INFORMATION PAPER
on
Main eHealth activities outside of the EU

Annex 8
Main Singapore eHealth policies and activities

LIST OF ABBREVIATIONS

ACCRONYM	DEFINITION
BHG	Borderless Healthcare Group
EHR	Electronic Health Records
EMRX	Electronic Medical record exchange
EMR	Electronic medical records
GDP	Gross domestic product
HITMAP	Health IT Master Plan
ICT	Healthcare and Information and Communications
IHIS	Integrated Health Information System
MOH	Ministry of Health
MOHH	Ministry Of Health Holdings
NEHR	National Electronic Health Record
NHIS	National Health Identification Service

TABLE OF CONTENTS

Preamble

Object

The present document is an Annex to Joint Action to support of the eHealth Network (JAseHN) Deliverable 8.1.4 in WP8 "Report on main eHealth activities outside of the EU". It has been prepared by Diogo Bento Martins, Henrique Martins, Juliana Sá – from Shared Services, Ministry of Health - Portugal) under the control of Michèle Thonnet (Work Package leader- FRNA), then corrected and approved by the sPSC.

The objective of D8.1.4 is to observe the situation in various countries in order to better understand the development factors and main trends in the worldwide movement towards a tighter integration of ICT tools in healthcare but also to be able to initiate cooperation when advisable and possible. To that end, concrete projects have been identified as potentially interesting for eHN Member States (MS) exchanges or cooperation. These opportunities would need deeper analysis, through direct contact with experts, notably local representatives of the concerned MS or participants in EU projects.

- I -
Introduction and background

1. The undisputed continental leader

Singapore is a 5.75 million people city-state and one of the major's economical centers in the world. The proportion of residents aged 15 to 64 years increased from 71.0% in 1990 to 72.8% in 2015 while the proportion of children under 15 years has steadily declined from 23.0% in 1990 to 15.4% in 2015. Adding to population aging, there are some other important tends related with cultural diversity and the influx of foreigners. In this way, Singapore faces multiple challenges related with an aging and population mobility.

However, this nation benefits from several characteristics that make it an being small, compact, and having a digitally literate population; having a good infrastructure base, with high speed connectivity, and high smart phone penetration; successful computerisation and digital transformation in agencies such as the Immigration & Checkpoints Authority (ICA), Inland Revenue Authority of Singapore (IRAS), and National Library Board (NLB); having a pool of talent who perform well in the STEM (Science, Technology, Engineering & Mathematics) disciplines, and greater demand and higher wages for infocomm-technology professionals and engineers; a vibrant and global innovation ecosystem with an expanding number of local and international start-up and an open data network with private sector leveraging on Government data through data.gov.sg to drive new services, and public-private collaborations.

Additionally, Singapore as a nation, is quite committed with the plan to use digital solutions to provide better efficacy on services and business. In 2014, the Smart Nation and Digital Government Group (SNDGG) was launched focused on five domains: transport; home & environment; business productivity; health and enabled ageing and public sector services. Smart Nation is about creating new opportunities in a digital age, and transforming the way people live, work and play. While the SNDGG is the overall tech-agency for our Smart Nation initiatives, the health IT pillar is led/driven by the Ministry of Health (MOH) and the Integrated Health Information Systems (IHis), a wholly-owned subsidiary of MOH Holdings Pte Ltd and the health technology agency for MOH Singapore.

1.1 Motivations for selecting Singapore for eHealth study

Singapore generally has an efficient and widespread system of healthcare, Bloomberg ranked Singapore's healthcare system the most efficient in the world in 2014. The Ministry of

Health believes in ensuring quality and affordable basic medical services for all. Singapore has a healthcare system with a financial supporting model based on the idea that patients should bear their health costs and only 5 to 7% of the GDP is allocated to health due to a very strong management policy. In terms of health, the Smart Nation initiative is focused on promoting active ageing. Several digital initiatives were created around this project to promote health.

This global national approach to become a "smart nation" and the effective efforts that Singapore is doing to increase efficacy by using technology makes it on particularly important example in terms of eHealth which can inspire other nations to walk a similar path.

1.2 Healthcare system

National health system in this country, requires individuals take responsibility in their healthcare; patients need to pay for extra healthcare beyond what is considered basic by the government. Healthcare support is based in several nets with the main goal of not to leave any person out of the system. *Medisave* is a forced saving plan that comes from Singaporean's working wages, *MediShield* is a national catastrophe insurance plan that works as an extra founding for chronic illnesses and *Medifund* which is a plan for those how are not in none of the previous programs and that is administered by hospital boards.

