Digital Health for Hong Kong and the Greater Bay Area

**A briefing paper for the Chief Executive of the Hong Kong SAR Government
by the Healthcare Committee of the British Chamber of Commerce in Hong Kong**

Executive Summary

We recommend adoption of a digital health strategy for Hong Kong and the GBA with a vision to provide high-quality, accessible and sustainable care for all through establishing and leading a regional digital health ecosystem. Digital healthcare has many advantages in terms of accessibility, quality and affordability but to realise its full potential will require a carefully planned approach. This should encompass a vision, strategic objectives, priority focus areas and implementation principles. Moving ahead quickly, and getting it right, will give a real boost to the digital economy and help offset growing healthcare spend.

Hong Kong has an efficient healthcare system but has not benefitted from the rapid technological progression of healthcare as fast as other markets. The World Health Organization (WHO) strongly urges use of digital technologies for health and has guidelines to implement a global digital health strategy, which 120 out of its 194 Member States have begun implementation. We describe some of the WHO guidelines and efforts of several other nations.

The COVID-19 pandemic has created a burning platform for change, and calls for new ways of working to reframe how health services could be delivered with a more flexible and modern approach, leveraging new digital technologies. These changes will enable Hong Kong to effectively implement a digital health strategy across the healthcare ecosystem.

We provide examples of the UK where cases of implementation have led to a reduction of up to 35% of inpatient costs, and of Estonia which has been on a digital journey for several years with 95% of government services being digital. These could provide many useful lessons for the HKSARG across sectors beyond healthcare.

Key principles and focus areas guiding the digital health strategy should include:

- Patient Centred
- Collaboration and Partnership
- Resilience

- Privacy and Security
- Evidence-Based Innovation
- Interoperable Technical Standards

Our recommendations (comprising some immediate quick wins in implementation for the HKSARG) include:

- Rapid clarification of regulations for telemedicine
- Regulations on digital medical device, use of AI in digital health and guidance on ethics in use of AI
- Enable electronic Health Record Sharing via a patient portal accessible to all based on user consent
- Use of the HKID (and proposed iAM Smart ID) to enable access to digital health platforms
- Bring R&D investment in digital healthcare in Hong Kong into line with other countries
- Train the workforce in digital healthcare

This will considerably alleviate the growing pressure on Hong Kong's public health system, promote the development of new industries and enhance Hong Kong's reputation as a technology hub in the region.

Finally, we strongly recommend that Hong Kong to articulates and builds a digital health strategy for itself and helps shape that for the wider GBA region as a whole.

Introduction

While Hong Kong's healthcare system has often been lauded as one of the best and most efficient[1], the accelerating pace of technology and innovation in healthcare dictates that we must not rest on our laurels. Healthcare systems the world over are applying digital solutions to ensure sustainability and affordability of an ever increasingly complex sector serving society. Disruptive innovation in healthcare has the potential to dramatically shape a country's healthcare system by partially disintermediating traditional (expensive) hospital-centred care delivery.

The unforeseen COVID-19 pandemic has forced healthcare providers all over the world to instigate telehealth in a remarkably short period of time. This has forced acute (hospital-based) providers to recognise the need for integration and interoperability of their technology systems to function efficiently.

As health policy makers debate effective ways to consolidate their fragmented health services, governments and healthcare providers must together create the efficient systems possible to put the patient front and centre. Barriers encountered will include outdated legacy systems, lack of digital awareness, and the reluctance to fund this critical digital transformation. The positive consequences include a more efficient, resilient and effective healthcare system which can lead to significant cost savings to the healthcare budget.

The same way the idea of Self-Sovereign Identity (SSI), which allows for individuals to retain and control their personal data, most progressive healthcare systems acknowledge that the individual should be the data controller in charge of their own personal health record, empowering them to take charge of their own health, consenting to share their information with healthcare providers as necessary (and optionally for research).

For a territory with its level of GDP per capita, aspirations for technological leadership and the tagline of being "Asia's World City", Hong Kong has an opportunity to increase its level of implementation of digital health. The Hong Kong SAR Government (HKSARG) should address this issue specifically, work through the challenges presented, and seize the opportunity to take a leadership role in defining an overarching Digital Healthcare Strategy across the health ecosystem – both for the SAR and for the Greater Bay Area (GBA) as a whole.

This document presents:

I.	The World Health Organization's Global Digital Health Strategy
II.	An overview of international experience in digital health
III.	A review of digital health in Hong Kong
IV.	Recommendations to the HKSARG for a digital health strategy (including some quick wins)

Our vision though this paper is to support the HKSARG to build Hong Kong into a leader in digital health across the GBA, and eventually become a regional and global exemplar.

