Briefing Paper

Smart Health – the IoT and patient empowerment?

November 2015
Smart Health – and patient empowerment

The concept of ‘smart health’ is a central component of any Smart Nation/ Smart City programme.\(^1\) It arises in the context of ICTs as the next link in a chain that starts from the age of computing, with the introduction of e-Health, such as putting patients’ records into digital storage; it moves on to the use of mobile, and now smartphone phones and devices, that enable patients to receive SMS reminders to take medications and to access health portals for information, to make appointments, etc.; and is now entering the age of smart health.\(^2\) Smart health is broadly seen as engaging ICTs within the context of the city, the surrounding environment and the personal through the widespread use of sensors.

“Gradually, doctors will advise their patients to monitor themselves and use devices in the home (or even in their heads) for positive feedback that improves behaviour. Such devices will have to be idiot-proof, and the suggestions they give extremely easy to work into a patient’s lifestyle.” \(^3\)

But the growing focus on the potential of patient empowerment through apps and devices that give individuals a means to monitor their health, to connect to healthcare professionals for consultations, and to healthcare portals for the information and guidance they need, is a double-edged sword. To work well it requires citizens, and especially patients in need of treatment, to be able adjust their behaviour in response to the data and advice they are receiving without the direct supervision of healthcare professionals. Easier said than done, and not just for the elderly who may have difficulties coping with relatively mundane tasks. The big danger here is that ‘smart health’ can become primarily a mechanism for minimizing the costs of healthcare administered by healthcare professionals,\(^4\) while at the same time a lucrative market for vendors of devices and health supplements of dubious benefit.\(^5\) Glossy adverts for personalized healthcare showing slim and super-fit middle-aged professionals jogging along in their designer wearables are less obviously an indication of smart health, and rather more of smart people and their snappy dressing. But, as Tim Cook says of the Apple watch:

“What people love about [the Apple watch], they love the health and fitness portion of it. They love being reminded they’ve been sitting too long. People love notifications...” \(^6\) (Tim Cook, Apple CEO, *The Wall Street Journal*, 27 October 2015)

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\(^4\) For example, ‘The state of Massachusetts has sort of bet the farm on it, because patient empowerment is supposed to temper to rising price of healthcare.’ Ibid.

Briefing Paper: Smart Health

The jury is still out on how far smart devices genuinely contribute to healthier standards of living, and how far they will remain commercial fads and gimmicks, like an exercise bike that is used for the first two months and then forever put aside. They only become game-changers when mind-sets, lifestyles and behaviours change in a sustained manner. Most of us find that difficult until the moment we might be forced to confront the reality of an illness.

That said, as a study by Analysys Mason has recently revealed, health apps are increasingly popular across Asian markets. Chart 1 illustrates three such markets, with percentage of those buying medical insurance in circles.

**Chart 1: Usage of healthcare or fitness apps, by app type and country, Asia–Pacific**

[Chart showing usage of healthcare or fitness apps by app type and country, Asia–Pacific]


**Smart Health – three levels of applications**

Smart health can be seen as falling into three categories: the delivery of smart healthcare systems by hospitals, clinics, first responders and others; intermediary service providers such as telecom and mobile networks, on-line portals as part of e-Government, etc.; and patient empowerment through the use of smart monitoring devices, apps and social media information exchanges.

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6 Not all smart devices are M2M. A Japanese smart toilet measures urine flow to identify ailments, while a mobile app calibrates the user’s voice to detect symptoms of stress. See [http://www.dailymail.co.uk/sciencetech/article-3306193/Smart-toilet-analyse-PEE-app-detects-depression-Japanese-expo-reveals-strange-health-gadgets.html](http://www.dailymail.co.uk/sciencetech/article-3306193/Smart-toilet-analyse-PEE-app-detects-depression-Japanese-expo-reveals-strange-health-gadgets.html)

At the institutional level of care, such as hospitals, ICTs have the same range of backend, middle and frontend applications as they do in any enterprise or large organization. What makes these systems ‘smart’ is a combined use of sensors as additional sources of data, mobile and handheld devices, and the use of data analytics, in either predictive, synoptic or analytic modes. The complications of introducing ICT systems are not only similar to other organizations, but probably more complex for a variety of reasons. First, hospitals have to cater for a very diverse range of services and patients. Second, there are many layers of “ownership” of data involved, ranging from the hospital administration to third parties, and from doctors to patients. It might be noted that a “lot of patient records are unstructured and unusable and they are kept by different organizations in different silos.”8 Third, equipment is often highly specialised and may not inter-operate with other parts of the IT architecture. Fourth, hospital personnel are drawn from a wide variety of backgrounds and not all will be familiar with procedures and protocols required by IT systems.

