Global Healthcare Trends and the Transformative Future of the Industry

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Dr. Zubin J Daruwalla, MBBCh (Hons), BAO, MRCSI, MCh (Orth), MMed (Orth)

Director & Healthcare Lead, PwC South East Asia Consulting
Agenda

Regional outlook

Global trends

Transformative future & the importance of innovation and collaboration

Challenges

An ode to the future
“We are living in one of the most transformational times in human history...”

Change²

- Futurist, Gerd Leonhard
Regional outlook of the healthcare industry
Public and private healthcare spending are growing in Southeast Asia as demand for healthcare services increases across the region

Market Drivers

Adoption of Universal Healthcare
- Healthcare is a priority sector across ASEAN
- Public spending growing as the demand for accessible healthcare increases
- Private sector playing a greater role due to under-developed public healthcare system

Expanding medical tourism
- Singapore, Malaysia, and Thailand’s private healthcare players offer quality medical services to patients from all around the world
- Singapore is a regional hub for surgery, medicine and specialist services
- Malaysia and Thailand have attracted tourists looking for affordable healthcare

Increasing penetration of medical devices
- Current penetration of is low but market sale is expected to double by 2019 to US$9bn
- Inexpensive medical devices, such as prosthetic and diagnostic tools are researched and manufactured in the region for the region
- Lack of domestic competition in the region

Healthcare Spending and Growth

Thailand
- Spending: US$17.9bn
- CAGR: 6.5%

Vietnam
- Spending: US$11.1bn
- CAGR: 8.8%

Myanmar
- Spending: US$1.1bn
- CAGR: 6.2%

Cambodia
- Spending: US$1.3bn
- CAGR: 10.8%

Malaysia
- Spending: US$13.0bn
- CAGR: 4.5%

Philippines
- Spending: US$12.7bn
- CAGR: 8.7%

Singapore
- Spending: US$14.4bn
- CAGR: 7.2%

Indonesia
- Spending: US$26.2bn
- CAGR: 9.6%

Source: BMI Research; PwC Analysis
Increasing disposable income, rising middle class, and ageing populations are driving demand.

*Private consumption (US$ billion)*

<table>
<thead>
<tr>
<th>Country</th>
<th>2014</th>
<th>2024f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>$509</td>
<td>$1,411</td>
</tr>
<tr>
<td>Philippines</td>
<td>$207</td>
<td>$456</td>
</tr>
<tr>
<td>Thailand</td>
<td>$212</td>
<td>$373</td>
</tr>
<tr>
<td>Vietnam</td>
<td>$119</td>
<td>$322</td>
</tr>
<tr>
<td>Malaysia</td>
<td>$169</td>
<td>$320</td>
</tr>
<tr>
<td>Singapore</td>
<td>$113</td>
<td>$207</td>
</tr>
<tr>
<td>Cambodia</td>
<td>$14</td>
<td>$33</td>
</tr>
<tr>
<td>Brunei</td>
<td>$7</td>
<td>$11</td>
</tr>
</tbody>
</table>

*Share of ASEAN households in each income bracket (2010-2025)*

<table>
<thead>
<tr>
<th>Income Bracket</th>
<th>2010</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Consuming middle class</td>
<td>14%</td>
<td>23%</td>
</tr>
<tr>
<td>Emerging consumers</td>
<td>33%</td>
<td>42%</td>
</tr>
<tr>
<td>Basic consumer needs</td>
<td>51%</td>
<td>30%</td>
</tr>
</tbody>
</table>

*Share of population >65 years of age (%)*

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vietnam</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Thailand</td>
<td>9%</td>
<td>10%</td>
</tr>
<tr>
<td>Singapore</td>
<td>9%</td>
<td>11%</td>
</tr>
<tr>
<td>Philippines</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>6%</td>
<td>7%</td>
</tr>
</tbody>
</table>

*Consuming households with income >$7,500 (2030)*

- Vietnam: 6
- Thailand: 10
- Singapore: 14
- Malaysia: 5
- Indonesia: 7

Source: BMI Research; McKinsey Global Institute Cityscope database, McKinsey Global Institute analysis

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PwC June 2017
The outlook for private healthcare in Southeast Asia is thus positive, driven by a high demand for private provision.

**Revenue growth**
Forecasts estimate over 20% growth in revenues for private hospitals in APAC up to 2018

**Private hospital revenues APAC (2012-18) (US$b)**

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>378</td>
<td>467</td>
<td>574</td>
<td>707</td>
<td>844</td>
<td>1,005</td>
<td>1,206</td>
</tr>
</tbody>
</table>

CAGR (’14 –’18)
+20.4%

**Growing demand**
It is estimated that 180m new hospital beds will be needed over the next decade to satisfy demand in APAC, with 40% expected to be fulfilled by private healthcare providers

**Growing demand**

**Rising urbanisation**
An influx of population into the cities, where most of the hospitals are concentrated, will increase demand for services

**Urban population as a share of total population (%)**

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>54</td>
<td>69</td>
<td>79</td>
</tr>
<tr>
<td>Malaysia</td>
<td>69</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>Philippines</td>
<td>66</td>
<td>72</td>
<td>77</td>
</tr>
<tr>
<td>Singapore</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>34</td>
<td>46</td>
<td>52</td>
</tr>
<tr>
<td>Vietnam</td>
<td>28</td>
<td>35</td>
<td>42</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan; The Guardian; PwC Analysis

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Rapid epidemiological transition is also shifting the burden of disease from infectious to chronic and lifestyle-related diseases

Incidence of chronic diseases in Asia Pacific

Source: Frost and Sullivan; Cowen Therapeutic Categories Outlook

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Commitments to regional integration and SEA governments’ aspirations to grow medical tourism have resulted in a relaxation of regulatory restrictions to attract foreign investment, making growth opportunities in SEA numerous.

