate data across systems? Can health information systems represent the actual state and variables of disease, or are they biased towards metrics that are easily measured and captured? How do they account for variations in disease progression, presentation and individual responses to treatments, as epigenetics come into play? Will automated and evidence-based treatment protocols cause the demise of personalised engagement and attention? Will people’s health issues creep into credit ratings and financial identities? How do we maintain anonymity in an environment where the client doesn’t value privacy? Will the data be representative and reliable for seasonal migrant workers?
Endnotes

1 Organization for Rare Diseases India. ‘What is a rare disease?’ (n.d.) Retrieved from http://ordindia.org/#

2 World Health Organization. (2012). Accelerating work to overcome the global impact of neglected tropical
hq/2012/WHO_HTM_NTD_2012.1_eng.pdf?ua=1

3 De Schutter, Olivier. (2014). Unhealthy diets greater threat to health than tobacco: UN expert calls for global regulation.
Chapter 6: Social Enterprise Opportunities

In this chapter we focus on avenues through which social entrepreneurs can contribute to the health system for low-income India. As in the rest of the report, we define social entrepreneurs narrowly as innovators seeking to achieve sustainable social impact through a for-profit business model. We hope the analysis and scenarios developed in the previous chapters provoke thought among many stakeholders in the health system, from government to patients to industry, but this chapter focuses narrowly on implications for a specific group of potential contributors to the health system.

There are three caveats to this chapter’s discussion. First, we do not claim that social enterprise, or market-based models more generally, will provide all of the solutions to the main health challenges that India faces. Our research does suggest, however, that an increasing range of health services for the poor and underserved can be delivered through models that also allow for sustainable financial profits. The extent of the opportunities for social enterprises will depend on policy investments and choices that are made – in particular about health finance, procurement in the public health system, training and certification for health workers, and public information campaigns that affect health literacy. However, the sheer pace of technological change in healthcare devices, diagnostics and supporting information technology infrastructure will certainly open up new opportunities even in the most limiting of policy environments.

Second, we do not claim that entrepreneurial and private sector activity will always contribute positively to the healthcare system. All approaches – public sector, philanthropic and private market-driven approaches – have their strengths and weaknesses. The information asymmetries between patients, caregivers, financiers and providers of drugs, diagnostics and treatment devices are particularly acute in healthcare. This poses significant complications for headlong rushes into the market. Low-cost diagnostics, for example, can be an important tool for doctors seeking to provide efficient, effective care but they can also become a lucrative service for companies that prey on patients’ heightened awareness of the possibilities and consequences of disease.

Third, we cannot predict the future nor deliver a list of ideas or enterprises to invest in today. If we could, we would do it ourselves right now. We do not know what combination of pathways discussed in the critical factors chapter will play out, or which of the scenarios discussed in the previous chapter will be most descriptive of the actual events that will unfold over the next half-decade. This chapter seeks to bring some of the general visions of the possible futures down to specific opportunities for business models that address the needs of the poor and underserved, but the opportunities are, in the end, contingent on events. It is a starting point for making sense of current events and their implications, not a conclusion.

As discussed throughout the report, there are several driving forces that shape emerging opportunities. First, rising household budgets for health. Part of this is due to rising per capita incomes: the lowest-income Indians are still very poor, but less poor than they were a decade ago and ideally this trend will continue. Public investment in universal healthcare through government facilities and expanded, more effective, insurance cover is emerging more slowly than many had hoped, but the drive to reduce leakage in existing health budgets may shift resources towards goods and services that can demonstrate their contribution to the health system. It may also spur more
investment in health information systems and workflow management, a potential market for information technology entrepreneurs as well as a foundation for other impact business models in the future.

Second, science is progressing. We know more in general about disease symptoms and progression, treatment options and underlying human biology every year. As the cost of genomics profiling drops, we are likely to learn more about individuals’ and populations’ particular physiology and be better able to understand risks and predict their responses to treatment. These advances in the understanding of disease and treatment options also require ongoing investments in health literacy and education to ensure some degree of patient agency.

Third, India’s commitment to technology innovation, including the ecosystem for financing and otherwise supporting entrepreneurship is maturing. Conditions for entrepreneurs working in healthcare in India, from the established pharmaceutical sector to those in the nascent manufacturing of devices and diagnostics, appear to be improving.

Finally, the information revolution is transforming medical systems around the world by enabling specialists, healthcare workers, financiers, communities and individuals to know more, faster and in more remote areas. While India’s information technology infrastructure — the pipelines for data flow to its farthest corners — is evolving slowly, there are multiple non-linearities possible within the horizon of this report. Slowly but surely, key attributes of people, their networks and their environments are moving into the digital realm and this, in turn, opens up opportunities for new business models. These developments expand the potential scope of healthcare, but also raise new questions about the appropriate use and ownership of the information about individuals.

Throughout this report, our underlying questions have been: How to improve and broaden access to care? And what are some of the opportunities where there is potential for market-based models to contribute?