At the intermediary level, such as telecom networks and health portals, online (fixed or wireless) connectivity with patients and with the general public has become commonplace. What is new is the coming of machine-to-machine (M2M) communications through the use of sensors. These can be wearables and home monitors as in the Internet-of-Things (IoT) which relay information about body and home to a database, and sensors around the city environs that monitor pollution levels, provide information about areas of dengue, and so on. All this data can, in principle, be stored and analysed and generate alerts delivered to citizens and to medical personal and first responders. It can also be used by governments for health planning and by vendors and health service providers such as clinics and health insurers.

For patients and citizens the promise of smart health is empowerment, the ready availability of healthcare information and a means to self-monitor and to communicate whenever necessary with healthcare providers. This aspect of ‘smart’ is important, even if it is often over-played at the current time, because it offers a way to refocus scarce healthcare resources. To some extent it shifts costs in terms of money and time onto the patients who need to purchase the smart devices and download the apps, but another way to look at that is to see these expenditures as bringing additional resources into healthcare provision. Smart health could also have the implication of a shift towards illness prevention rather than illness treatment, and by catching the symptoms of illness in their early stages should mean more effective treatment, which again should save resources.

Smart for everyone?

These conclusions are, of course, the best possible outcomes in the best of all possible worlds. The real world is different. Not all the resources saved due to the lower costs of treatment and service delivery will necessarily be passed onto the patient in terms of lower prices, largely because of the composition of costs. First, ICTs may fall in unit cost, but as the adoption of ever more sophisticated IT systems spreads across entire hospitals, total costs may rise. Second, non-ICT costs, such as pharma costs and administrative costs, including the salaries of much-sought-after health professionals, are likely to soar if demand outstrips supply as, for example, populations age, and the risks of pandemics and climate-change related diseases rise, and as new medical breakthrough

create an even greater demand for healthcare solutions. For example, Singapore’s healthcare professionals in 2012 in numbers were projected to grow by 50 per cent by 2020.\(^9\) Third, in countries that rely predominantly on private sector healthcare provision, markets will also see cost cutting feeding into profitability, especially where there is an incentive to invest in further R&D. In countries with predominantly public sector healthcare provision, political decisions will need to be made about public spending priorities. In broad stroke macro-economic terms, a significant shift in society’s consumption and investment expenditures towards healthcare provision, and in medical R&D, looks inevitable. The best outcomes may be “second best” solutions, pay more but receive better quality healthcare. In a world of sharply divided personal levels of income and wealth, this will prove a challenge to the poorest in society. That is a challenge that smart health really needs to address in no uncertain terms.

One of the unfortunate realities in many organizations and companies of the adoption of ICTs is the priority given to administrative convenience and cutting costs rather than to improved customer care. Everyone has experienced the telephone voice response systems that walk the customer through what feels like a dozen steps, often including time-consuming advertisements, redundant information messages and some unpleasant and badly recorded music before finally denying access to a real person to interact with. This despite the availability of technologies such as WebRTC that would allow customers to click onto a website icon and have a real-time video call with a customer care officer. Installing WebRTC or similar apps implies users being able to access real people who handle the inquiries, which is considered not cost-effective. In some areas ICTs can cut costs and improve services very effectively, but in other areas the real benefit of ICTs will only come about by devoting more resources, not less.

**Smart Health – and costs**

One area in which savings and convenience arise for both doctors and patients alike is through the use of various online means of communication and consultation. A study in the USA by Accenture in 2015,\(^10\) finds the cost savings of ‘virtual health’ which reduces the need for visits to a primary care physician (PCP), can run into billions of dollars annually.

If this is done to suit the patient and the patient is well-versed in how it works, then all is good, but there is big “but” here. The use of IoT and smart devices, such as video phones, involves transferring part of the cost of the delivery of healthcare services to the end user, and without any guaranteed improvement in the quality of service.\(^11\) Personal visits to a GP may be expensive in terms of the GP’s time taken up, but for many patients the role of the GP as a friendly reassuring voice providing advice and even some degree of companionship is part of the traditional service. On the other hand,

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\(^11\) This started many years ago when consumers began buying fixed line telephones in supermarkets and in electronics stores until finally the telecom companies stopped supplying house phones. At the time, the telecom companies opposed this development because they saw the telephone as a means of tying in their customers. The same development is occurring in the mobile and smartphone markets, which means the incremental costs to the citizen of using their smart device for medical calls is actually close to zero.
if all the patient receives is a surfeit of pills handed out like sweets – and maybe as sweeteners to the GP from pharma companies – then the loss of service quality could be over-estimated.