**Investment opportunities**

- AEC commitments made by Malaysia, and Singapore permit foreign equity ownership in private hospitals up to 70%.
- In Malaysia, there are additional restrictions prescribing a joint venture.
- In Thailand, foreign equity participation is through JV only and limits vary between 51% and 70% (or up to 49%, as long as foreign shareholders make up less than half of the total number of shareholders).
- Indonesia has also raised its ceiling for foreign ownership in hospitals to 67% and opened up access to investment opportunities across the country.
- Vietnam and Cambodia allow 100% foreign-invested hospitals.
- Foreign equity ownership for hospitals is capped at 40% in the Philippines.

**Promoting the healthcare industry**

- ASEAN Economic Community 2015 aims to establish an integrated region and market, with a free flow of goods services, investment, skilled labour and freer flow of capital.
- Healthcare and tourism are two of the priority service sectors targeted for removal of all restrictions by 2015.
- Thailand government policy since 2004 to become the medical hub of Asia.
- Malaysia established the Malaysia Healthcare Travel Council to promote medical tourism and encourage foreign investment.
- Various tax and non-tax incentives are offered across the region, including import-duty exemptions for medical supplies and equipment and work permit facilitation.

Source: Thai Board of Investment; ASEAN website; C. Herberholz and S. Supankankunti ‘Medical Tourism in Malaysia, Singapore and Thailand, Chulalongkorn University, 2013; Wall Street Journal; Manila Bulletin.
Regional outlook of the healthcare industry
Global healthcare trends

“The goal is to turn data into information, and information into insight.”

- Carly Fiorina
  Former CEO HP
At PwC, we have defined what we refer to as the New Health Economy

The traditional healthcare delivery model continues to evolve into an ecosystem of collaborators with interrelated value drivers.

In the New Health Economy, “patients” will be “consumers” first, with both the freedom and responsibility that come with making more decisions and spending their own money. These consumers will demand a continuum of well-being, rewarding the trusted advisers that can help achieve that.

The healthcare industry has been slow to deliver customer-centered value. But the ground is shifting rapidly.
How does the world look today?

Older

- 2 Billion
  people aged 60+ in 2050

Fatter

- ~3 mn
  deaths due to obesity

Sicker

- 60%
  of all deaths due to non-communicable diseases

Source: WHO, UN - World Population Aging Data 2013

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A triple burden of disease: Acute, Chronic and now the Pandemics

Malaria
450,000 deaths a year

Ebola
10,000 deaths till date

1.5 million people died of AIDS related illnesses till 2013

Eradicating 7* epidemics would save a yearly total of 1.2 mn lives

*7 Epidemics include measles, mumps, rubella, filariasis, pork tapeworm, malaria and hepatitis C

Source: World Health Organization

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If diseases don’t kill us, we will kill ourselves!

Forecast loss of output caused by non-communicable diseases worldwide, 2011-30 (in $Tn)

Mental Illness
Cardiovascular Diseases
Cancers
Chronic Respiratory
Diabetes

1 person kills himself every 40 seconds

Source: World Economic Forum, Harvard School of Public Health; Mental Health Atlas; WHO; The Economist

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Mental illness is still a stigma but is being addressed with a number of solutions driven by technology

- What qualifies as *mental illness* and what does not?
- Who gets *treated* and who does not?
- Who finally *pays*?
Doctors are victims, too!

Medical interns have met with depression criterion at some point in their lives

Physicians are facing symptoms of burnout
Fatigue and burnout are not the only reasons doctors are wanting to leave the profession en masse

“Doximity, a professional network for physicians, reported in 2011 that only 68% of Stanford medical students go on to pursue clinical residency, a lower share than all but six medical schools in the country.”


December 23 2015
This exodus could be crippling to the industry

“The platform has more than 23,000 members in 102 countries and has expanded its parameters to include science PhDs.”
Rising healthcare costs continue to challenge national agendas globally

Spend on health is a high % of GDP in many developed countries...

...and has been growing over time

Source: Economist Intelligence Unit, October 2013; OECD Health Statistics 2014
Countries are seeing system pressure points arise from a supply and demand mismatch and silo’d fragmentation
A general move from fragmented to integrated care across the continuum is much needed and occurring.

Healthcare providers have been concentrating here.

Extension of care

Preventative care
Primary care
Immediate care
Specialty visit
Diagnostics
Treatment ancillaries
Emergency care
Inpatient care
Rehab care
Long-term care
Skilled nursing
Residential care
End-of-life care

Source: PwC Analysis

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June 2017
Complexity is now, “Institutionalized,” with ICD 10 having 70,000 ways to get sick, hurt or mortally injured.
Therapies are having deleterious effects

Survival rates are not improving

Aggressive treatments have unforeseen and often devastating consequences

Cancer has a language problem
Emphasis on patient safety has evolved
‘Quality’ care consists of six crucial components...