Our research and consultation identifies several broad areas for impact-focused businesses to shape and/or find opportunities in the evolution of the health system. First, expanding the scope of care. Advances in diagnostics, for example, open up new treatment options by enabling earlier detection of anomalies and, correspondingly, potential demand for products and services that help avoid or cure serious illness. Preventive health services may also find new markets as public and private providers of health finance become more cost-conscious, individuals become more aware of the relationship between these investments and their own well-being, and the gains from prevention become easier and/or less costly to quantify. Mental health services, a domain of growing interest, focused funding and more quantified costs and benefits of treatment around the world, is another potential growth area.

A second potential avenue of opportunity is to expand people’s participation in care. Patients are potentially motivated sources of information about their health and risk factors, informed advocates for quality, and even collaborators in treatment. Engaging patients in the supply of medical care could not only mitigate some of the shortages of healthcare providers, but also contribute to a more robust bulwark against fraud, abuse and misuse of medical information. The challenge is to build a public information environment that supports health literacy and
regulatory safeguards for consumer protection that acknowledges the limits of patient expertise. The technology tools for people to learn from their social networks and broader online communities exist; the challenge is to empower people to use these and effectively filter information. Some of this information management will rely on state and philanthropic support, but the changes in practice also create opportunities for support services to government and non-profit providers. Health information services as well as initiatives to improve the metrics around quality of care, for example, are likely to find customers among groups focused on ensuring value for money in healthcare.

Third, there are opportunities to *improve access to care*. One route is through medical technology innovation – developing lighter, smaller, cheaper devices for diagnostics and treatment that can extend the kinds of services now available in urban areas and larger secondary/tertiary hospitals to smaller, more far-flung clinics or even homes. A second route is through supporting access to health finance, as stand-alone ventures or in collaboration with emerging state and national government initiatives. As in other opportunity areas, the transformation of healthcare finance also opens up opportunities for support services ranging from data aggregation to patient support to risk analytics that leverage the growing information base on everything from environmental risks to patient profiles.

Fourth, the ecosystem for innovation for low-cost medical care is still developing. There is more consensus on the gaps than on the means to remedy them, and the ecosystem will require continued philanthropic support to enable new approaches to be explored. But, just as the broader social enterprise ecosystem has transitioned from a donor-supported model to one that also includes financial investments and portfolio-level strategies for generating financial values, so too may the healthcare ecosystem. The scale of demand for healthcare and the clear economic benefits of improving health suggest that it will, even if it takes some time for the returns on health investment to be appropriable in a way that supports market-based models.

**From Health To Wellness, Care To Ecosystem**

Many opportunities exist for social enterprises to help extend delivery models to include preventive health and early diagnostics. Changing demographics and growing incidence of diseases mean more Indians are seeking healthcare. The current system can’t possibly cater to them all, nor can all Indians afford the related costs. This creates an urgent need to reduce the demand for healthcare by preventing problems before they begin.

Preventive healthcare and early diagnostics have traditionally been viewed as areas for public or philanthropic interventions. Effective programmes in countries such as Cuba, Thailand and Brazil, for example, have achieved this at the primary care level by offering universal access to health promotion and prevention programmes. Health screenings, health education and programmes are delivered through a network of expanded primary care clinics, each with a strong community engagement component. The results are improved country health indicators, mitigated disease burdens and reduced overall costs for patients.

With increasing ability to quantify the returns from preventive care, however, as well as greater population awareness of the value of prevention, some of these opportunities for impact may also become opportunities for business.
Preventive Health & Early Intervention

Preventive health and early interventions have traditionally been seen as activities for public or philanthropic concerns due to the difficulty of assessing the individual impact of averted illness. This calculus changes as patients themselves become more aware of the value of avoided illness. Competition among private healthcare financiers also generates harder budget constraints, as does tighter or more tightly enforced regulation that prevents ‘easy’ ways of limiting costs through discrimination or denial of coverage on technicalities. Services that support value for money also become more valuable as funding for public health insurers or care providers becomes performance based. In short, preventive healthcare is one of the most cost-effective ways to lower aggregate healthcare costs. This broad need turns into a market opportunity as soon as these savings can be measured and claimed.

Several potential growth areas in preventive health include:

- More accurate early-use diagnostics for chronic conditions (e.g. diabetes) as well as diseases for which treatment complexity escalates substantially with disease progression (e.g. cervical cancer).
- Molecular diagnostics for precision medicine and more focused, targeted treatment should be looked at as a slightly longer-term opportunity for entrepreneurs, but certainly on the horizon. Market forecasts for molecular diagnostics are substantial, and costs are dropping rapidly. Pune-based Genepath Dx, for example, has already started to focus on the mass Indian market, with a commitment to provide ‘accurate, reliable, rapid and affordable diagnostics that are relevant and actionable’.1 One of the challenges will be to integrate this new information into existing systems for delivering care.
- Tools for managing information and aggregating inputs from various sources to spot risk factors, patterns of disease progression, or otherwise inform effective preventive health. Insurance companies seeking to expand business beyond the crowded higher-end customer base to offer products to lower-income households and larger employers are a potential customer base for these kinds of analytics platforms. State and national governments are also emerging as a potential market as they seek to meet more health demand with smaller financial outlays, though changes in procurement norms will be required before these are viable clients for small enterprises seeking to support ‘smarter’ public healthcare.