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[1] https://www.bloomberg.com/news/articles/2018-09-19/u-s-near-bottom-of-health-index-hong-kong-and-singapore-at-top

I. The World Health Organization's Global Digital Health Strategy
– Implications for Digital Health and Healthcare Infrastructure

Digital health refers to the field of knowledge and practice associated with the development and use of digital technologies to enable patients and population to improve their health. Digital health covers digital consumers with a wider range of smart-devices and connected equipment and encompasses uses of digital technologies for health such as the Internet of things, artificial intelligence, big data and robotics.[2]

Having recognised the potential of digital technologies to improve the accessibility, quality and affordability of health services, the World Health Organization (WHO) urges its Member States to identify areas of improvement in use of digital technologies for health and to consider how digital technologies could be integrated into existing health systems for the promotion of people-centered health and disease prevention. The WHO sets out a *Global Digital Health Strategy* to provide guidance for Member States' efforts in the area[3]. This includes a vision, strategic objectives, a framework for action and implementation principles to advance digital health.

Collaboration between the Health sector, both public and private, and the Information and Communication Technologies (ICT) sector, both public and private, is central to the effort to promote digital health. The WHO and the International Telecommunication Union (ITU) have jointly introduced the *National eHealth Strategy Toolkit*[4], a practical, comprehensive, step-by-step guide that helps governments develop digital health strategy. These guidelines will require governments to review their existing healthcare infrastructure to ensure it remains both fit for purpose and is future-ready to service a continuously evolving healthcare delivery environment.

It is interesting to note that more than 120 member states (out of the 194 members), including low- and middle-income countries, have developed such strategies and policies to varying degrees.

II. International Experience in Digital Health

Many economies and regions have set out their own strategies and plans to accelerate the adoption of digital solutions to support the transformation of healthcare. Digital healthcare solutions are widely regarded as a key strategic focus area to maintain economic strength and global competitiveness in an era heavily reliant on information. Below is a summary of digital health strategies in selected markets.

(a) United Kingdom

In October 2018, UK Department of Health and Social Care released a policy paper titled *The Future of Healthcare: Our Vision for Digital, Data and Technology in Health and Care*[5] for discussion. The paper proposed a blueprint to meet the needs of all users. This is illustrated in Figure 1.

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[2] WHO, Draft global strategy on digital health 2020–2025, https://www.who.int/docs/default-source/documents/gs4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf?sfvrsn=f112ede5_50
[3] WHO, WHA71.7 Digital health, https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R7-en.pdf
[4] https://www.itu.int/pub/D-STR-E_HEALTH.05-2012
[5] https://www.gov.uk/government/publications/the-future-of-healthcare-our-vision-for-digital-data-and-technology-in-health-and-care/the-future-of-healthcare-our-vision-for-digital-data-and-technology-in-health-and-care
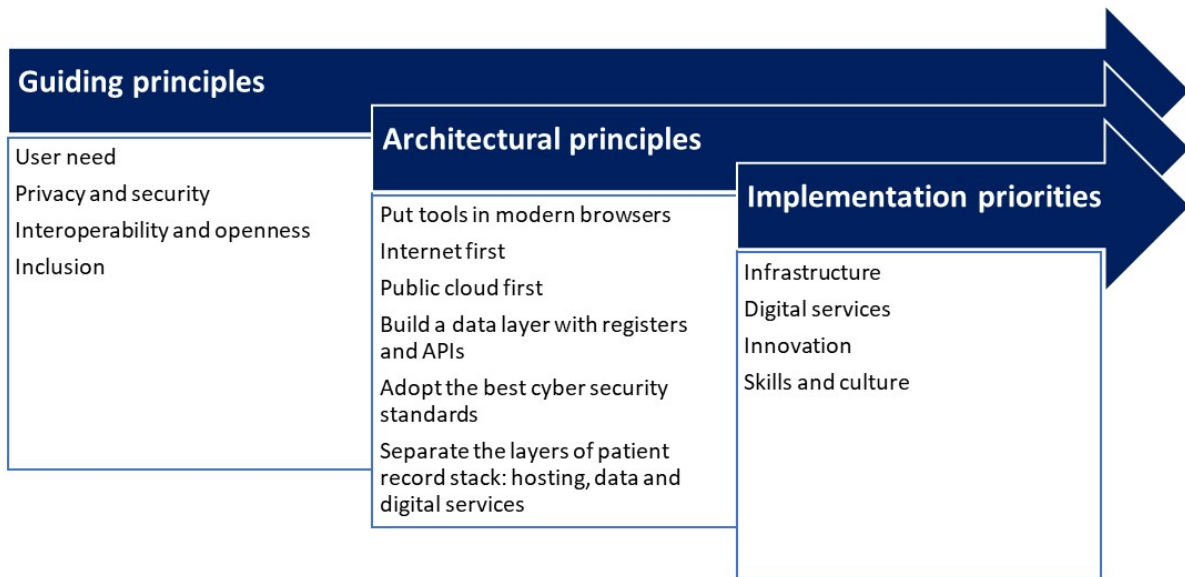
Guiding principles