Graphic 1: The Real Impact of Virtual Health, Accenture Consulting 2015

Smart Health and insurance

Paying for health insurance is itself getting smarter as big data analytics and personal health data supplied from an ever growing variety of sources, from insurance applications to social media, from health records to the IoT, opens up opportunities to fine-tune insurance policies and premiums. The regulatory issues involved are not just privacy and data usage issues, but also policy issues such as not denying anyone of their right to insurance or pricing them out of the market. This debate underlies part of the ‘Obamacare’ (the Affordable Care Act) controversy in the United States.

‘Nudge’ or behavioural economics is all about nudging people into changing their behaviour by giving them incentives to choose to do so. For example, lower income customers may choose a video service that includes adverts but is available at a lower subscription rate. Business models based upon ‘nudge’ are emerging, and in the world of IoT incentives such as lower insurance premiums in
exchange for access to personal data are expected to become more common. Certainly the big IT companies think so. “Google Invests in New Health Insurer” (Wall Street Journal, 12 September 2015), “Google hires specialist for mental health push” (Financial Times, 16 September 2015), “Philips switches focus away from lights to health” (Financial Times, 16 September 2015) are headlines tracking the growing interest in smart healthcare hardware, software and services. If there were any doubt as to whether this was a global trend:

“China hackers sought health insurance tips, says US probe” (Financial Times, 28th October 2015)

In February 2015, Anthem, the second largest health insurer in the US – under the circumstances, a rather morbid name with an undertone of funerals – revealed it had been hacked, losing data relating to 80 million clients. Other healthcare companies, such as Premera and several hospitals had suffered the same fate. According to the story, “Chinese hackers had trained their sights on the US health sector to help the country understand how other nations deal with medical care, people familiar with the Anthem investigation said.” It leaves open the question why a few telephone calls or on-site visits were not preferred, although the article does suggest that “a desire to gain intellectual property and trade secrets was the rationale for the hack.” Nevertheless, it sounds like a tortuous route to take.

But it does illustrate the growing importance of health care and health insurance as populations live longer and way beyond the age when the majority of citizens are actively receiving incomes and paying taxes. And, in the case of China’s enormous population, how to introduce a national healthcare service to replace the loss of state enterprise healthcare facilities for their employees. Finding new cost-efficient ways to deliver healthcare services is undoubtedly high on the agenda of most governments.

Smart Health in Singapore

One of the key areas of Singapore’s Smart Nation Media Masterplan is the programme called Smart Health-Assist, which is being piloted in the Jurong Lake District. The pilot will consist of sensors in the home to enable the elderly to remain independent while still receiving healthcare attention, checks and assistance when required. A survey by the HDB of a trial in 12 homes of an elderly alert system, starting in November 2014, found a favourable response. The MCI has called for development in the areas of next generation sensors, the networking of homes and care centres, and decision support systems and big data analytics. In support of this initiative the IDA issued a Call for Collaboration (CFC) to develop new models of distance care for the elderly. This is part of the IDA’s ongoing role of supporting healthcare initiatives taken by the Ministry of Health, by hospital authorities and community organizations in the development and applications of networks and ICTs.

12 The sub-head of the Philips article reads “Dutch group joins rival GEC among others in perceiving opportunities for medical technology in €140 billion market.”
14 The Straits Times (17 March 2015) ‘HDB elderly alert system well-received in test-bed’ http://www.straitstimes.com/singapore/housing/hdb-elderly-alert-system-well-received-in-test-bed
IDA aims to achieve the following outcomes through the adoption of infocomm in the healthcare sector:

- A common information network and data standards that enable integration and coordination of care such that patients are treated at the most appropriate point of care;
- Linkages to outsourced clinical services or clinical decision support systems to reduce duplicate tests, costs and medical errors;
- Allowing individuals greater ease to access health information to manage their own health;
- Linkages between biomedical and healthcare to facilitate translation of new biomedical discoveries into novel healthcare applications and treatments.


Among the many programmes and initiatives sponsored by the IDA is the Integrated Clinic Management Systems (CMS) Programme, launched in 2006 to encourage GP clinics to network with each other using industry standards to provide for secure transfer of health data about patients, and to interface with different healthcare providers, hospitals and the like. The CMS programme was in support of the MOH’s vision of “One Singaporean, One Electronic Medical Record” and was followed from 2010 with the GP-IT Enablement Programme to enable GPs who had adopted IT systems to connect with the National Electronic Health Record (NEHR)\(^\text{16}\) and to care services such as laboratory and diagnostic radiology results. As of February 2015, according to the MOH, “all community hospitals, 56 community healthcare providers and close to 40% of GP clinics have access to NEHR.”\(^\text{17}\) Phase 2 and beyond of the NEHR will include a means to share active patient care being undertaken, and the use of data analytics to provide a basis for resource planning.