As discussed earlier in the report, social entrepreneurs can affect both the demand and supply for early diagnostics as well as shape market dynamics. Mumbai-based Pathdoor.com, for example, enables comparison shopping among diagnostics labs in several cities in India.

Diagnostics

Social entrepreneurs may also find opportunities in integration of diagnostic tools with information systems and healthcare providers’ operations. Medical devices for monitoring or diagnostics are generally stand-alone today, but once they become networked and are able to communicate patient information to providers, new healthcare models can be built that integrate these data with back-end intelligence and higher capabilities for analytics. Smartphones are an ideal platform for diagnostics and monitoring, not because of the advanced functionality they offer, but due to the fact they have become so widespread that the cost of the device is minimal in comparison to specialised medical technologies. Attachments to the phone or applications on it can turn smartphones into medical sensing devices.

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1. Pathdoor.com is an example of a social enterprise that offers comparison shopping for diagnostics labs in several cities in India.
Screening for communicable diseases is another area for entrepreneurs to watch (or participate in) over the coming years. Significant grant funding is going into research and development for diagnostics for diseases such as typhoid, tuberculosis, malaria, dengue fever and hepatitis B & C. Grand Challenges Canada, for example, identifies critical barriers to healthcare in the developing world, and provides grant funding to innovators tackling these. Of the 49 Indian innovators they have supported, three were in POC monitoring (two maternal health, one glucose monitoring), and 18 were in POC diagnostics. Of the POC diagnostics, 13 were for communicable diseases (TB, leishmaniasis, rotavirus, HIV, pneumonia and elephantiasis).

The infrastructure for designing indigenous POC tests is emerging. It has two aspects: first, to design processes related to molecular biology and biochemistry to perform the test with acceptable sensitivity and specificity; and second, to design devices and instruments that will provide a platform to carry out the tests in a POC setting. The first aspect requires high-end facilities to carry out basic and translational research in human disease biology. While some private companies have established such facilities, much of this research in India is being carried out in research centres and institutes due to the nature of research and resources required. Some notable institutes involved in such research include Rajiv Gandhi Centre for Biotechnology (RGCB) located in Thiruvananthapuram, International Centre for Genetic Engineering and Biotechnology (ICGEB) – India section located in New Delhi, and Centre for Cellular and Molecular Platform (C-CAMP) located in Bangalore.

The second aspect – designing of new devices and instrumentation for POC testing – is where more and more entrepreneurial efforts are noticeable in India. For example, Bigtec Labs located in Bangalore leverage expertise in the areas of micro electro-mechanical systems (MEMS) and handheld electronics, genomics and proteomics, biology and chemistry to develop microfluidic devices and lab-on-chip technology. These technologies can be used to develop platforms capable of performing sample preparation, complex biochemical reactions, and sample screening and detection on a single chip. Molbio Diagnostics recently launched a real-time micro-PCR (polymerase chain reaction) system named TrueLab™ capable of conducting rapid, microchip-based real-time, quantitative tests. From sample preparation to the final reporting, these tests can be conducted in less than one hour. The system is portable, lightweight, and can be operated on a rechargeable battery. Achira Labs, a Bangalore-based company started in 2009, is developing technology platforms to perform rapid, quantitative and multiplexed immunoassays at a low cost. The first technology platform of Achira Labs comprises a microfluidic chip and a reader, and is targeted for the diagnosis of disorders associated with thyroid or female fertility. Achira Labs recently won the Grand Challenges Canada award for their idea of developing a fabric diagnostic chip (‘Fab Chips’). This highly innovative way of making diagnostic chips using silk fabric allows the production to be easy and very scalable. Fab Chips are targeted at applications such as those used in public health initiatives.

Widespread use of low-cost medical monitoring and diagnostics may also generate new healthcare delivery models. San Francisco-based start-up Cellscope is one illustration of the possibilities. The company is designing an array of innovative optical attachments for smartphones, which could be used as a ‘digital first-aid kit’ to capture quality data for remote diagnosis by a doctor. Their first commercial product, called CellScopeOto, allows visualising and capturing images of the inside of the ear by converting the phone into a connected digital otoscope. This example belongs to a growing list of initiatives where data in the form of text, numbers, audio and images are being used to provide healthcare services remotely. MicroX Labs and Vectordoc, two start-ups supported by Villgro Innovations Foundation, are also signals of emerging broader opportunities. MicroX, incubated at the Indian Institute of Science, Bangalore, provides low-cost point-of-care diagnostics and Vectordoc uses analytics to help
focus expert attention in low-resource settings. The ReMeDi kit developed by Neurosynaptic Communications is another application that allows for remote health monitoring.