User need
Privacy and security
Interoperability and openness
Inclusion

Architectural principles

Put tools in modern browsers
Internet first
Public cloud first
Build a data layer with registers and APIs
Adopt the best cyber security standards
Separate the layers of patient record stack: hosting, data and digital services

Implementation priorities

Infrastructure
Digital services
Innovation
Skills and culture

Figure 1: The UK's Vision for digital, data and technology in health and care

Within Primary Care in the UK, all patients have online access to their health records, and are able to book GP appointments and order repeat prescriptions with the prescription being electronically transmitted directly to the pharmacy for dispensing. Many healthcare organisations work together with local partners across both health and social care to develop whole systems of integrated care services on interoperable platforms, enabling them to more effectively manage patients with complex needs. These solutions help to support the management of patients in their home, and provide virtual consultations and remote monitoring, which in turn allows for earlier discharge from hospital with continued monitoring in the home care setting if necessary. During the current pandemic, many hospital and health providers have started to provide more care using telehealth. This ensures care con be continued during this time of crisis.

An example of a private sector company aligning successfully with the UK's stated digital health strategy is a company called *Babylon*, which is a digital-first healthcare company which combines technology and medical expertise to bring doctors and people closer together, with digital healthcare tools designed to empower people with knowledge about their health. Through a range of digital health services – such as AI-backed digital health tools and video doctor appointments – it gives people round-the-clock access to affordable, holistic healthcare services. Babylon's highly accessible NHS primary care service in the UK has *resulted in a reduction in hospital spend by 35%*, with high scores for patient satisfaction and clinical morale while *achieving a 97% clinical quality score*.

By articulating a clear and detailed digital health strategy for the UK, the government enabled the public and private sectors to collaborate to deliver high quality, more affordable and accessible healthcare to its population.

(b) China

Healthy China 2030 Planning Outline[6] supports health technology innovation (Chapter 23) and gives guidelines on the establishment of digitised health service system (Chapter 24). Given the highly fragmented nature of even the public sector healthcare services space in China, there have not been any public sector platforms which have been able to achieve nationwide adoption at this stage.

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[6] http://www.gov.cn/zhengce/2016-10/25/content_5124174.htm

Private players, particularly tech companies and life/health insurers, are actively implementing digital health initiatives, these include:

- *AliHealth* is primarily a pharma e-commerce business which is rapidly diversifying into consumer and digital health and developing a focus on distribution of insurance products.

- *Ping An's Good Doctor* connects to a nationwide network of healthcare providers including 3,100 hospitals, more than 1,000 health check centres as well as dentists and pharmacies across Mainland China. The service has over 190 million registered users, although only a small percentage currently access these services.

- *WeDoctor from Tencent* uses technology to empower medical care and aims to build a world-leading HMO (Health Maintenance Organization) platform to provide users with medical and health services using an "online + offline, general + specialist" model. They claim to be the health gatekeepers of hundreds of millions of families in Mainland China. Partnering with a local business in Hong Kong, Tencent *Doctorwork* piloted two intelligent clinics featured by the "Intelligent Health Assessment Set" and is developing an IT system connecting medical services across mainland China and Hong Kong.

(c) Australia

Australia's National Digital Health Strategy[7] developed by the Australian Digital Health Agency proposes seven strategic priority outcomes (e.g. information availability, data security, workforce training) to be achieved by 2022. With a long-term vision of better health for citizens enabled by digital technologies, the efforts are guided by seven principles (e.g. putting users at the center, ensuring privacy and security, fostering agile collaboration).
The document highlights six critical success factors: 1) trust and security assurance, 2) commitment, cooperation and collaboration across all governments, 3) establishment of legislative, regulatory and policy frameworks, 4) strong consumer and clinician engagement, 5) effective governance and leadership and 6) learning from others.

(d) Estonia

Estonia's health service has been digital for over 12 years. Over 95% of the data generated by hospitals and doctors is digitised. Citizens can access their own medical records via a secure online portal and choose who can access their records. The system improves the cost-effectiveness, sustainability and efficiency of the Estonian healthcare service. It also facilitates the transition to preventive, rather than curative, medicine and is underpinned by blockchain technology, a crucial pillar in ensuring the integrity and security of all patient data.