- Safe
- Effective
- Timely
- Efficient
- Patient-centred
- Equitable

Source: Institute of Medicine, American Hospital Association

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...with ‘safe’ care really being the foundation of care provision

Source: Institute of Medicine, American Hospital Association

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The World Health Assembly first passed a resolution urging countries to prioritize patient safety in 2002.
Traditionally, the patient safety conversation has revolved around the following questions:

- How can we leverage technology for safer care?
- What are the approaches to improve safe care?
- What are the common errors in medical care?
- What are the common types of avoidable lapses in safe care that these errors can lead to?
- In what settings of care can these lapses occur?
- Can we empower patients to take charge of their own safety?

Source: Agency for Healthcare Research & Quality, Imperial College London, WHO, PwC Analysis

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PwC
But how will the concept and delivery of safe care evolve under the reshaping trends plaguing the world’s health industry?

Source: PwC Analysis
Global Healthcare Trends and the Transformative Future of the Industry
PwC
June 2017
In the New Health Economy, our patient safety conversation will revolve around slightly different questions.

- How do we effectively complement technology for safer care?
- What new approaches should we seek to improve safe care?
- What may be the emerging errors in medical care?
- What are the common types of lapses in safe care that these errors can lead to?
- In what settings of care can these lapses occur?
- Can we empower patients to take charge of their own safety?

Source: PwC Analysis
Several hospitals, academic medical centres, ambulatory care centres and primary care centres are achieving JCI accreditation
We are living in a more patient-centric era where patients are empowered and make their own decisions on whom they see, when they see them and even where or how
Patients are demanding more value, convenience, and personal experiences in health

82% are open to new, non-traditional ways of getting medical attention

74% are open to virtual doctor visit

43% want to shop for healthcare

Source: PwC Health Research Institute, April 2014, “Healthcare’s New Entrants: Who will be the industry's Amazon.com?”, PwC’s Customer Experience Survey, Cisco Connected Customer Experience Report
Patients’ confidence is at an all time low

55% of patients trust the Internet more than the doctor

75% want to move from informed consent to shared decision making

Source: PwC’s Customer Experience in Healthcare survey; Cisco Connected Customer Experience Report
Digital disruption to the healthcare industry is the driver of this paradigm shift to patient-centric, value-based care...
...with the patient behaving as an always “on” consumer

- **Patient-centricity & empowerment**
  - Expects a connected experience
    - Consumers compare experiences across industries and think “if I can do that on Amazon, why can’t I do this with you?”
  - Wants to participate
    - Consumers expect to be able to find reviews and give feedback, have their views taken into account and collaborate with their favorite brands.
  - Brings an innovative appetite
    - The rapid evolution of personal technology has created consumer thirst for innovative new services and products.
  - Can make smarter decisions
    - Consumers are better informed than ever, which means they make smarter decisions that lead to better personal outcomes.

Image from: Vigyanix

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June 2017
But value-based care is just one of three major themes of the paradigm shift we are seeing, well articulated by Singapore’s Health Minister, Gan Kim Yong on 13 April 2016

“A 'paradigm shift' needed in approach to ageing and health: Gan Kim Yong”

To move beyond the hospital to the community, to move beyond quality to value, and to move beyond healthcare to health.

“You’ve got a rare condition called ‘good health’. Frankly, we’re not sure how to treat it.”
Hospital to Home
**One of the most key of all global healthcare trends**

- Reduces costs
- Lowers hospital admissions
- Minimizes/removes hospital-acquired infections
- Provides better patient comfort
- Caters to both the physical as well as emotional wellbeing
According to Professor Michael E. Porter, the fundamental goal of health care is maximizing value for patients.

- A value-based model is one where care is organized into Integrated Practice Units around medical conditions.
The Key to Transitioning from Fee-for-Service to Value-Based Reimbursement

• According to Bobbi Brown and Jared Crapo from Health Catalyst, the switch to value-based reimbursement turned the traditional model of healthcare reimbursement on its head, causing providers to change the way they bill for care.

• Instead of being paid by the number of visits and tests they order (fee-for-service), providers’ payments are now based on the value of care they deliver.

• This change is driving improvements to the delivery of care by mandating better care at a lower cost.

Source: https://www.healthcatalyst.com/hospital-transitioning-fee-for-service-value-based-reimbursements
We are living in a very connected world

Three billion people around the world are connected to the Internet

For every person on the planet there will be close to ten connected devices by 2020
Hopping onto the digital connectivity bandwagon will be the key to solving healthcare access challenges.

India Just Crossed 1 Billion Mobile Subscribers Milestone And The Excitement's Just Beginning

SPENDING ON SERVICES IN RURAL HOUSEHOLDS

- Mobile phones (communication services): 25.33%
- Beauty services: 11.07%
- TV & radio services: 10.58%
- Repair & maintenance: 10.27%
- Tailoring: 10.18%

In terms of monthly per capita expenditure (MPCE) also, highest expenditure was found on communication services, amounting to ₹36.35 in rural areas.

Images from: Forbes, Indian news articles
“...wearable tech will change your life – like it or not”
Wearable technology includes items, such as jewellery, glasses and clothing – worn on, in and around the body – incorporating sensors and other electronic technologies.
Health tops the list of information that US consumers want from their wearables

Consumers were asked what information they want to receive from wearable technology.