There are other niche markets for innovations in diagnostics that are likely to achieve social impact by improving their accessibility to low-income individuals. First, technologies suited for new markets. While most of the big players cater to populations largely in metropolitan areas, they are also looking at expanding their presence to Tier II and III cities, large towns and even to rural areas. Considerations for selecting appropriate technologies are different in these settings. Technologies that are low cost, robust, less demanding on infrastructure, and do not require highly skilled operators are preferred in these settings.

Second, innovations that reduce the need for and complexity of transport of samples. The hub-and-spoke nature of working models requires transportation of large number of samples from satellite laboratories and collection centres (spokes) to the main hubs. Technologies that can facilitate transportation of samples under conditions prevailing in India may need to be developed. The hub-and-spoke model also requires a strong Information and Communication Technology (ICT) support for easy and timely transfer of data back and forth between hub and spokes. This has important implications on the overall efficiency of the whole model. Innovative ICT solutions can also be of great value to expand services in larger geographic areas.

Mental Health

As mentioned in other sections of this report, addressing mental health issues is an important need: most mental health cases go untreated in India. The open question is whether this need can be met through market-based models.

Within India, mental healthcare for low-income individuals has traditionally been provided by public and philanthropic organisations, often with substantial involvement of community and lay workers. These have helped demonstrate possibilities for delivering cost-effective care, even in settings with limited formally trained expertise available. For example, well-received studies and programmes, including the Raipur Rani and Sakalwara projects in the 1980s and 1990s, and, more recently, the MANAS intervention and COPSI trial, demonstrated that mental health can successfully be delivered at the primary care level through a ‘stepped care’ approach, which relies heavily on lay health workers. Organisations such as Banyan in Southern India are increasingly developmental in their mental health approach, working more closely with communities and community systems as well as the families of those with mental illness. Other organisations such as Sangath have extended into communities by developing easily scalable treatment packages and lay health worker training materials.

Shifts in social attitudes increase the possibility that willingness to pay will at some point exceed the cost of delivery of mental health services. Attitudes towards mental health appear to be changing in ways that evoke the recent shift in attitudes around elder care. Care for older people has traditionally been regarded as a family obligation, with limited acceptance of commercial models except for specific treatment. This has shifted in the last decade (in part out of necessity as more families live separately for economic reasons), and elder care is one of the growing areas for health services. Similarly, stigma and lack of awareness may contribute far less to treatment gaps than traditionally thought. No hard data exist, but several experts we spoke with say that they see great willingness and reduced resistance on the part of insurance and other companies, healthcare providers, communities and individuals to treat mental illness in the same way as other illness.
Expanding Peoples’ Participation In Care

We discussed the importance of extending primary care systems to include preventive care in earlier chapters. Importantly, these can also be extended to help enhance patient agency by improving health literacy and stimulating healthcare seeking behaviour through strengthened community engagement programmes. We are still learning about the cost-effectiveness of behaviour and cultural change (BCC) initiatives, but some areas such as maternal health and family planning seem to be clearer than others. By contextualising programmatic interventions to cultural and social settings of the target area, initiatives in these areas have had a pronounced impact on health outcomes. Using a randomised experimental pre- and post-test design, BCC was integrated into an existing government programme to improve knowledge and use of post-partum contraception in Meerut, Uttar Pradesh; results revealed that pregnant women in the intervention group had greater and correct knowledge about birth spacing methods as well as a higher likelihood of using a contraceptive method (especially modern contraceptives) than pregnant women in the control group. The experiment engaged mothers-in-law or the oldest female family member along with husbands, and other male members of the community as well, and educated them about maternity care.

Similarly, a cross-sectional study of married women of reproductive age in four rural districts in Bihar and Jharkhand revealed that women who were exposed to (safe) abortion messages were more likely to be favourable towards the same. The study also found that in the rural settings in Bihar and Jharkhand, these women were difficult to reach and hence the need to involve other members of the community (usually community leaders and influential individuals) who can then pass on the information gained to the women. These illustrations show the importance of social structures in health decision-making. For maternal and childcare decisions, the mother-in-law and/or the husband have a say in the health practices of the pregnant woman and the newly delivered child. Hence it becomes imperative to provide a conducive environment for the women by ensuring that campaign activities (and interventions) are directed towards mothers-in-law and husbands (and if necessary, influential community members as well); in this way, their knowledge and attitude towards health practices could directly translate into better health outcomes for the women and children in their household.

More broadly, a systematic review and meta-analysis of randomised controlled trials in four countries (including India) revealed that participatory learning through women’s groups was a cost-effective strategy (by WHO standards) in improving maternal and neonatal health in low-resource settings.