At the patient end of the healthcare spectrum, the Ministry of Communications and Information (MCI) announced the Personal Health Management (PHM) Programme which “seeks to enable patients/consumers to actively participate in their health and well-being through the use of personal health technologies. Plans are in place to create a National Health Platform to support various healthcare organisations in developing and delivering patient/consumer-centric solutions through the web and mobile channels.”\(^\text{18}\) Whereas the national health records initiative of the MOH comes out of the e-health era, the concept of “personal health technologies” has the ring of smart health about it, and the MOH’s trials of sensors in the homes of the elderly in the Jurong Lake District area, which is rapidly becoming a testbed for Smart Nation applications, is an example of this. The most recent announcement has been the launching of a HealthHub Portal (http://www.healthhub.sg/) for all Singaporeans to access various services, including their medical records using their personal SingPass. The portal can be accessed through Facebook and using apps from Apple Store and Google Play.

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The Healthcare Structure in Singapore

The MOH website lists the following healthcare facilities run under its regulations:

- Primary Healthcare Services
- Hospital Services
- Dental Services
- Intermediate and Long Term Care (ILTC)
- Residential ILTC services
- Community-based ILTC Services

Eighteen polyclinics and about 1,500 private medical clinics provide primary healthcare services for outpatients, including primary medical treatment, preventive healthcare and health education. Through ICT networks many are linked to each other and to the hospitals, allowing patient appointments to be booked online and medical records to be shared.

<table>
<thead>
<tr>
<th>Hospital Services in Singapore</th>
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<td>As of 2015, there are 26 hospitals and specialty centres in Singapore. Of these eight are public hospitals comprising six acute general hospitals (SGH, NUH, CGH, TTSH, KTPH &amp; NTFGH), a women's and children's hospital (KKH) and a psychiatry hospital (IMH). In addition, there are eight national specialty centres for cancer, cardiac, eye, skin, neuroscience, dental care and a medical centre for multiple disciplines... The 10 private hospitals tend to be smaller, with bed spaces ranging between 20 to 345 beds, compared with the public sector hospitals with beds ranging from 185 to 2,010. The government has restructured all its acute hospitals and specialty centres to be run as private companies wholly-owned by the government. This is to enable the public hospitals to have the management autonomy and flexibility to respond more promptly to the needs of the patients. In the process, commercial accounting systems have been introduced, providing a more accurate picture of the operating costs and instilling greater financial discipline and accountability. The public hospitals are different from the other private hospitals in that they receive an annual government subvention or subsidy for the provision of subsidised medical services to the patients. They are to be managed like not-for-profit organisations. The public hospitals are subject to broad policy guidance by the government through the Ministry of Health. The government has also introduced community hospitals for intermediate healthcare for the convalescent sick and aged who do not require the care of the general hospitals. Source: (edited) Ministry of Health, Hospitals, <a href="https://www.moh.gov.sg/content/moh_web/home/our_healthcare_system/Healthcare_Services/Hospitals.html">https://www.moh.gov.sg/content/moh_web/home/our_healthcare_system/Healthcare_Services/Hospitals.html</a></td>
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The MOH has clustered hospitals into 6 regional groupings to integrate healthcare provision:

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19 The research for this paper suggests some of the more specialist health caring services, for example the hospice service, find investment in ICTs for patient care held back by a lack of funds.
20 A full list of hospitals in Singapore is available at [http://www.hospitals.sg/hospitals](http://www.hospitals.sg/hospitals)
• Alexandra Health Pte Ltd (anchored by Khoo Teck Puat Hospital in the North)
• Eastern Health Alliance (anchored by Changi General Hospital in the East)
• National Healthcare Group (anchored by Tan Tock Seng Hospital in the central region)
• National University Health System (anchored by National University Hospital)
• Jurong Health (anchored by the upcoming Jurong General Hospital in the west)
• SingHealth (anchored by the Singapore General Hospital)

“The Agency for Integrated Care (AIC) was set up to smooth the transition of patients from one care setting to another at the national level. This is also supported by the effort by the Ministry of Health to develop a nation-wide electronic medical records system, National Electronic Health Records.”