- Exercise smarter: 77%
- Collect and track medical information: 75%
- Eat better: 67%
- Finding retail deals: 46%
- Controlling home appliances: 32%
- Access to entertainment: 29%
- Plugging into social media: 26%
Consumers were shown to trust clinicians the most with their wearable data

Source: PwC CIS Wearables consumer survey 2014
US consumers were asked how likely each of the following is to come about as a result of widespread use of wearable technology

- **56%** believe that the average life expectancy will grow by 10 years because of wearable-enabled monitoring of our vital signs.

- **46%** believe wearable technology will decrease obesity by allowing us to monitor our nutrition and exercise.

- **42%** believe the average person’s athletic ability will improve dramatically as we use wearable technology to monitor and fine-tune our sports progress.

*Source: HR/CIW Wearables consumer survey 2014*
The wearable device market is in the billions

Penetration of mobile phones continues to rise, driving widespread internet connectivity, and transforming consumer behaviour.

By 2018, wearable devices are forecast to reach a market value of USD$12.6 billion.
Wearable devices make up $3.1b of the entire wellness and fitness market
Health wearables – fast facts

- 61% of all wearable devices are health, fitness or activity trackers
- 46% of people who track their health say it has changed their overall approach to maintaining wellness
- Google, Apple and Samsung have all been exploring how to incorporate health IT features into wearable devices and existing mobile devices
- It has been predicted that by 2020, wearables will be central to healthcare, business and personal systems
Health wearables – fast facts

The future of healthcare is mobile

Today, only 27% of physicians are encouraging patients to use mobile health applications.

But 59% of physicians and insurers believe that widespread adoption of mobile health applications in the near future is unavoidable.

Source: Economist Intelligence Unit mHealth Survey (commissioned by PwC), 2012
While just one in five US consumers in 2014 said they owned a wearable device...

21% of US consumers currently own a wearable technology product.

Source: HRI/CIS Wearables consumer survey 2014
...when asked as to how likely they were to purchase the following wearable technology devices in the next 12 months, the results spoke for themselves.

![Wearable devices chart]

- **45%** Fitness band
- **35%** Smart watch
- **20%** Smart clothing
- **19%** Smart glasses
- **13%** People-tracking devices

*Source: HRI/CIS Wearables consumer survey 2014*

*Note: This survey was conducted before the announcement of the Apple Watch.*
Integral components for wearable technology to be successful in healthcare exist:

- Intelligent
- Interoperable
- Integrated
- Social
- Engaging
- Outcomes-based
For maximum uptake however, cost of wearables will have to be kept minimum
Just as the trend of hospital to home is built on the foundation of patient-centricity and empowerment, so too is point of care diagnostics

- Greater convenience
- More control
- Improved ease-of-use
- “Lab-on-a-chip” and, “Nanobots swimming in our blood”
- Will labs even exist in the future?
Would you be willing to access care virtually? How do you rate compared to 2339 people surveyed?

Source: Strategy & Consumer Survey 2014
Technology is allowing HCPs to provide telemedicine consults from thousands of miles away

The room was packed with doctors, renowned specialists who had come for the annual consultants’ dinner of the Chelsea and Westminster Hospital, one of Britain’s leading medical establishments.

As waiters set down plates of lamb and risotto, Nott checked his phone and found a series of text messages. “Hi David,” it began. “This is an urgent consultation from inside Syria.”

Attached was a photograph of a man who had been shot in the throat and the stomach.

Source: The New Yorker
Technological advances are creating new care delivery models – and consumers are responding...

59% say mHealth has changed how they seek information on health issues.

49% expect mHealth to change how they manage their overall health.

...and also leveraging these new technologies to self-manage their care

59% of patients say that mHealth services have replaced some visits to doctors or nurses

In the next three years, patients agree mHealth applications/services will:

- 52% make healthcare substantially more convenient for me
- 48% improve the quality of healthcare I receive
- 46% substantially reduce my healthcare costs

Source: Economist Intelligence Unit, “Emerging mHealth: Paths for growth” (2012)
Mobile health has multiple applications in the disease lifecycle from diagnosis to treatment and monitoring

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Mobile health market opportunity by service categories in APAC, US$ billion, 2017

- Monitoring, 3.7, 55%
- Emergency response, 0.0, 0%
- Health Practitioner Support, 0.4, 7%
- Health Surveillance Support, 0.1, 1%
- Administration, 0.1, 1%
- Wellness, 0.2, 2%
- Prevention, 0.0, 1%
- Diagnosis, 1.9, 28%
- Treatment, 0.4, 5%

Source: PwC analysis
Drones

Source: Google Images

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From “flying ambulances” to remote care delivery

Source: Protomag
Source: USA Today
Source: International Business Times
Drones are increasingly being put to use in medical emergencies in remote areas

Source: NBC News, IFL Science
The cost of genome sequencing is getting lower and lower...

- On January 9 2017, “Illumina says it can deliver a $100 genome – soon”
...with direct-to-consumer genetic tests getting more and more in demand

- On Thursday 6 April 2017, “The FDA gave 23andMe permission to market its Personal Genome Service genetic health risk tests for 10 diseases, (being) the first direct-to-consumer genetic test the FDA has allowed to provide that information”

Big data is growing at a rate of 50 per cent per year – providing rich opportunities to target and personalise engagement with products and services.