Such initiatives are currently non-profit or publicly led, but are not obviously different from businesses’ use of ‘village level entrepreneurs’ who stimulate demand, create product awareness, and fill last-mile value chain gaps. There is always the potential for these initiatives to go awry by promoting some treatments or drugs over others, particularly when they are part of a commercial endeavour, but this risk can be mitigated by public, private and philanthropic investment in health literacy as well as (for social entrepreneurs) adequate due diligence from incubators, impact investors and other funders.

Some noteworthy examples of community outreach in social enterprise settings can be found in the Sugha Vazhvu and Aravind Eye Hospital programmes, where a significant proportion of resources go to community engagement. A main Aravind Eye Hospital goal, moving forward, is to strengthen community engagement and increase numbers of rural care centres or ‘vision centres’. The goal here is to create healthcare demand, stimulate a need for curative care and create awareness — all of which directly improve patient agency that is likely to extend to other interactions with the health system. Activities include counselling, community screenings and house-to-
house geo-mapping of catchment areas. This information is also potentially valuable as market insight for health entrepreneurs, as it can feed into databases that allow for healthcare system optimisation and patient satisfaction, and reveal insights such as how distance to facilities affects healthcare seeking behaviour. Along the same lines, there is room to strengthen community health worker roles using ICT interventions such as mobile phones loaded with data to track health and monitor problems and medical compliance.

Quality of Care

The world of demand-side health finance and increasing competition for patients as well as accountability for funding means that healthcare providers are under increasing pressure to demonstrate their efficiencies and efficacy – all of which may be processes outside of standard management metrics. Social entrepreneurs who support due diligence through systematic metrics and protocols may find a profitable market for their services, in addition to contributing to stronger incentives for quality care. At the time of writing, we did not see any examples of healthcare focused quality monitors, but the level of investor interest in Tracxn, a Bangalore-based research firm specialising in start-up due diligence suggests possibilities as health-related ventures expand.

Social entrepreneurs may also find markets for protocols, or forms of expertise that help supplement personnel training or enable less trained people (even the patients) to diagnose and treat some health concerns. There is a public system for creating standards, and many may come from university and government supported entities, but the translation of these guidelines into actionable organisation modules that support healthcare providers’ compliance with regulations or conditions for funding is potentially an entrepreneurial activity. Protocols are currently developed internally by social entrepreneurs, but these also may be ‘franchisable’. Innovative programmes such as those being implemented at Sugha Vazhvu have developed strict protocols for health workers to follow. Back-end teams or statisticians constantly review health worker decisions and diagnoses for accuracy, and feed these back into protocol updates. Protocols are particularly helpful for expanding and guiding the role of ASHA or AYUSH workers. Glocal Hospitals, for example, describes themselves as protocol – rather than physician – driven.

Inform and Empower: the Patient Perspective

Another angle for social entrepreneurs to explore is personal health tools that empower patients to track their own health issues over time using data portals that aggregate reliable medical information so that patients can be more informed about healthier behaviours. Start-ups like WellnessFX™, Cake Health and VitaPortal are prime examples of these. Ideally, some of these applications would use mobile phone platforms to ensure greater reach. At scale, anonymised data streams from these can also feed predictive analytic platforms to gauge efficacy and quality of care by provider and location – a knowledge product with a market among healthcare consumers and financiers.

Over the last few years, unique innovation models have emerged that attempt to create sustainable business models that blend consumer healthcare needs and leverage a variety of data streams. PharmaSecure is one such example. A US-based company with offices in India, this mature start-up works with pharmaceutical companies to print unique, randomly generated codes on medicine packages along with a phone number. The patient or customer can send the unique code by an SMS or text message to a given phone number, to verify whether or not the medicine is genuine. PharmaSecure has sold over 800 million codes so far to help identify genuine or counterfeit drugs. The same technology platform also enables low-cost, two-way communication between the consumer and the drug manufacturers. Drug manufacturers can get consumer-level intelligence about medications, as well as
drug utilisation patterns, persistence and adherence to medication, and so on. PharmaSecure is working with the Bill & Melinda Gates Foundation on a Grand Challenge to try to improve patient adherence to tuberculosis (TB) treatment. What is so compelling about PharmaSecure is that it offers value propositions to multiple stakeholders (from direct consumers to pharmaceutical companies) throughout the value chain of healthcare delivery.

**Expanding Access To Care**

Social entrepreneurs in health often seek impact through expanding access to care: by establishing care centres in areas others have avoided, cutting costs through business model or technology innovation, and relieving human capital and financial constraints, among other activities. These activities are still very much needed, and the possibilities for expanding access have multiplied.

**Human Capital**

The perennial challenge of filling the gap between healthcare workers required and those that exist creates three kinds of social enterprise opportunities: capacity arbitrage, teaching, and reducing the skill required for any particular diagnostic or treatment.

*Capacity arbitrage* becomes possible when there are areas with large numbers of skilled workers in one place but not another and there are some means to transfer the capacity, if not the people, from one to the other. Telemedicine provides such a means. Doctors and nurses may prefer to stay in urban or higher-income areas as discussed earlier in the report, and access to medical care in rural areas suffers. However, their insights and expertise can be shared through telemedicine.