Many health services occur online from video consultations to e-prescriptions. Over 75% of Estonia's entire public bureaucracy is digitised. The digital health ecosystem integrates with other government and private sector systems and automates many ordinarily complex operations. An example is registering a death and notifying all the relevant parties: in Estonia, once a death is registered online, notifications are automatically sent to that person's workplace, the tax office and the population registry.

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[7] https://conversation.digitalhealth.gov.au/australias-national-digital-health-strategy

The GDPR-compliant Estonian healthcare digital platform is being used to exploit cost-effective and high value benefits not previously available without the access to its data. The nation has launched two major clinical pilots in personalised medicine. These pilots combine genomic and other health data to better predict and prevent cardiovascular disease and breast cancer. The long-term goal of these pilots is to develop algorithms that can be fed into clinical decision support software, which would in turn be made available to general practitioners. This way doctors can be empowered to use genomic data to provide more targeted prevention and care to patients[8].

These achievements were initially articulated in the *Estonian eHealth Strategic Development Plan 2020*[9] which was submitted to the Estonian cabinet in 2015 and laid out its digital development to both 2020 and 2025. The vision statement of the strategy was simply "*Better information – more health!*".

Estonian residents have ID cards with the same technology as Hong Kong ID Cards. With their cards, they can access over 3,000 services provided by the government as well as commercial enterprises (compared to Hong Kong's one – immigration).

(e) United States

The Office of the National Coordinator for Health Information Technology (ONC) under U.S. Department of Health and Human Services administers the *Federal Health IT Strategic Plan 2015-2020*[10]. The Plan states the vision – "high-quality care, lower costs, healthy population and engaged people" and seven principles (including for example, a focus on value, and be person-centered). Four strategic goals have been identified as 1) advance person-centered and self-managed health, 2) transform health care delivery and community health, 3) foster research, scientific Knowledge, and innovation and 4) enhance the nation's health IT infrastructure.

The draft *2020-2025 Federal Health IT Strategic Plan*[11] with refreshed vision, principles and strategic goals was published. It adapts to the latest trends and addresses new issues in digital health in the country. The document has finished the public consultation stage and will be officially published in due course.

(f) South-East Asia

The WHO Regional Office for South-East Asia [12] has prepared a *Regional Strategy for Strengthening eHealth in the South-East Asia Region, 2014–2020*[13] to provide a harmonized and comprehensive strategic framework and technical support to Member States. The strategy focuses on the four key areas – policy and strategy, tools and methods, collaboration and partnership, and human resource development. Ten of the region's eleven countries have digital health strategies, plans and architecture blueprints at various stages of development, revision and implementation.

The WHO Regional Office for the Western Pacific [14] also prepared a regional action agenda on *Harnessing eHealth for Improved Health Service Delivery*[15]. It encourages countries to prioritize

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[8] https://www.healtheuropa.eu/estonian-e-health-system/89750/
[9] https://www.sm.ee/sites/default/files/content-editors/sisekomm/e-tervise_strateegia_2020_15_en1.pdf
[10] https://dashboard.healthit.gov/strategic-plan/federal-health-it-strategic-plan-2015-2020.php
[11] https://www.healthit.gov/topic/2020-2025-federal-health-it-strategic-plan
[12] WHO Regional Office for South-East Asia has eleven Member States – Bangladesh, Bhutan, India, Indonesia, Maldives, Myanmar, Nepal, North Korea, Sri Lanka, Thailand and Timor-Leste.
[13] https://apps.who.int/iris/handle/10665/160760
[14] WHO Regional Office for the Western Pacific has 37 Member States.
[15] https://iris.wpro.who.int/handle/10665.1/14435

how eHealth is applied to improve service delivery, develop appropriate foundations such as ICT infrastructure and an enabling environment for information sharing and governance, and strengthen eHealth implementation.

Several years ago, the Singapore government adopted a proactive approach to enable the health sector to engage directly with individuals through the creation of Singapore's Health Hub[16]. Both the public and private sectors are now involved and can develop and test innovations through this platform. Having created an interactive digital ecosystem to enable R&D to meet commerce, Singapore as early as 2018 took an important step by creating its "Licensing Experimentation and Adaptation Programme (LEAP)[17]" – which provides regulatory "sandboxes" to enable new and innovative models and services to be developed and refined in a safe and controlled environment under the supervision and scrutiny of Singapore's Ministry of Health.

Key Opportunity within the Greater Bay Area

Healthcare and *technology* are two focused areas under the nation's **GBA Outline Development Plan**. While the Guangdong authorities are tasked to focus on executing national policies and strategies set by the Central Government, the HKSARG has the flexibility to develop an integrated digital health strategy tailored for both Hong Kong and the GBA as a whole.