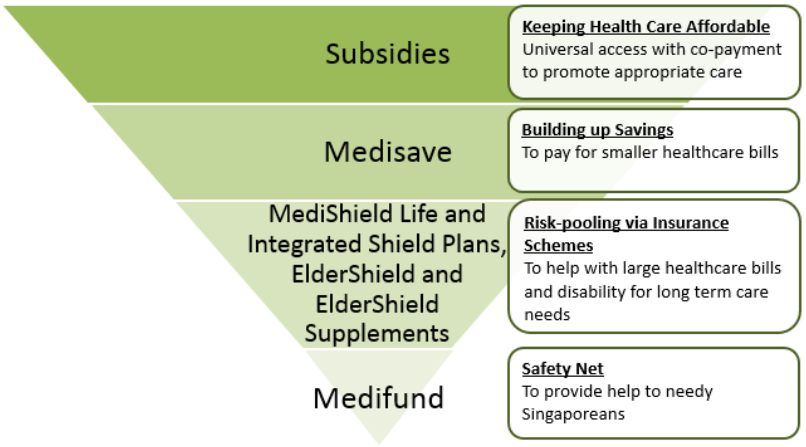

Fig 1. Singapore Health System Structure

Government has an important role in regulating of the market, choosing which treatments and drugs are provided to the patients. Patients are encouraged to face healthcare as consumers by exposing them to the cost of their healthcare. Most of the hospitals are public and a large proportion of doctors work directly to the state. "

Singapore's National Health Care Plan, issued in 1983, set four strategies for keeping care affordable and meeting the demands of a growing and increasingly affluent population. It

restructured the public hospital system, granting more autonomy to hospitals and promoting competition among them. They introduced *Medisave*, a medical savings account that enabled individuals to put away money (compulsory) to pay for their healthcare.

The blueprint for Singapore's current healthcare system was published as a White Paper entitled Affordable Health Care. It announced five objectives and set four plans for implementing each:

- Become a healthy nation by promoting good health
- Promote individual responsibility for one's own health and avoid overreliance on state welfare or third-party medical insurance
- Ensure good and affordable basic medical services for all Singaporeans
- Engage competition and market forces to improve service and raise efficiency
- Intervene directly in the healthcare sector when necessary, where the market fails to keep healthcare costs down

In order for the health sector to sustain its effectiveness and efficiency amid a demographic shift in aging, the government in 2012 launched its Singapore Healthcare 2020 Masterplan. Main goals of this program were: accessibility - to better integrate care across different settings is re-organising healthcare system into Regional Health Systems; quality - equipping medical institutions, having a skilled workforce and improving patients and staff interaction with technology; and affordability – choose wisely the options of treatment and materials.

As Singapore rapidly develops, the Government has placed strong emphasis on the development of the Healthcare and Information and Communications (ICT) sectors. Investment in these sectors has been significant, helping to advance healthcare into the new millennium. The Ministry of Health (MOH) established in 2008 the Integrated Health Information System (IHIS) and numerous pilot studies were delivered after that, in order to raise the level of health and health awareness through education, screening programs, dental services to children, nutrition programs, and more.

In May 2011, the MOH unveiled the new and revamped strategic Health IT Master Plan (HITMAP). Since 2014, HITMAP has been the guiding force behind the IT programmes by the healthcare sector in Singapore. The National Electronic Health Record (NEHR) program is a linchpin for Singapore's Healthcare IT Master Plan. It stores a unified medical record for every patient within and it is used in more than 280 institutions by over 14,000 physicians.

HITMAP allows the MOH's 3 key shifts to take form:

- beyond quality to value
- beyond hospital to community
- beyond healthcare to health

along with

- supporting policy formulation and evaluation,
- supporting systems governance public health
- supporting operations management
- strengthening IT resiliency
- improving cost effectiveness

Additionally, the government allocated 19 billion SGD to support Singapore's research and development, healthcare being one of the focus areas. In line with the above goals, the MOH has unveiled new programmes, bringing healthcare in Singapore into the digital age.