To many, ‘telemedicine’ means a videoconference between patients and doctors, or doctors and specialists, the kind of activity that will grow as broadband becomes more common. Most tele-health activities today, including awareness, counselling on health-related matters, checking compliance to seek care, screening and early detection, and diagnosis and consultation itself fall in this category. Some providers are public: DISHA-1056, a 74-doctor, 24 x 7 helpline on physical and mental wellness, for example, is a joint venture undertaken by National Health Mission (NHM) and the Kerala Government Department of Health and Family Welfare. Others are foundations: the Apollo Telemedicine Foundation, for example.

But there are signals of potential markets for social entrepreneurs to join the industry and expand the range of approaches. The Apollo Telemedicine Foundation, for example, has collaborated with a telemedicine provider to offer video-based telemedicine designed by Resilience Labs (formerly known as CIRM Labs) to the members of the urban microfinance institution Equitas. This service to a private limited company signals a potential broader shift.

Initial overhead costs and infrastructure can be substantial and must then be maintained: Does the network have sufficient bandwidth to support high-resolution, multi-point videoconferencing? The capital costs of the initial infrastructure for telemedicine are decreasing over time, lowering entry barriers. Ongoing improvements need to be made in video compression, storage, indexing and access capabilities, including options for wired and wireless video transmissions for higher-definition streaming, which will all contribute to this trend. Still, doctors who conduct
remote diagnostic consultations are accustomed to working around lags in the network and low-resolution images by using lower-fidelity techniques or requesting that imaging and lab results be sent to them separately.

**Figure 1**
Tele-health Information Session

(Source: Apollo Hospitals conducting a tele-health information sessions for communities in Tamil Nadu.)

In the spirit of frugal innovation, it is getting easier to patch together free and commercial tools to accomplish their tasks. Narayana Hrudayalaya, for example, switched from the use of satellite communications to using Skype for tele-consultations, with the result that each physician can potentially reach patients across India, Pakistan, Afghanistan and the Middle East with greater ease, without having to do extensive hardware installations or maintain the software.

Finally, successful telemedicine depends on a lot more than data transfer – the challenges of optimising human resources, for example, presents opportunities for social entrepreneurs to find a competitive edge. Tele-consultations are especially useful in providing tertiary care support for patients at the secondary healthcare level. When it comes to primary and preventive care or catering to larger populations, however, access to specialists and doctors may be more intermittent. Resources need to be organised and scheduled well in advance: Which doctors are available at what times? What are the backup plans in case one part of a fragile network drops out? How can provisioning for failure be kept to a minimum while maintaining service quality?

Similarly, organising various streams of data flows can also affect competitiveness. Tertiary care teams can also use tele-health infrastructure to regularly review patient cases with ASHA workers, offer advice about post-operative care, answer questions and share information about medications and test results, coordinate medical clinics in regional areas, and so on. But all of these streams of information must be coordinated.

Can social entrepreneurs develop portals that connect tertiary with primary healthcare centres? The overarching opportunity for innovation in this space is to improve data liquidity between systems. This might range from developing interoperability between systems to discovering ways to aggregate current data and medical histories about patients from their test results, data feeds off monitoring devices, self reports and other
sources. The more quickly and seamlessly physicians and medical professionals can access and review layers of relevant information (or data that is often buried in the patient record), the easier it may be to develop accurate diagnoses during tele-consultations. Ideally, front-line workers with greater proximity to and responsibility towards patients in low-resource settings, will be included in conversations regarding continued care.

While a widespread adoption of telemedicine depends on ease of use, access to tools and adequate infrastructure, we should not assume that online interactions simply replicate face-to-face consultations. Visual diagnostics and multi-sensory clues that experienced doctors usually rely on to understand a patient’s state, such as gait, body posture, tone of voice, respiration and eye contact among others, will be harder to gauge online.

**Deskilling health delivery**

Deskilling health delivery is another big challenge, and a perennial opportunity – trying to optimise efficiencies by dividing activities up into simpler tasks and using different resources to complete those tasks. In the next five years, the opportunities for task-shifting may arise between appropriate personnel, software algorithms and automation. Already, medical laboratories are automating diagnostic tests so they can increase the processing speed and volume of tests and quality control, while reducing the chances of contamination and human error. In India, immediate opportunities for innovation include workstation automation in clinical labs (rather than automating entire diagnostics labs which is far more expensive) and miniaturisation.

Swasth India\(^3\), an urban healthcare clinic model, leverages a different kind of capacity rationing. Presently, their clinics are based in informal settlements in Mumbai and other locations. Their model provides clean, integrated health clinics located in highly visible areas, (in close proximity to shops that people use frequently, for example), but limits availability of medical professionals to particular times of the day and evening, which helps to reduce costs of doctors. They also rely on branded generics to reduce the overall cost of medication for patients.