In the world of retail the notion of online-to-offline, is increasingly important, but the lines between physical and virtual channels are blurring even in healthcare.
And this is just the technology that is within our reach, what about those technologies that are yet to become mainstream?

**Internet of Things**
A proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data.

**iBeacons**
Apple's technology which allows Mobile Apps to listen for signals from beacons in the physical world and react accordingly.

**Augmented Reality**
A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

**3D Printing**
A process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material.
All this data provides clinical as well as non-clinical information to allow the provision of deep analytics.
Whether artificial intelligence (AI) will really redesign healthcare is debatable, but it certainly has started to revolutionize our lives.
Digital disruption:
Ready or not, here it comes.
How long did it take the telephone to get to 50 million users?

A. 15 years
B. 35 years
C. 55 years
D. 75 years
How long did it take the television to get to 50 million users?

A. 3 years
B. 13 years
C. 23 years
D. 33 years
How long did it take Angry Birds to get to 50 million users?

A. 1 year
B. 1/2 year
C. 3 months
D. 1 month
The pace of digitization is exponentially increasing; years to days

Digitalization Adoption

- Telephone: 75 years
- Radio: 38 years
- TV: 13 years
- Internet: 4 years
- Facebook: 3.5 years
- iPod: 3 years
- AOL: 2.5 years
- DrawSomething!: 50 days
- Angry Birds: 35 days

Source: visual.ly.com
Across APAC, there are numerous examples of mobile health deployments

Apollo Telemedicine Networking Foundation, India:
Apollo Hospitals
Mobile phones connect community health workers to specialists. This also includes remote ICU monitoring, electronic health records and a mobile telemedicine unit.

Health Line, Bangladesh:
Telenor
Telenor supported 24/7 medical call centre staffed by physicians, aimed at people in remote areas. Can provide information on access to doctors and medical facilities, pharmacies, and to laboratory results, medical advice and emergency advice.

Health Text, UAE:
du
Duell offers a number of subscriptions for daily health text messages with the program Live Well, Lose Weight, Healti, Pregnancy Tips and Quit Smoke. The service is provided in English and Arabic, and offers tips, facts and advice.

Mobile Midwives, Indonesia:
World Vision
Mobile phones connect midwives providing obstetric care in remote locations to specialists. This has proven effective to help midwives take care of complex patients.

Breast Screen Rural Broadband Digital Mammography Project, Australia:
Ericsson
The Ericsson supported project has shown that broadband can give rural women access to the latest digital mammography technologies and address some of the risks and inefficiencies associated with conventional the analog X-ray film based screening system.

IdealLife Kiosks, China:
Novatech
Remote monitoring kiosks for high-volume settings (schools, living centers, physician offices and health clinics). These kiosks measures blood pressure, weight, blood glucose levels and other biometric readings.

Source: Wireless Intelligence
Even across emerging markets, there are countless new digital health models being developed, many of which have already revolutionized the way care is delivered.
What about the new kids on the block?

A disruptive, recent arrival to a market or industry. It may include companies whose core businesses reside entirely outside of the new industry, or looking to expand into new roles.
Disrupting what’s “static” will be the cornerstone of the new entrants’ business models...

Disruption is not going to come from traditional healthcare sources, but rather from the new entrants willing to play around the conventional modalities.

Global ancillary & wellness market: USD 1.49 Trillion

Government & private providers: USD 8.1 Trillion

- $391B Global nutrition market
- $236.5B Sporting goods and apparel
- $595B Weight loss industry
- $8.02B Mobile health apps
- $114B Alternative medicine
- $48B Medical tourism
- $3.1B Wearable devices
- $19.4B RPM/Telemedicine
- $78.4B Global fitness industry
...with the lines between various stakeholders increasingly blurring

Business Model Transformation: Owning the Disease

**Prevention**
Awareness/detection drivers, patient education programmes, HbA1c camps, diabetes walks and doctor meetings

**Treatment**
Insulin and oral hypoglycaemic agents

**Engagement**
Diabetes self-management education and 1-year programme by Saath 7

**Support**
**SMS alerts** on patients’ cell phones to be consistent and compliant with dosage time

**Management**
Low-cost, reusable insulin pen called **AllStar**, priced at Rs.650

**Delivery**
Sanofi’s partnership with Apollo Hospitals for diabetes care to be a one-stop shop for diabetics

Indian market appropriate strategies

- **Low-cost manufacturing**
- **Market-appropriate products**
- **Increased rural marketing**
Health systems are starting to recognize that consumers are ready to receive care in new ways from these new entrants.

82% of survey respondents said they were open to trying new, non-traditional ways of seeking medical attention or treatment.

Source: HRI consumer survey, December 2013

Global Healthcare Trends and the Transformative Future of the Industry

PwC
Disruptive trends are revolutionising the industry, and impacting the delivery and financing of care

Demographic shifts & social change  Shift in global economic power  Technological advances  The empowered consumer  Globalisation

...resulting in:

The emergence of new business models  A rebalance of the public and private sectors in the financing and delivery of care  A trend from inpatient care to outpatient services  A greater focus to reward for outcomes instead of volume of activity  The healthcare sector industrialising
Business models are already exhibiting the various elements of successful disruptors in other industries.