2. Health situation and policies

The Singapore NEHR is led by MOH Holdings (MOHH) which is the holding company of Singapore's public healthcare clusters – National University Health System (NUHS), Nation Healthcare Group (NHG) and Singapore Health Services (SingHealth). The aim of MOH Holdeings include developing a national IT framework that facilitates seamless delivery of care to patients and operationalizing a talent management and HR framework for the entire public healthcare spectrum.

NEHR roles include:

- Patient data exchange system across the national healthcare network;
- Manages patient's health record by capturing clinically relevant information from their encounters with clinicians and healthcare professionals throughout their life;
- Provides secure access to a patient's health records by authorised clinicians and healthcare professionals to:
    - Enable greater coordination and informed decision-making;
    - Support more accurate diagnosis, better treatment, and patient-centred integrated care;

- Clinicians able to access secure near "real-time" care records for each patient including problem lists, medications, discharge and event summaries, allergies, immunisations, investigations, and procedures.

Their vision is led by the goal: "One patient, One Health Record".

3. Implementation

3.1 Structure

In terms of architecture of NEHR was designed with the end in mind:

- Architecture designed to be inherently flexible
- Easy to implement changes as policies evolve over time
- Designed to meet needs and goals of three core stakeholders (shown below).

There are four core elements in the above blueprint:

a) Access Channels

NEHR data will be viewed in an appropriate format for clinicians and in the future, for patients and researchers. There are 2 core channels, separating access and display: a clinical portal and integration with existing electronic medical records (EMR) systems.

b) Data Sources

The primary sources in Singapore are: public hospitals' and polyclinics' EMR systems, registration systems and ancillary systems. Data is also provided by the national registries.

c) EHR Information Exchange

Set of services to facilitate sharing of information. The NEHR relies on enabling the exchange of patient and clinical information throughout the NEHRT system, data sources and data consumers. This allows the NEHR to be a producer, consumer and supplier of data.

d) Technology infrastructure

This feature provides the supporting platforms, integration, security and operations capabilities.

3.2 NEHR capabilities

The National Health Identification Service (NHIS) is a patient master index, linked to various healthcare centres in Singapore. It allows the NEHR to match patient records from across the health domain in the country. Healthcare practitioners are able to identify patients thorough a variety of factors; name, birth date, NRIC and other demographic information.

3.3 Summary care record.

Through the NEHR, each patient has a summary care record, providing an informative overview of their recent clinical activities. These activities can include x-rays, laboratory results, medications etc. The summary care record is a high-level overview, where clinical practitioners can access more detailed documents as required.

a) Access to Discharge and Event Summaries:

The access of this area informs clinicians of specific occurrences of the patient, such as hospital admissions.

b) Access to Health Data in national registries:

NEHR allows clinicians to access existing and past records in the national registry; child immunization records, medical allergies etc. This supports the country's Electronic Medical record exchange (EMRX) system, which enables clinicians to access past medical documents of a patient. Patients accessing their own information will be available in the future all though details about this access are not yet available.

c) Privacy and Security:

Two vital aspects of the NEHR are privacy and security. Singapore's system has integrated role-based access, data sensitivity classification and 'break-the-glass' functionality.

d) Audit and logging capability.

Once a clinician has accessed the information, his details are captured by the NEHR's audit and logging capability.

4. Program Goals

In the initial phase, the NEHR was aimed to **preventing actions** and **continuity of care**. Prevention is defined as proactive and personalised approaches to health promotion and disease prevention, raising the level of health literacy to keep Singapore's population healthy and delaying onset of disease for those at risk. Focus is also on early detection of diseases, and appropriate intervention. The long-term goal is to allow primary, acute and community-care

clinicians to access and contribute clinical data that help enhance medical treatment and improve patient safety.

Continuity of care is defined as the transition and coordination of patient care from one care provider to the next.

- Providers in different healthcare settings will function as one team, having access to health, social, financial information for holistic view of consumer.

This strategy allows for seamless, coordinated and quality care across all healthcare facilities in Singapore.

- II -
Strategies and eHealth development

Following the vision "One Singapore, One Health Record" requires some comprehensive rich, view-only system which includes:

5. System integration

Institutions implementing integration programs incur significant costs in running their own health IT systems. To lower costs, Singapore's entire healthcare information exchange system is moving to the cloud. The health cloud, or hCloud, will store healthcare information from different hospitals and will have enough capacity to host additional applications in the future.