A third opportunity area for social entrepreneurs to address is the growing deficit in human capital across the healthcare sector. Here, we highlight a few compelling areas for innovation in medical education and practice that can be accomplished in the near term. Ideas to explore include educational tools to enhance medical skills and knowledge; new partnerships to boost vocational training; diverse portfolios for point-of-care diagnostics; and applications to improve patient health behaviours.

Social entrepreneurs with an interest in educational tools have ample prospects to design medical education for the future. In the last five years, open education has transformed pedagogy and the ways in which we teach and learn. High volumes of digital content, instructional materials, tools and videos are now accessible to anyone around the world with an Internet connection.

India has the second highest number of users of Massive Open Online Courses (MOOCs) worldwide. With changing business models, universities and companies no longer need to offer material for free. Online educational courseware aggregators like Coursera or Udacity offer short certification courses for a fee, and are exploring new models of payment for professionals who teach online. The future of digital education, however,
is not simply virtual, but uses blended learning frameworks integrating digital content for self-directed and peer-based work in the classroom.

Social entrepreneurs could also leverage open educational resources to build peer-based learning platforms for medical colleges. Perhaps these platforms can enhance traditional clinical skills instruction by encouraging new competencies in translational research, data analytics and simulations. New digital training laboratories with computer simulation tools could vastly improve what medical students retain, and help them to put into practice what they learn in traditional lecture halls. Today, medical simulation tools are used to train students in various surgical procedures, including dissections using high-resolution anatomical images, and even to simulate the response of pathogens to antibiotics at a molecular level, instead of using live animals.

Tutoring programmes for medical college entrance exams can also be built, at scale. At the secondary school level, students may find new digital content about medicine, dentistry and nursing increasingly compelling, and develop an early interest in the biomedical sciences, which eventually draws more students into medical professions. Digital content can help to streamline courses for certification and recertification over the career of a medical practitioner. Skills training can be extended to vocational schools as well, building a future pipeline for jobs. In sum, MOOCs and open education platforms, peer-based tools and digital media have unlocked radically new avenues for lifelong learning. There are any numbers of opportunities to apply these to the healthcare sector in India.

Two new needs for education stand out in particular. As the volume of electronic medical records increases, there is a corresponding need for trained data entry jobs, where systematic and longitudinal data can be captured about patients when they visit primary and secondary care centres. The second is health IT training to maintain the physical and communications infrastructure at primary healthcare centres and health sub-centres. There is a strong role for PPPs and further government investment in vocational training that targets job creation in healthcare.

Any number of the significant challenges in medical education and training today might inspire innovation to strengthen and expand human capital for the future. As business models shift, we may well see a corresponding shift from educational training to retraining, reskilling and ongoing learning throughout people’s lives.

Insurance & Financing

The anticipated spread of private and state-supported health insurance and demand-side finance would not only expand the market for health services, but also generate new avenues for business-to-business ventures. In terms of the provision and administration of health systems, there is a clear role for Third Party Administrators (TPAs) to play in rural areas. For instance, in Karnataka, a rural TPA, Sudhanand Health Care services, provides insurance services to Grameen Koota, a microfinance institution’s member base. It networks and empanels hospitals and pre-authorizes hospitalization cases and costs. This is a natural path for BPO start-ups that already have a data-handling back-end and could add health expertise while maintaining BPO-like cost structures.
TPAs’ services (client identification, hospital facility quality assessment based empanelment or de-empanelment, setting pre-authorisation process for claims with insurers, cash management of payments to hospitals and archiving of claim papers) are also important for the functionality of health finance for low income India. They will be critical to insurers as they bring not only historical data, and on ground operational team, but also loyalty and technology alignment of health service providers. Indian has only 31 TPAs.14

Similarly any move toward more comprehensive medical records including histories would create opportunities for social entrepreneurs, much as digitization of government records created a new cadre of local technologies and tiny enterprises. Digitisation as a business started with E-Bhoomi in Karnataka and expanded with voter lists, followed by the National Rural Employment Guarantee Scheme (NREGS), and financial inclusion initiatives in rural areas. FINO, a banking correspondent, for example, earns a substantial share of its revenue from government transfers, NREGS, and No Frills Account creation efforts. There are potential similar businesses for health finance - RSBY card issuance is an important source of revenue for FINO. New entrepreneurs may find opportunities to enter this space to offer additional client benefits (e.g. enrollment with health checkups, health status reports) even as existing digitization agencies move into the new business line.

Building The Ecosystem

In the absence of naturally developed university-based innovation ecosystems, India needs to fund efforts to form ecosystems through collaborations across different institutes within universities as well as outside of them. India has world-renowned research and teaching institutes in various disciplines. The challenge is to bring these disciplines and practice areas (academic and other) together. At many universities overseas, different departments, research centres, institutes and even start-up companies are housed on the same campus. They form multi-disciplinary ‘ecosystems’ that foster innovation through dialogue and close collaboration between students, researchers and academics from different disciplines. Geographic proximity enables these interactions where a cross-fertilisation of ideas can occur right from the start of an undergraduate programme.