(See above.) In addition to the public hospitals, the services provided by the private sector health service groups such the Parkway Group, the Raffles Medical Group, and Thomson Medical attract overseas patients to Singapore seeking healthcare as well as many Singaporeans and Singapore-based professionals.

ICTs and Healthcare in Singapore

Singapore had already started its progression towards the use of ICTs in healthcare in the 1990s (see Appendix). Among the ICT apps listed by the IDA as early as 2004 at various hospitals and clinics were texts, alerts and reminders to patients and doctors using SMS and WiFi networks, monitoring devices, database data-sharing systems, including for example, X-rays, the use of Electronic Medical Records (EMR), web portals set up by hospitals for patient information, Computerized Clinical Order Entry (CCOE) systems, RFID tags for medicines and for patients, and on-demand entertainment systems for patients. Robotics can be added to this list, such as the bottle-dispensing system in KK Women’s and Children’s Hospital (KKH) and the disperser at the Tan Tock Seng Hospital.

As the costs of healthcare rise, the pressure is already on to find cost-effective solutions that not only maintain the quality of patient care services, but even extend them. At the other end of the

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scale is the growing paid demand for healthcare services that will drive the adoption and development of ICT applications and R&D in pharmaceuticals. According to projections by Frost and Sullivan, by 2016 the Asia-Pacific healthcare industry will be worth USD160 billion. The following map from Frost and Sullivan suggests that total expenditure on healthcare in the APAC region will grow by over 150 per cent from 2012-2020. The CAGR for Singapore over that period is forecast to be 9.6 per cent. In the region, only India and the Philippines are forecast to grow faster.

**Smart Health and skills**

Healthcare training has always been an important part of healthcare services, and the introduction of ICTs calls upon healthcare staff at all levels to become familiar with digital equipment and ways to use it. The benefits are clear, including greater accuracy and reduced errors, a better experience for the patients, higher quality and often non-intrusive practices that can replace open surgery and intrusive personal examinations leading to better diagnostics, etc. Training staff in these smarter ways to deliver healthcare is therefore an essential part of the process. One such example is the opening of the SingHealth Duke-NUS Surgical Skills and Simulation Centre (SSSC) is located in the Academia building at the Singapore General Hospital campus. The SSSC aims to help surgeons and specialists involved in surgeries hone their skills. The centre includes live streaming and recordings of training sessions and a 24-hour Surgical Simulation Laboratory and is expected to train up to 1,000 healthcare specialists every year.

Another example is the introduction, from Britain, of a mobile app that allows trainee eye doctors to practice Touch Surgery on up to 60 different eye operations, including cataract surgery. The app has been launched at the Singapore National Eye Centre (SNEC).

**Smart Health, the cloud and the carriers**

In 2015 the Integrated Health Information Systems (iHiS), the Ministry of Health Holdings’ IT arm, was awarded the prestigious *DataCloud Enterprise Cloud Award: Cloud End User Innovation Award* for its Health Cloud (H-Cloud) project.

“The H-Cloud was developed by IHiS together with Schneider Electric and is based on a modular architecture that would provide a single platform for clinicians to access, analyse, and update patient EMRs, while also guaranteeing disaster recovery and uptime for all clinical centres during and after any emergency.... H-Cloud has effectively raised infrastructure and application availability from 99.5% to 99.99% as a result of the cloud’s active-active configuration; quadrupled levels of server utilisation; and reduced compute provisioning time from 6-8 weeks to 2-3 days, with no need to buy and set up additional computers as H-Cloud has sufficient capacity to host new applications or expand existing ones.... An independent assessment by Price Waterhouse Coopers suggests that the Health

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25 Channel NewsAsia (24 October 2015), ‘New surgical skills and simulation centre launched’,
26 The Straits Times (24 October 2015), ‘Trainee eye docs use app to practise skills’,
http://www.straitstimes.com/singapore/trainee-eye-docs-use-app-to-practise-skills
Cloud would deliver savings of millions of dollars over the next ten years. Each hospital cluster would reduce its costs by about 55% on average as compared to business-as-usual costs by 2025.” (IHIS website, 5 June 201527)

Using the cloud to store, analyse and communicate healthcare information about patients inevitably raises concerns about security and about cross-border data transfers and who is authorized to send and receive such data. For example, Australia enforces strict controls over cross-border transfers of personal health data from the cloud as recent research by the Asia Cloud Computing Association spells out.28 Interestingly, one of the most active carriers in the region promoting cloud-based healthcare services is Australia’s Telstra.29 Another carrier, Vodafone, has partnered with pharmaceutical company AstraZeneca to provide mobile health services for improving treatment of cardiovascular conditions.30