III. Digital Health in Hong Kong

The local context is discussed under the following three areas:

  a. The information and communications technology (ICT) environment
  b. The enabling environment
  c. The context for digital health

The first represents the ICT market and overall penetration of computing and networking infrastructure. The enabling environment is fundamental to scaling up and sustaining ICT adoption within the health sector and includes aspects such as governance, policy, legislation, standards, the built environment and human resources. These both inform the context for further elaboration of digital health in Hong Kong (and the GBA).

a. The ICT Environment in Hong Kong

Infrastructure – Hong Kong has world-class ICT infrastructure. In 2019, over 94% of households had Internet access, and over 90% of businesses used the Internet[18]. Advanced infrastructure forms the foundations for electronic information exchange across geographical and health-sector boundaries. It includes not only physical infrastructure but also core services and applications that underpin a favourable environment for digital health.

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[16] https://www.healthhub.sg/
[17] https://www.moh.gov.sg/news-highlights/details/moh-launches-first-regulatory-sandbox-to-support-development-of-telemedicine
[18] https://www.censtatd.gov.hk/hkstat/sub/so120.jsp

Enabling the use of the Hong Kong ID Card, and the proposed iAM Smart electronic ID, to access integrated digital healthcare services will accelerate the rapid implementation of a digital health strategy for Hong Kong.

Services and applications – ICT services and applications in Hong Kong provide tangible means for users' access to and exchange and management of information and content. The HKSARG and private providers have implemented a variety of digital initiatives to improve patients' experience and empower people for self-management of health. Some use cases of digital health platforms are shown briefly below, and selected examples are shown in more detail in the Appendix:

- The *electronic Health Record Sharing System (eHRSS)* launched by the HKSARG in 2016 is territory-wide information infrastructure that enables registered healthcare providers to view and share the eHRs. An eHRSS-specific legislation is introduced to facilitate implementation. Stage Two development is underway, focusing on the expansion of the sharable scope and the launch of a "Patient Portal" to assist people's own health management. This platform originated in the public sector and requires patients to have a record in the public sector to participate. It specifically excludes residents with no public sector medical records.

- *AECOM* – globally has been involved in designing and developing new, refurbished and temporary hospitals utilising digital solutions to move good and services in and around hospitals, harnessing new technologies to automate existing processes, as well as using BIM, Modular Integrated Construction, Design for Manufacture and Assembly (DfMA).

- *myBupa* is a one-stop online customer service portal which allows Bupa's medical insurance policyholders to view scheme details, view and download policy-related documents, file clinical claims online, and search for network doctors/clinics on-the-go. The Live Chat function offers a new option for customers to get help digitally.

- *Pulse by Prudential* is a free digital health app offering holistic health management to consumers and forms a key part of Prudential's strategy to provide affordable and accessible healthcare to everyone across Asia and Africa. It has attracted over 12 million downloads in 10 different languages across 13 markets including Hong Kong. Pulse's AI symptom checker can reduce unnecessary GP and hospital visits; a high proportion of symptom check recommend self-management. When the app services include virtual consultations (human doctors), it helps increase access to primary care, reduces costs, increases efficiency, and reduces the burden on hospitals and private doctors.

- *Quality HealthCare Patient Portal*, serving over 400,000 lives, is a patient centric integrated app platform that enables clinic directory search, e-ticketing, appointment booking, telemedicine, virtual workshops, and access to personal health records and diagnostic tools. Preventative Health Alerts provide an advisory service to patients to support a healthier life. The *Corporate Wellness Portal* provides its base of almost 2,000 companies a platform to support employee wellness benefits tailored to each company's health objective and the employee's choice.

- *Roche* in partnership with the Logistics and Supply MultiTech R&D Centre have secured partnership funding through the Innovation and Technology Fund to pilot a new digital end-to-end community healthcare ecosystem. This will harness blockchain, and Hong Kong discovered technologies, video medical consultations, e-Prescribing, home medical delivery, and in-home monitoring for a group of patients with stable chronic disease. If successful,

leveraging the roll-out of 5G, the pilot could be expanded across Hong Kong and the Greater Bay Area for other patient groups to improve health outcomes.

The ICT environment must also be open to innovation with adoption of emerging technologies such as robotics, AI, genomics and blockchain to continuously improve the ICT infrastructure.

b. The Enabling Environment in Hong Kong

Other components of the local context for digital health can be examined from the perspective of the enabling environment.