This cross-fertilisation is essential. Take medical devices, for example. Most of these technologies will require some combination of technology, design and business inputs. Technologies have to be robust in the most challenging of settings, including lack of consistent electricity (popular models include solar-powered products or manually operated machines) or portability (which is largely driven by the mobile health movement). They also have to be user-friendly: less invasive, easier to use, and require less training or certification to enable lower-skilled healthcare workers to perform a test or administer a treatment. Building and sourcing in ways that bring down the cost of the device is also important. Some designers are utilising 3-D printing for ‘lean experimentation’ and ‘quick failures’ – rather than conceptualising a design, putting it on paper, sending it off to a manufacturer and waiting one to two weeks for a prototype, by having a 3-D printer onsite, multiple design iterations can be realised in a day using cheaper materials. Innovators are also finding creative ways to identify lower-cost suppliers or to manufacture critical pieces on their own, within India, to bring down the bill of materials.

In addition, across the set of entrepreneurs that we interviewed through this research, certain patterns emerged which could also be seen as opportunities for business to business services or, at the very least, contributions to the ecosystem. Most social entrepreneurs faced the following challenges in growing and scaling their businesses:
• **Talent** – Some start-ups are successfully hiring technical talent, but still reported spending considerable time and expense trying to recruit students. It takes a great deal of effort to convince students of the benefits and flexibility of joining a start-up rather than pursuing a corporate career. Hiring business experts is even more difficult, as few graduates are willing or able to forgo a corporate salary, even when these companies offer equity to employees. Founding CEOs, who typically come from a medical or engineering background, find that at a certain point, their administrative duties become so overwhelming that the innovation so core to the business begins to suffer. Similarly, many innovations developed through universities or research institutes often have a lack of business resources to bring a product to market, and thus only a handful of innovations ever make it out of the research hub. One such success story exemplifies multi-disciplinary and multi-cultural collaboration: San Francisco based OneBreath, is a portable ventilator developed by Matthew Callaghan, an MD from Stanford’s Bodesign program, who brought on board Bangalore-based Vijay Simha, to serve as CEO of the company.

• **Distribution** – With a nascent private system for healthcare and an opaque public procurement process, entrepreneurs reported challenges in finding distribution channels. These challenges may subside, however, if increased public funding channelled through patients expands the reach of private chains. Similarly, the ongoing changes in the public system may also streamline procurement and open public health infrastructure as a viable distribution channel.

• **Mentoring** – There was a universal sense of a shortage of mentors. Impact investors or incubators who are able to crack this, to find champions in the ecosystem and links to highly respected doctors in regions, may find themselves attracting and building more successful social impact start-ups.

• **Product Design and Testing** – There may be opportunities for business models to emerge around access to product design and testing facilities. Often these require a certain scale to be profitable; the challenge is how to offer small portions of the infrastructure to entrepreneurs as a service model.

In the end, there is no substitute for being ‘in context’ to spur innovation to meet the needs of low-income Indians. Take the example of Biosense, a Mumbai-based early-stage company developing low-cost diagnostics. The company was faced with a price constraint – the cost of their kit, and thus the payback period to their customers, depended on the price of the expensive and imported urine strips that test the albumin to creatinine ratio (an important marker in detecting kidney and cardiovascular diseases). The standard strips used by most labs cost ₹85 per strip. In order to bring the cost of their tests down, the team at Biosense developed their own strip at half the price, bringing the cost down to ₹40 per strip. In addition to the cost challenge, Biosense found that they were receiving multiple complaints about the smell of urine in the van during an initial deployment of their product with Wockhardt Foundation for use in their mobile vans. The kit offered by Biosense contained a cup to receive samples, which would sit open in the van while the test was being conducted. Doctors would avoid conducting tests in order to avoid working all day in a hot van smelling of urine. The team is now working on a solution to the problem, but these types of design challenges may not have been discovered, or may have only been discovered later, if the product had been developed overseas where such an issue may not exist.
In September 2013, Medtronic, a US-based leader in medical technologies such as cardiac and diabetes products, announced a partnership with Apollo Hospitals to develop a lower-cost dialysis system that is specific to the challenges in India. Medtronic recognised that India is a very large potential market, and they strategically chose a local partner to aid in the development. This is the first time Medtronic has developed a product in India, and they are relying on Apollo for clinical insights, as well as establishing their own local R&D team. Typically, dialysis in India occurs at a hospital or a centre that specialises in dialysis, but with the emergence of home healthcare trends that are successfully bringing down the cost of care while improving accessibility, Medtronic saw an opportunity to create a portable device specifically designed for the unique delivery models emerging in India. Other enterprises, large and small, are following suit.

The challenge before us is to accelerate these developments.
**Endnotes**

1 http://www.genepathdx.com/


5 Retrieved from https://www.cellscope.com/


11 Direct to Consumer marketing of pharmaceuticals in the United States, for example, has often been criticised and there are regulations on the content of advertisements.


13 http://www.swasthindia.in


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