Smart Health, carriers and vendors

The role of fixed and mobile telecom carriers and ISPs is an important link in the smart health chain. They are crucial in providing connectivity to the cloud, to smart devices, for M2M, IoT and to hospitals with dedicated and secure networks or carrier-grade fast broadband. Smart mobile apps are the next tier above this level. In Singapore there are many appearing on the market, partly as a result of the IDA’s Healthcare Innovation Programme. Motorola has been a participant and among local Singaporean companies are “SQL View, Napier Healthcare, Medisyx, Y3 Technologies, Cadi Scientific, Ace Vision, LANWorks, Cicada Cube, KOOPrime, HutCabb, Autoscan, Care Inc and KenLab, whose enterprise mobile solutions are either currently undergoing trials in local healthcare clusters or currently in pilot phases.”31 Another developer of apps entitled Smart Ageing, Heartsmart and Health Abacus is BH Mobile Pte Ltd, a subsidiary of Borderless Healthcare Group (BHG) founded by a Singaporean doctor Dr Wei Siang Yu.32 But a potential danger is the growing use of mobile apps that involve security risks. A recent study in the UK found that of 80 personal mobile apps, one-third of them failed to encrypt the data, including four that had been approved by the National Health Service (NHS) to transmit health data, “which if intercepted might cause ‘embarrassment or distress’.”33 And in the USA another recent report from the Massachusetts Institute of Technology, Harvard and Carnegie-Mellon universities found that 73 per cent of Android apps and 47 per cent of

28 ACCA (September 2015), ‘The promise of cloud computing for the healthcare sector in the Asia-Pacific region: Interim Report’.
iOS apps were sharing personal information with third parties, including three out of the 30 medical, health care and fitness apps studied. In Singapore all three carriers have developed and are promoting M2M solutions to the health sector, both in support of the smart health initiatives of the Infocomm Masterplan for a Smart Nation and because the sector is seen to be a growth sector. A report from MarketResearch.com forecasts the value of the Internet-of-Things in healthcare devices by 2020 globally will reach USD117 billion.

Chart 2: Asia Pacific Healthcare Outlook, 2012 – 2015, Frost & Sullivan

Smart health is therefore a growth area full of opportunity all along the supply chain, from inventors and innovators, vendors and investors, healthcare authorities and healthcare professionals, and citizens and patients. For example, the Institute of Infocomm Research at A*Star has recently come up with a prototype smart glasses based upon Google glass for seniors with dementia. The idea is that the glasses can identify people and objects and help prompt the wearer with recognition.

Smart Health and satellite

34 BBC News (5 November 2015) ‘Report finds apps regularly “spy on users”’
35 Forbes (22 April, 2015) ‘$117 Billion Market For Internet of Things In Healthcare By 2020’
36 The Straits Times (10th July 2015), ‘Smart glasses for seniors with dementia’
http://www.straitstimes.com/singapore/health/smart-glasses-for-seniors-with-dementia
Extending the reach of smart health to remote communities and to maritime vessels in mid-ocean is another challenge, one that satellites such as Inmarsat serving maritime areas and a new generation of ‘smart’ satellites with multi-directional beams such as Singapore-based Kacific serving the Pacific Islands, can handle with ease. Providing connectivity to IoT aboard ship and remote rural areas can bring smart health analytics and health care to communities on the fringe of well-connected societies, an issue of importance to APEC. For Singapore as a hub for the region, and with concerns about contagious diseases and pandemics coming into the City-State, satellite-aided communications can provide advanced warnings.

It is not just wearables that are promising smart solutions. Medical pill cameras are already in use.

[Image: Pill Camera Diagram]

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Smart Health – paying for it

Singapore spends annually over SGD7 billion (USD5 billion) on the healthcare budget, or around 12 per cent of total public expenditure; 80 per cent of primary healthcare is delivered by the private sector and 80 per cent of hospital services are publicly funded. In the UK the public sector funding for the National Health service is around 18 per cent. In the US the figure is over 22 per cent. In Hong Kong it is close to 17 per cent. Singapore’s approach has been very much to focus on public insurance schemes along with traditional family support, but as the Prime Minister hinted recently, the balance may have to change as an aging population poses serious challenges to the healthcare and support systems.

Prime Minister Lee Hsien Loong said at the Universal Health Coverage Ministerial Meeting on 10th February 2015.