Our daily lives have been overhauled owing to multiple disruptive innovations.

A disruptive healthcare business model must include all the above elements.
The clock is already ticking...Is the time ripe for healthcare?

The world’s most popular media owner, *creates no content*

The world’s largest accommodation provider, *owns no real estate*

The world’s largest taxi company, *owns no vehicles*

The most valuable retailer, *owns no inventory*
A new era of health is upon us...Are we ready for a hospital which has no patients?
Global health trends will continue to shape the New Health Economy and result in new entrants

South East Asia is in a prime position to leapfrog other global economies

Disruption has already started – healthcare providers need to embrace the change or potentially fall behind

Movements should revolve around productivity, IT and digitisation, consumer driven health and integration of health care
Transformative future of the industry & the importance of innovation and collaboration
**Case Study: Verily and Alcon – Digital contact lenses for diabetes management**

1. Sensors are embedded between two soft layers of lens material and a pinhole in the lens allows tear fluid to seep into the sensor and be used to measure blood sugar levels.

2. A microscopic wireless antenna then communicates this data to a wireless device, which transmits it to external receiver devices (users, care givers, providers etc.)

3. Continuous glucose data is also sent to an associated app on the user’s smartphone which prompts the user to act and make decisions.

4. Providers can predict adverse events caused by diagnosis based on continuous glucose monitoring data.
Case Study: SENSIMED Triggerfish® – Smart contact lenses to tackle glaucoma

1. SENSIMED Triggerfish® Sensor is a soft disposable silicone contact lens embedding a micro-sensor that captures spontaneous circumferential changes at the corneoscleral area.

2. The adhesive SENSIMED Triggerfish® Antenna, which is placed around the eye, receives wirelessly the information from the contact lens.

3. The data is transmitted through a thin flexible cable from the Antenna to the portable recorder.

4. The portable recorder, worn by the patient, stores the acquired data during the monitoring session. At the end of the recording period, the data is transferred via Bluetooth from the recorder to the software previously installed on the practitioner’s computer.

- Provides information on continuous natural changes to the eye to ophthalmologists including intraocular pressure
- Allows improved glaucoma management and faster intervention
**Case Study: GenSight Biologics – Biomimetic goggles to treat faulty retina with a goal to preserve or restore vision**

**OPTOELECTRONIC STIMULATION DEVICE**

1. Image light
2. Image captured by camera
3. Image processed
4. LED light amplified image to DMD
5. DMD reflects LED light-amplified image
6. Retinal cells expressing light-sensitive proteins and transmitting signal to visual cortex

Diseased retina treated by AAV- gene therapy

Emit optimum Light wavelength

Signal through retina to back of the eye

Visual perception
**Case Study: ReThink Medical – Heart failure prediction**

- Raised $3m for a wearable that predicts and prevents heart failure

- Algorithms can detect signatures of worsening heart conditions weeks before patient senses them; usually a month of worsening conditions and heart failure

- Data transmitted via WiFi hub to a provider, who intervenes if problems detected

- Partnership with Japanese device company Terumo
Companies driving innovations in smart clothing

ATHOS
- Shirts and shorts for improved workouts and training
- Focused on professional athletes
- Uses EMG (electromyography), as well as heart rate and acceleration, to track muscle use, which is then sent to a companion app
- $50.7M raised

OM
- OMbrella is a sensor-equipped, fitness tracking smart bra
- OMbrella snaps onto back of bra to read heart rate, respiration, movement, and steps via the bra’s sensors
- Bra-only retails for $60, or available as a package with the OMbrella and USB cable for $143
- $21M raised

HEXOSKIN
- Biometric shirt that tracks steps, distance, heart rate and more
- Pairs with third-party running apps like Strava, Runkeeper and MapMyRun, as well as GPS-enabled smart watches
- Grant from Department of Homeland Security for research on monitoring first responders
- Retail for $399

sensoria
- Smart sock maker has moved into upper garments
- Funded a Kickstarter project for new app and garments that synch with a heart rate monitor and can text a friend or family member if a user is experiencing cardiac irregularities
- Partnerships with Renault and Microsoft, the latter of which previously employed the company’s three founders

Owlet
- Smart sock monitors a baby’s heart rate and oxygen level
- Uses pulse oximetry to measure heart rate and oxygen level and sends an alert if baby stops breathing
- 100,000 hours of testing; 100 billion heartbeats monitored
- Retail for $249
- $25M raised

SUPERFLEX
- Powered suit to aid the elderly in strength and mobility
- Will aid in complementing strength during the act of standing up, sitting down or staying upright
- Developed for a DARPA-funded program to reduce injury risk and enhance soldier endurance while carrying heavy loads
- $9.6M raised
Other wearable examples by Pharma and MedTech

NEC/Gunze Ltd. - Developed an intelligent undershirt that can be connected to a smartphone and provide data on the health of the person wearing it. The shirt has an ultra-fine and flexible sensor (which can be removed before the shirt is washed) that can monitor posture, heart rate, and calories consumed and burned.

Kyocera - announced that it will collaborate with The Association for Preventive Medicine of Japan in the field of healthcare to offer a new service, Daily Support®, which aims to assist with continuous lifestyle habit improvements through the use of a smartphone and wearable device combined with individual guidance from healthcare professionals. Planned to launch in fall 2015 in Japan, the service will be provided to companies, health insurance unions and healthcare service providers seeking better health management for employees and clients.