Investment and Resources – Total research and development (R&D) expenditure remains relatively low in Hong Kong compared with international standards. Total R&D expenditure amounted to HKD 24.5bn in 2018[19], equivalent to 0.9% of the local GDP. Other notable expenditures are shown in Figure 2[20][21]. Hong Kong's total health expenditure is equal to 6.2% of local GDP in recent years[22], below OECD's average level of 8.8%[23]. Government spending and individual out-of-pocket payment already take up 50% and 32% of current health expenditure respectively, indicating that private insurance schemes can play a more active role in financing health initiatives.
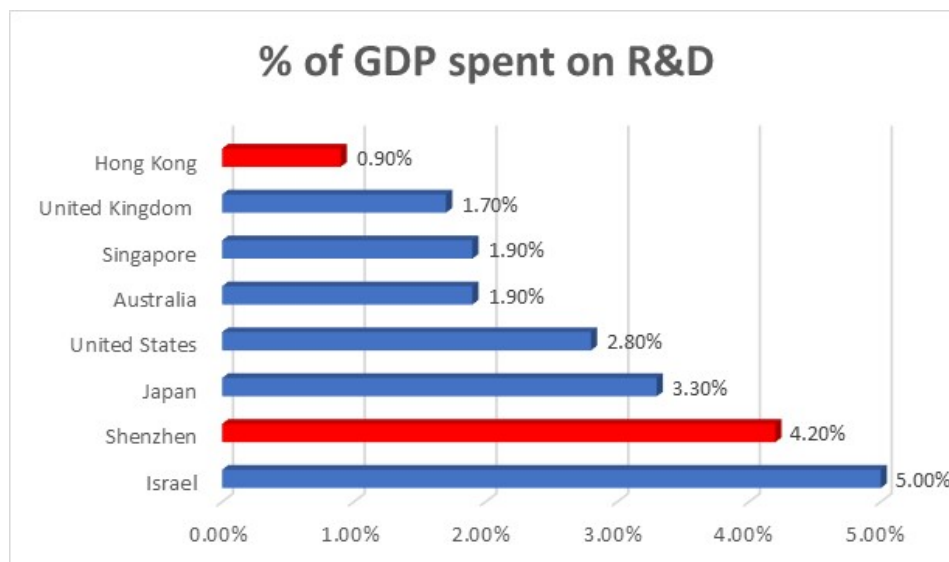

Figure 2: Percentage of GDP spent on R&D

Leadership and Governance – The HKSARG is well placed to direct and coordinate city-wide digital health initiatives. The Innovation and Technology Bureau was set up in 2015 to promote the development of the ICT industry in Hong Kong. Yet there is no such an agency with the responsibility to lead and drive digital health initiatives for Hong Kong and the GBA.

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[19] https://www.censtatd.gov.hk/hkstat/sub/so120.jsp
[20] https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS
[21]
https://research.hktdc.com/en/article/Mzg4MDE0NTE2#:~:text=A%20goal%20was%20laid%20down,accounted%20for%204.2%25%20of%20GDP.
[22] https://www.fhb.gov.hk/statistics/en/dha/dha_summary_report.htm#A
[23] http://www.oecd.org/els/health-systems/health-data.htm#:~:text=Data%20source&text=In%202019%2C%20before%20the%20onset,since%20the%20last%20economic%20crisis

Built Environment and Logistics – digital health does not stop at clinical systems and processes. Improved efficiency also derives from harnessing digital solutions within hospitals. Examples include: movement of goods, services and assets in and around hospitals using Automated Robotics (AMR); command centres to track everything from patients, beds and assets using RFID tagging of equipment and robotic pharmacy. In order to realise these benefits – effective design and construction of hospitals and health centres is essential, and these modalities *must be incorporated in the Second 10 Year Hospital Development Plan*. With the long duration required by each project programme it is essential to have flexible and adaptable designs and procurement methods to avoid the risk of hospital designs being outdated before these long term building projects are completed. This includes designing hospitals at all stages of the process utilising BIM and, the adoption and roll out of innovative construction methods such as Modular Integrated Construction (MiC) and Design for Manufacture and Assembly (DfMA) in healthcare.

Legislation and compliance – Relevant legislation is required in Hong Kong to keep abreast of advancements in digital health. For instance, Hong Kong has not introduced specific rules or principles to guide medical practitioners' conduct on digital platforms. Lack of clear legislation on areas such as telemedicine will create a material barrier to the scaling-up of such convenient and cost-effective digital health technologies.

Workforce – Education and training programs for health workforce capacity building are crucial and a well-established local network is essential for digital initiative implementation. While the Hospital Authority and most private healthcare providers are maintaining their own training mechanisms, digital health is a new subject that deserves more attention. Education on digital health must be systematically integrated at both the clinical training level (medical and nursing schools) and beyond during mandatory continuous professional development.