“The Republic's three-pronged approach consists of, first, a focus on public health, such as investing in basic sanitation, compulsory inoculation and mass education; second, a system that "marries the best of a privatised healthcare system with the best aspects of a single-payer model", with Government hospitals restructured to become autonomous, non-profit accounting entities; and third, a balance in healthcare financing between individuals, insurance and Government, with official subsidies supplemented by compulsory savings in the form of Medisave, MediShield and Medifund. Insurance premiums will be higher because MediShield Life is a more encompassing scheme, so the government is subsidising the premiums to keep them affordable, especially for the lower-income group,” said Mr Lee.

Source: ‘4 shifts in Singapore’s approach to healthcare, outlined by PM Lee’

In June, 2015 the MOH added Eldershield as “an affordable severe disability insurance scheme which provides basic financial protection to those who need long-term care, especially during old age. It provides a monthly cash payout to help pay the out-of-pocket expenses for the care of a severely-disabled person.”

In November 2015, MediShield was launched to cover the financial needs of Singaporeans and Permanent Residents for healthcare insurance cover. From 1st November, all Singaporeans and PRs will be automatically covered, with subsidies on premiums for lower income families.

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40 UK Public Spending, http://www.ukpublicspending.co.uk/uk_health_care_spending_10.html
Appendix 1 – Health informatics

In 2005 TRP (the Hong Kong parent of TRPC Ltd, Singapore) ran a forum on Health Informatics – available at [http://trpc.biz/health-informatics-in-hong-kong/](http://trpc.biz/health-informatics-in-hong-kong/). The paper was researched before the era of “smart health” and provides a useful reference point for the issues included in the current Briefing Paper, including international comparisons in approaches. The title of the paper draws upon the distinction between health informatics and medical informatics.

Appendix 2 – Smart cards for healthcare services

The use of smart cards using biometric or two or three-factor authentication for security has been debated for well over a decade. What information should be stored in the secure elements? Should such data be machine-readable or encrypted? Should the data be stored in the cloud or in some other secure database and the card itself only provide hyperlinks? Should the card remain ‘functional’ for health purposes only, or multi-functional to include related services such as insurance, or unrelated services such as online payments, or should the card be embedded in a ‘foundational’ national ID card system? Should the cards be ‘international’ in function?43 Different systems have been adopted in different countries.

Examples of Healthcare Information that can be stored on Smart Cards


43 The only internationally recognized standard for cards is by the [International Civil Aviation Organization (ICAO)](http://www.icao.int/)

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[Image of diagrams and tables related to smart cards and their applications in healthcare]
Appendix 3 – TPP and medical equipment

Can the TPP deal with smart issues?

At what stage might a smart health device become a medical device? At the moment is the distinction between a device that senses or monitors an ailment and a device that treats an ailment? Or is it between a device used by a citizen/patient and a device used by a health professional? Or is it between a stand-alone device designed for medical purposes and a multi-purpose device that includes medical functions? Will the TPP prove smart enough to handle these cross-over issues in digital devices?

Text of the Trans-Pacific Partnership (TPP) is currently available at http://www.mfat.govt.nz/Treaties-and-International-Law/01-Treaties-for-which-NZ-is-Depository/0-Trans-Pacific-Partnership-Text.php

References to medical equipment appear as follows (footnotes excluded):

ANNEX 8 – B: INFORMATION AND COMMUNICATIONS TECHNOLOGY PRODUCTS

Section B: Electromagnetic Compatibility of Information Technology Equipment (ITE) Products

Para 3: If a Party requires positive assurance that an ITE product meets a standard or technical regulation for electromagnetic compatibility, it shall accept a supplier's declaration of conformity

Para 6: Paragraph 3 shall not apply with respect to any product:
   (a) that a Party regulates as a medical device, or a medical device system, or a component of a medical device or medical device system; or
   (b) for which the Party demonstrates that there is a high risk that the product will cause harmful electromagnetic interference with a safety or radio transmission or reception device or system

ANNEX 8 - E: MEDICAL DEVICES

1. This Annex applies to the preparation, adoption and application of technical regulations, standards, conformity assessment procedures, marketing authorisation and notification procedures of central government bodies, other than technical specifications prepared by governmental entities for production or consumption requirements of such entities and sanitary or phytosanitary measures, that may affect trade in medical devices products between the Parties. A Party’s obligations under this Annex apply to any product that the Party defines as a medical device pursuant to paragraph 2. For the purpose of this Annex, preparation of a standard, technical regulation, conformity assessment procedure or marketing authorisation includes, as appropriate, the evaluation of the risks involved, the need to adopt a measure to address those risks, review of relevant scientific or technical information, and consideration of the characteristics or design of possible alternative approaches.