The system has the all the information about the patient in any healthcare facility that the patient visits, including: clinical events (clinic visits, surgeries), investigation reports, radiology reports, alerts and allergies, immunization records, medications and host of supporting documents.

Under the initiative Smart Nation there is also a new web portal and mobile application, HealthHub. launched in October 2016. It works as a digital healthcare companion for every citizen by equipping citizens with the information, knowledge, tools and services to help them take greater ownership of their own health and wellness. It allows several options such as:

- Access personal hospital records, lab test results (chronic diseases), and future medical appointments with various public healthcare institutions;
- Access immunisation records, dental health records, medical appointments, details of medications and known side effects.
- Access an extensive directory of healthcare and lifestyle facilities and services available island wide. This includes locations of polyclinics, healthier restaurants and sports facilities.
- Users will also be able to earn and accumulate Healthpoints that can be converted into rewards by sharing health articles or events read on HealthHub on social media platforms.

6. Management of data from many sources

When brought together, the different data sources in Singapore had significant variations of data and basic concepts had different definitions across different healthcare organizations. This fact created complexities of disparate data from many different sources, which has been solved by using production data analysis and to focus on raw data for initial release.

7. Tele-Health

Singapore government is committed to bring health services closer to the patients mainly because the population is aging, and elderly are living apart from younger family members. The Telehealth and Telemedicine programs help seniors to manage chronic conditions beyond the acute setting. Present services include:

- Tele-rehabilitation for stroke patients performing rehab at home;
- Tele-ophthalmology for patients in polyclinics receiving a virtual eye exam by hospital ophthalmologists.

For some years now, most of polyclinics in Singapore are transmitting X-ray images to be analysed in radiology centres, treating stroke in emergency together with specialists in videoconference, transmitting eye images to specialists and transmitting dermatology images.

Some concrete examples on tele-health are included in the Smart Nation initiative:

- Elderly Monitoring Systems which are able for families caring for frail or elderly members, the elderly monitoring system can help provide peace of mind to caregivers while they are away from home.
- Vital Signs Monitoring by using devices to monitor patients' vital signs at home or community, care providers will not only be able to educate patients to self-care but can also receive alerts for intervening early warning signs.
- Tele-rehabilitation and Video Consultation to improve access to rehabilitation services and achieve higher patient compliance towards better functional recovery, several hospitals are trialing a tele-health rehabilitation system for patients with orthopaedic conditions or who are recovering from a stroke. In addition, these trials assess the suitability for wider application in an ageing population.

8. mHealth

The multilingual and multicultural population of Singapore seems to make it good place to introduce new technologies. Singapore mHealth action are focused on:

- Promotion of health and prevention of disease – several health programs are based in SMS alerts;
- Diagnosis – used in for eye exams, dermatology and stroke;
- Treatment – providing guidance for rehabilitation;
- Monitoring – allowing monitorization of chronic illnesses;
- Support for health services – registering for an appointment and getting the queue number.

Borderless Healthcare Group (BHG) is a home growing company that delivers three Android and iPhone apps, Smart Ageing, Heart smart and Health Abacus via its "Borderless Clinic" mobile engine app. The apps allow live chat sessions when patients can ask their doctors questions about their conditions, medications and lab results. Several other apps were created to engagement of citizen's, transparency between healthcare organizations and citizens and the desire for increase access.

A concrete practical example of mHealth application in this country is included in the Smart Nation initiative. It is a Health Promotion Board (HPB) physical activity program called the "National Steps Challenge™" which includes a mobile app that counts steps and gives rewards to increase physical activity in the national population. According with data from the initiative, since its launch in November 2015, 70% of previously inactive participants now average more than 7,000 steps per day, with 30% of participants clocking about 10,000 steps a day on average and more than 330,000 participants have signed for the second part of the project.

- III -
Conclusions and possible ways ahead

9. Toward a new eHealth strategy

Analysis of Singapore strategy for health was primarily based on data available from public sources and reports. It allowed increasing the knowledge about this country strategy on e-health and this information can be used to inspire future work in Europe.

Some key points can be highlighted from the Singapore strategy: the healthcare system organization allows the government to lower spending and patients contact with cost of care is maximized which increases their responsibility using the services. Additionally, great priority has been given to e-health and technology by the government which has been essential to create interesting strategies and tools for this program that are recognized worldwide.