TOShiba

Toshiba - rolling out two activity trackers that can help caregivers monitor seniors remotely. Through an analysis of sensor data, the Silmee W20 and W21 wristbands can help track the amount of time a user spends eating as well as conversing with others. The bands can compile the data into life logs to be shared with caregivers.

Takeda – Getting serious about digital Takeda walks the walk with its digital accelerator model The company has also launched iBDdata, a wearable digital technology pilot program to support patients and physicians with the management of inflammatory bowel disease (IBD). The program is a partnership with Texas Digestive Disease Consultants and Vanderbilt University Medical Center and is designed for IBD patients to track their symptoms and lifestyle factors with wearable watch technology.
Case Study: eyeNETRA – Point of care diagnostics and VR

- MIT-incubated start-up that offers a series of Point of Care diagnostic tests for refractive errors (near and far sightedness)
- The equipment easily plugs into smartphones and has supporting applications which enable easy diagnosis, recording and transmission of test results
- The company is now seeking partners to create prescription Virtual Reality Screens

Smart Phone Autorefractor
Smart Phone Lensometer
Mobile Clinic Kit with Printer
Case Studies: MedShr and MyDoc – Smart phone apps that can be used to seek second opinions via affordable and accessible teleconsults
Case Study: Tan Tock Seng Hospital, Singapore – Improving eye care with tele-ophthalmology

- Modified teleconferencing system to enable patients and specialists to see and speak to each other

- System is set up at easily accessible neighborhood polyclinics and uses portable cameras and multiple computer screens

- Clinic does a pre-consultation assessment and results are shared with specialists ahead of the consultation

- Initiative found to reduce the load of acute care institutions and is now being extended to multiple polyclinics
Case Study: Deft University of Technology – Ambulance drone with cardiac defibrillator

- Ambulance drone in-built with a cardiac defibrillator that can reach patients during a cardiac arrest within 12 square km in less than 1 minute
- Via telemedicine and an in-built camera, an emergency operator can give instructions and observe for correct application by the civilian responder
- Survival rate from a cardiac arrest could be increased to 80% under the quick arrival response of the ambulance drones, rising even to 90% when an untrained responder is given accurate instructions by the emergency operator.
Case Study: GenSight Biologics – Genetic engineering-based novel therapies for neurodegenerative diseases of the eye

The proprietary Mitochondrial Targeting Sequence (MTS) permits missing mitochondrial proteins to be shuttled into the mitochondrion, enabling restoration of mitochondrial function.

Optogenetics uses gene therapy to introduce a gene encoding for a light-sensitive protein into specific target cells in the retina enabling them to respond to light stimulation in place of damaged photoreceptor cells.

Leber Hereditary Optic Neuropathy (LHON)  Retinitis Pigmentosa (RP)  Geographic Atrophy in dry-AMD
Case Study: Intelligent Research in Sight (IRIS™) – Registry for ophthalmology cases

What is IRIS™?

- First comprehensive eye disease clinical database
- Captured data from 10,800 ophthalmologists covering more than 48 million patients (2015 estimate)
- Uses HIPAA-compliant methods to collect data from EHRs
- Provides real-time feedback and drives improvements in quality and outcomes

What does IRIS™ offer?

- Consistent quality reporting standards and outcome measures for eye diseases
- Measures efficacy of various therapy options
- Identifies areas for further research and validation
Case Study: Google’s Deep Mind – AI to diagnose diabetic retinopathy and AMD

- Google’s Deep Mind team is partnering with UK’s NHS to develop a machine learning algorithm that can scan millions of retinal images and detect diabetic retinopathy and age-related macular degeneration (AMD)
- Physicians currently diagnose using physical medical charts and interviewing patients but the error rates are 10-20% on average
Some other examples of AI in healthcare

FDNA collaborates with pair of genomics testing labs on Face2Gene
FDNA will team with GeneDx and Blueprint Genetics on Face2Gene LABS, with FDNA sharing phenotypic data with the labs in real time.
Face2Gene aims to accelerate rare disease diagnosis by evaluating a patient’s clinical signs through artificial intelligence and facial analysis.
One in 10 people worldwide suffer from a rare genetic disease.

Cera launches AI chatbot for UK home care decision support
It targets assisting carers with recommendations for home care of people with conditions such as dementia.
Today, the bot, Martha, recommends care packages to potential customers.
It’s relaying on social care workers to generate the underlying data to train the AI.
Raised $3.4m to date.

Sunrise is an AI-guarded group chat for mental health
Sunrise is text group therapy integrated with natural language processing.
Support for PTSD, depression, grief and substance abuse.
One-on-one chat with a pro precedes placement in a group with 12 others with the same condition.
VoIP phone calls are also provided to better simulate in person sessions.
**Case Study: 6 over 6 – Digital optometry tools for consumers**

**GlassesOn**
- Mobile-based digital optometric tools to check eyesight and buy glasses online
- Uses a patent technique involving manipulation of light; registered as a Class 1 Exempt Medical Device with the FDA
- Provides a spontaneous, fashion-centric experience

**GlassesOn Eyes**
- Currently under development
- Manipulates optical and perceptual phenomena to give full measurement of refractive errors
Case Study: Novartis and TicTrac – Patient engagement platform for people with multiple sclerosis

- Partnership with patient engagement platform for multiple sclerosis patients to record data from wearables and social media

- The campaign prompts participants to track different aspects of their lifestyle including weight, activity, mood, and workload

- This data is used to create visualizations of their day-to-day life. Participants can sync various platforms and devices with Tictrac's platform including Fitbit, Jawbone UP, Withings, Gmail, Facebook, and Runkeeper
Case Study: Mount Sinai – Healthcare information access

Mount Sinai Hospital and Apple co-developed an app which connects healthcare professionals.