1bis. Recognising that each Party is required to define the scope of products covered by this Annex pursuant to paragraph 2, each Party should define the scope of products subject to its statutes and regulations for medical devices in a manner that is consistent with the meaning assigned to the term “medical device” in the Global Harmonization Task Force Final Document entitled “Definition of the Terms ‘Medical Device’ and ‘In Vitro Diagnostic (IVD) Medical Device’”.

16
2. Each Party shall define the scope of the products subject to its statutes and regulations for medical devices in its territory and make such information publicly available.

3. Each Party shall identify the agency or agencies that are authorized to regulate medical devices in its territory and make such information publicly available.

4. Where more than one agency is authorised to regulate medical products within the territory of a Party, the Party shall examine whether there is overlap or duplication in scope of those authorities and eliminate unnecessary duplication of any regulatory requirements resulting for medical products.

5. The Parties shall seek to collaborate through relevant international initiatives, such as those aimed at harmonization, as well as regional initiatives in support of such international initiatives, as appropriate, to improve the alignment of their respective cosmetic products regulations and regulatory activities.

6. Each Party shall consider relevant scientific or technical guidance documents developed through international collaborative efforts with respect to medical devices when developing or implementing regulations for marketing authorisations of medical devices. Each Party is encouraged to consider regionally-developed scientific or technical guidance documents that are aligned with such efforts, as appropriate.

6bis. Each Party shall observe the obligations in Article 2.1 and Article 5.1.1 of the TBT Agreement with respect to any marketing authorisation or notification procedure or element thereof that it prepares, adopts or applies for medical devices that do not fall within the definition of a technical regulation or conformity assessment procedure.

7. Recognising that different medical devices pose different levels of risk, each Party shall classify medical devices based on risk, taking into account scientifically relevant factors. Each Party shall ensure that, when it regulates a medical device, it regulates the device consistent with the classification the Party has assigned it.

7bis. Each Party recognises that the responsibility of providing sufficient information on which a Party makes regulatory determinations on a medical device rests with the applicant.

8. Each Party shall make its determination on whether to grant marketing authorisation for a specific medical device on the basis of:
   (a) information, including, where appropriate, clinical data, on safety and efficacy;
   (b) information on performance, design and manufacturing quality of the product;
   (c) labelling information related to safety, efficacy, and use of the product; and
   (d) other matters that may directly affect the health or safety of the user of the product.
   To this end, no Party shall require sale, pricing, or related financial data concerning the marketing of the product as part of such a determination.

9. Each Party shall administer any marketing authorisation process it maintains for medical devices in a timely, reasonable, objective, transparent, and impartial manner, and identify and manage any conflicts of interest so as to mitigate any associated risks.

Note, an error in the online text reproduces para 4 under the cosmetics annex. Cosmetics has been changed to medical in this version.
(a) Each Party shall provide an applicant seeking marketing authorisation for a medical device with its determination regarding marketing authorisation within a reasonable period of time. The Parties recognise that the reasonable period of time required to make a marketing authorisation determination may be affected by factors such as the novelty of a product or legitimate regulatory implications that may arise.

(b) If a Party determines that a marketing authorisation application for a medical device under review in its jurisdiction has deficiencies that have led or will lead to a non-authorisation decision, that Party shall inform the applicant seeking marketing authorisation and provide reasons why the application is deficient.

(c) If a Party requires marketing authorisation for a medical device, the Party shall ensure that any marketing authorisation determinations are subject to an appeal or review process that may be invoked at the request of the applicant seeking market authorisation. For greater certainty, the Party may maintain an appeal or review process that is either internal to the regulatory body responsible for the marketing authorisation determination, such as a dispute resolution or review process, or external to the regulatory body.

(d) Where a Party requires periodic re-authorisation for a medical device that has previously received marketing authorisation by the Party, the Party shall allow the medical device to remain on its market under the conditions of the previous marketing authorisation pending its decision on the periodic re-authorisation, except where a Party identifies a significant health or safety concern.

10. When developing regulatory requirements for medical devices, each Party shall consider its available resources and technical capacity so as to minimise the implementation of requirements that could:

(a) inhibit the effectiveness of the procedure for ensuring the safety, efficacy or manufacturing quality of medical devices; or

(b) lead to substantial delays in marketing authorisation regarding medical devices for sale on its market.

11. No Party shall require that a medical device receive marketing authorisation from country of manufacture as a condition for the medical device receiving marketing authorisation from the Party.

12. Where a Party requires a manufacturer or supplier of a medical device to indicate information on the product’s label, the Party shall permit the manufacturer or supplier to indicate the required information by relabeling the product or supplementary labelling of the product in accordance with the Party’s domestic requirements after importation but prior to offering the product for sale or supply in the Party’s territory.