Innovation Ecosystem – Successful innovation hubs like Silicon Valley in the US have thrived because of the juxtaposition of the key stakeholders including the R&D centres, entrepreneur incubators, investors and support services such as legal, accounting, etc. In the last 10 years China has transformed to a switched-on entrepreneurial culture, which is bigger and faster moving than Silicon Valley. China's venture capital and tech ecosystem has grown to four entrepreneurial clusters in Beijing, Shanghai, Shenzhen and Hangzhou and these are seriously challenging Silicon Valley. China's progress in biotech is on par with the US, and China will likely come to dominate electric vehicles and autonomous driving markets. There are obvious advantages in geographic proximity to Hong Kong joining forces with Shenzhen and the GBA in creating an aligned digital health innovation approach.

Hong Kong does have all the components required and must put in place a proactive policy to encourage and enable rapid, disruptive innovation to occur, possibly with the adoption of regulatory sandboxes to enable a faster iterative research cycle. In healthcare, the benefits will be quickly seen in both specific treatment innovations and population health.

Standards and interoperability – Standards that enable consistent and accurate collection and exchange/sharing of health information across health systems and services are the bedrock of digital health. Interoperability is particularly important to the potential connection with health systems across the border in the GBA. The eHRSS marks a positive step in this area and long-term commitment and consistent investments are necessary for all involved parties. Establishing this will allow different jurisdictions to link up and go live with near-seamless integration at the most appropriate time.

c. Context for Digital Health – Developing and Building Up

Hong Kong is immersed in a rapidly changing ICT environment but offers only a slowly progressing enabling environment. There is broader use of ICT in the general population as e-government, e-banking and other commercial ICT services begin to take hold across the population. However, digital health remains project-based. COVID-19 has stimulated the adoption to telehealth worldwide, but Hong Kong has limited adoption. It is critical not to lose this momentum available as the world begins to return to a "new normal".

In this *developing and building up* context, ICT can be a driver for progress with an increasing emphasis on competition and expansion of services by the private sector. But due to the inadequate enabling environment, scaling up is not immediately possible and the health impact remains limited. Therefore, the HKSARG must take the leadership initiative to articulate a clear digital health strategy and focus on strengthening the enabling environment for both Hong Kong and the GBA at large. It will help create legal certainty, establish the policy context for delivering digital health services, and identify the standards to be adopted to build interoperable systems in Hong Kong and the GBA. Private sector stakeholders will become motivated to develop synergistic products and services to support the overarching strategic vision.

IV. Recommendations for the Hong Kong Government

An ecosystem-wide digital health strategy for Hong Kong must facilitate the delivery of high-quality, accessible care for all in Hong Kong and advance the HKSARG's core policy objective to improve people's livelihood. Moreover, Hong Kong's leadership in promoting digital health in the GBA will contribute to its goal to become an international innovation and technology hub.

The role of government in this regard is to put in place an enabling framework in terms of legislation, ensure that the public health system will remain fit for purpose, as well as to make targeted investments in infrastructure, new technologies and R&D and upskill the workforce. Demonstrating leadership and working closely with the private sector is critical to achieving alignment of efforts and goals. Articulating a clear and comprehensive digital health strategy is the first step to achieving this. The British Chamber of Commerce in Hong Kong would be pleased to work with the HKSARG in developing the strategy and in aligning the interests of the public and private sectors.

a. Digital Health Strategy for Hong Kong

The HKSARG must work with stakeholders to develop its digital health strategy within the first half of 2021 and it must articulate the vision for Hong Kong to provide high-quality, accessible, sustainable care for all. The HKSARG must establish and lead a regional digital health ecosystem which can be implemented at speed. The delivery of high-quality, accessible care through the use of digital solutions will considerably alleviate the growing pressure on Hong Kong's public health system. A digital health system should sustain itself with co-ordinated efforts from all parties including patients, health authorities, healthcare providers, health insurers, pharmaceutical companies, IT firms, consultancies, and academic & research institutions. The system must be able to reach everyone in Hong Kong and across the region. Below are some preliminary thoughts on the key components:

PRINCIPLES

- *Patient Centred.* User needs, and their context of use, must be at the centre of decision making and the sharing of their data. Improving user experience must be given priority to ensure the system is effective for all.

- *Privacy and Security*. Information sharing should be balanced with protection of sensitive personal information through legislation and enforcement. This is key to building and maintaining users' trust. Use of a government-sponsored blockchain could be considered here.

- *Collaboration and Partnership*. To meet users' evolving needs, co-design and co-production methodologies are important given different specialities and limited resources of each individual player.