App provides healthcare professionals with anywhere access to data from 66 applications used in the hospital.

Data includes clinical data, reference materials and patient information. Passwords and VPN certificates provide the appropriate levels of security.
Case Study: Ningbo – Digital and cloud hospital in China
Case Study: A futuristic combination to replace hospitals?

Who Needs A Hospital, When This Self-Driving Doctor Comes To You?
A new concept called Aim brings the doctor to you, in a self-driving car.

BY MARK WILSON
3 MINUTE READ

Even those of us fortunate enough to have good health insurance will often put off seeing a doctor when we probably should. Often it's...
Case Study: Are telcos the perfect medium?

PwC’s DoubleJump™ Interchange supports collaboration across an ecosystem with telcos being ideal partners.
Case Study: Insurance

Health Insurance Has Changed

FROM
- Your employer defines your health benefits
- Cost based on employer negotiated rates
- Limited correlation between health services and cost

TO
- Health benefits defined by personal choice and health needs
- Cost based on market rates via health exchanges
- Increased sensitivity as cost is personalized via high deductible plans
Case Study: Retail

Retail Health, Retail Medicine and the New Healthcare Experience

People expect convenience, quality and transparency when choosing how to spend time and money – and increasingly they seek the same from healthcare providers. Retail health is emerging as a means of delivering quality, convenient care to millions of consumers, as well as a model for healthcare systems to consider when providing services to new and existing patient populations.
Examples of various industry sectors using telemedicine service offerings

- Joint mobile and web applications development for health related wellness and chronic disease areas, including e.g. electronic health records
- Cooperation around key disease groups such as diabetes and cancer
- Home monitoring, remote device management, coaching and advice
- 24/7 care at a distance for residents
- Support in case specialist care is needed as well as referrals to the hospital

- Value-Added Healthcare Services including 24/7 physician care & prescriptions at a distance via phone, video, app or Internet; home monitoring, electronic health records
- Offers also to corporate telecoms clients, e.g. employers, insurance clients and others
- Direct cost reduction (10-15%) with option of offering a Gatekeeper service
- Significant reduction in hospital readmissions
- Rightsizing of patients before they hit the hospital
- Convenience and USP for their clients

- Health coaching
- Remote wellness monitoring
- Home care support
- Cooperation with sensor and fitness firms (e.g. Jawbone, Fitbit, Nike)
- Employer programs
- Virtual primary care clinic model via videoconferencing
- Increased sales (prescription drugs)
- Higher traffic
- Better retention

- Increased customers and better care integration through referrals from Medgate (e.g. for physical checkups, pathology tests)
- Medgate can support the practices e.g. out of hours
- Specialist support and referrals at a distance for the GPs
- Potential for setting up concierge medicine offers
Challenges
As a clinician, I’ve always believed we should use technology to complement our clinical practices, not replace them.

Are we losing the healing ‘touch’ of medicine?

Image from: Philips / www.usa.philips.com

New Health Economy

Accessibility
Affordability
A+ Care

Interoperability
Integration

New entrants

Security (Cyber)
Safety

People
Privacy

Technology
Transformation

Engagement
Experience
Expertise

Transparency
Treatment
PATIENTS
PATIENTS
Accessibility
Affordability
A+ Care
Interoperability
Integration
New entrants
Security (Cyber)
Safety

People Privacy
Technology Transformation
Engagement Experience Expertise
Transparency Treatment

P.A.T.I.E.N.T.S.
Cost (Affordability)
Consent (Privacy, HIPPA, PDPA)
Credibility
Culture
Change management
Connectivity
Convenience (Accessibility)
Cybersecurity
$8 C_s \rightarrow 1 C$
An ode to the future
Solving the challenge of accessibility, affordability and quality
As technology gets more sophisticated, digital innovations and care delivery could evolve from a HCP professional coming to the patient to detection & treatment capabilities inside the body.

**Timeline:**
- **2010:** Improved Processing and software engineering
- **2020:** Shrinking sensor sizes and innovative manufacturing
- **2025:** Cloud and mobile communication technologies
- **2030:** Artificial intelligence and Nano-technology

**Innovations:**
- **Wearables**
- **Ingestible & implantable sensors**
- **Ambulance drones**
- **“Trauma care in a rucksack”**
- **Smart homes**

**Run by brain-machine interfaces and AI?**

Source: “The Singularity is Near” by Ray Kurzweil, PwC analysis
Remember, we really are only limited by our own imagination...
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For further information, please contact:

Dr. Zubin J Daruwalla
Director & Healthcare Lead
PwC South East Asia Consulting

t: +65 9846 1007
e: zubin.j.daruwalla@sg.pwc.com