The Singapore experience may be an important source of inspiration for other programs. However, would be useful to gather more significant amount of information from other programmes across the world (e.g. Canada, Australia, Chile, etc). The process of information gathering should be done not only using data that is publicly available but also involving a contact person from the international system that is analysed. Further information considering implementation strategy should be added and the specific topic of acceptability and education of the stakeholders (patients and health professionals) about use of technology in healthcare settings should also be included in this document since there are very few resources available on this specific topic. There is also the need to better understand the use of eHealth to education and training of health professionals. Having a direct contact from the studied country can be useful not only to clarify procedures but also to learn from their experience, to develop joint actions and efforts that can be transformed in concrete joint actions globally.

10. Good practices

10.1 Implementing health normative standards

The system is a significant move toward achieving the "One Singaporean, One Health Record" vision by enabling individual EHR systems to interoperate. It's possible to highlighted key enablers that have helped drive the system, including: a clear government push, patient demand, the desire for more transparency between healthcare organizations and citizen's and the desire for increase access.

10.2 Reaching scale

The most obvious prerequisite for eHealth is a basic technical infrastructure, including crucial components like telecommunications networks, internet access, and high device penetration

- By focusing on core elements, eHealth managers can scope their efforts to areas that create the widest benefits to the systems as a whole
- Electronic Health Records (EHR) are often the catalyst to widespread healthcare system transformation
- The largest impact is often achieved in patient segments that suffer from chronic diseases.
- White technology infrastructure is a necessary enabler of eHealth; every effort should be made to ensure it is simple, accessible and affordable.

11. Challenges for the future

For the future, Singapore health system faces several challenges: on business and strategy, including helping partners with digitalization and connect to national systems through common standards and improvement of system continuity and resilience. These factors can achieve, in the future, a better adoption of IT by clinicians and a translation for digital documentation that are not only a digitalisation of old paper-based documents but also a flexible workflow with high standards on safety, accountability and accuracy. These goals can only be achieved by developing systems that are usable, cost-effective and valuable to all participants from patients to professionals by using trial and deployed innovative/smart technologies for better decision-support and operational efficiency.

Another core of challenges they identify are related with enhancing user experience design and user interface design, and enriching data to build a population profile. And make the systems to progress in the same directions of care when it is increasingly more oriented from institutionally centred models to community and patient centred.

It seems that Singapore priorities for the future will be to increase the quality of health records in the continuum of healthcare, protecting patient safety and engagement in the health protection.

12. Potential for cooperation

In a ranking of health-care systems of the world with a strong emphasis on access, equality and health-care financing, Singapore was ranked 6th out of 191 countries in 2000. Even though

Singapore is ranked highly in its healthcare efficiency, there is still much room for improvement. To reach 100% integration of all the health sectors in Singapore, private and public, there requires much coordination from the various stakeholders. For the future, there is hope that the NEHR can be accessed by all; patients and caregivers, instead of just healthcare professional. Patient & Caregivers today can already access selected summary health records, appointments, lab-tests results throught HealthHUB, there is availability and need for improvements to be align with best practices and standardization. Recent research shows that there is an impact of health policies in health, such as adherence to prescription, monitorization of chronic diseases and patient safety. However, there is no available information of NEHR impact on health outcomes. This is a crucial matter in order to plan and deliver the systems which should be objectively addressed and measured in the future.

- IV -
Main sources

- Singapore's National Health Care Plan
- White Paper/Blueprint for Singapore's Affordable Health Care
- Singapore unveils national Health IT Master Plan (HITMAP)
- Bloomberg Visual Data – infographics – most efficient health care around the world
- Healthcare2020: Improving Accessibility, Quality & Affordability, Ministry of Health Singapore - HealthScope, July – August 2012
- Kai Michelsen, Helmut Brand, Peter Achterberg and John Wilkinson Promoting better integration of health information systems: best practices and challenges, Health evidence network synthesis report
- William A. Haseltine (2013), "Affordable Excellence: The Singapore Healthcare Story"
- Low (at All) 2016, "Housing as a Social Determinant of Health in Singapore and Its Association with Readmission Risk and Increased Utilization of Hospital Services", Frontiers in Public Health
- www.smartnation.sg
- Ooi LC, Li D. Challenges of transformation on our healthcare IT journey. SMA news. 2015.
- Chee Yong C. Digital Health in Singapore. Ministry of Health. 2018.