- *Evidence-based Innovation*. Innovations should be fostered with the use of reliable and publicly available evidence to bring more efficient, transparent solutions. It is not just new technologies that make a difference.

- *Resilience*. A resilient system delivers everyday benefits and more importantly, protects people's lives and produces good health outcomes for all during a crisis (e.g. COVID-19) and in its aftermath.

- *Interoperable Technical Standards*. Many digital systems fail to integrate due to lack of interoperability. Any pan-GBA strategy must define a series of compatible datasets and technical parameters so that systems, initially developed in different jurisdictions, can come together when any plans for integration are implemented in the future.

- *Progress Measurement and Metrics.* A roadmap and timeline with KPIs accessible to the public will maintain the strong momentum for a digital health strategy and boost the confidence of all stakeholders that the programme is on track for important milestones to be achieved.

STRATEGIC PRIORITIES

- *The HKSARG must create and publish interoperable healthcare infrastructure and software standards*. Infrastructure components span both physical technology infrastructure and software platforms and services that support health information exchange must be standardised. In Hong Kong, health information system interoperability deserves extra attention. Interoperability standards include agreed data sets, data structure standards, common terminologies, secure messaging standards, software accreditation standards etc. The creation of new standards should be conducted in consultation with stakeholders and linked to desired health outcomes and goals. For instance, to support the management of the spread of new communicable diseases, data structure standards need to be introduced for storage of health and clinical event information, health event summaries, and test orders and results associated with such diseases.

- *Act now to promote progress and close gaps in digital health legislation*. A designated agency should be identified with a clear mandate to foster cross-Bureau collaboration in areas including digital health, building and infrastructure, ICT and logistics. Such an agency, which could be existing or new, should direct and coordinate projects and activities, conduct consultation with stakeholders, monitor and evaluate outcomes and propose urgently needed

legislation to advance the digital health agenda. Building on the broad legislation on privacy protection and data security already in place, Hong Kong must lay out rules and policies specifically governing digital health services such as:

- o Medical jurisdiction
- o Telemedicine
- o Data governance
- o Sales of medicines (including online)
- o Digital medical device, use of AI in digital health and guidance on ethics in use of AI
- o Mechanisms to ensure compliance of digital health products and services are also an important component of the governance structure.

- *Train workforce in digital healthcare*. A competitive and agile workforce is required to design, execute, operate and support digital health initiatives. Investments should be made to train those who use technologies as part of performing jobs (e.g. healthcare providers) and those who design, implement and support the broader environment (i.e. health IT workers). These changes will require a profound change in workforce management and training, without which we risk seeing a failure to deliver accessible, high quality healthcare, which is safe and efficient.

- *Foster a culture of embracing digital healthcare innovation*. Only 28% of the companies had adopted digital technology or had plans to do so, accordingly a survey conducted by HSBC in 2018[24]. It shows the urgency to foster a culture of embracing innovative technologies, which in turn creates the environment for wide adoption and utilisation of digital solutions in healthcare. Increased awareness among the society will generate new demand for digital health services, which further drives the industry to keep seeking innovative solutions, forming a virtuous circle within the system.

Following the clear articulation of a **"Digital Health Strategy for Hong Kong and the GBA"** must come a plan with clear timelines for implementation.

b. Potential Quick Wins

The development of a digital health strategy brings long-term benefits to the society but entails long-term investment. In the near term, actions can be taken by the HKSARG to achieve some quick wins to boost morale and engender followership:

- **Legislation.** Development in both the public and private sectors is hampered by constrictive or outdated legislation. The HKSARG must rapidly address current gaps in the ordinance and guidelines issued by the Medical Council of Hong Kong related to telemedicine, advertising and other codes of medical practice in new digital modalities to remove these barriers to progress. Innovative use of regulatory sandboxes will quickly enable current local R&D to be properly tested for efficacy.

- Hong Kong has the components to coordinate **Digitally Managed Clinical Trials** in Hong Kong and across the GBA. The results of such trials will enable drug registration to occur through several licensing authorities if the trials are designed to be compliant, e.g. with the CFDA, US FDA and European regulators.

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[24] https://www.business.hsbc.com.hk/-/media/library/business-hk/pdfs/en/digital-for-business-market-study-2018-en.pdf

- Hong Kong can progress the implementation of articulated policies relating to **Public-Private Partnerships (PPP)** in healthcare. Excess capacity could be efficiently utilised through digital solutions to save costs and reduce significant bottlenecks for access to care in the public system. Once Hong Kong has progressed in this area, it could be rolled out across the GBA to ensure that demand and excess capacity are efficiently matched.

- Accelerate the adoption of the **HKID**, and proposed **iAM Smart ID**, as the key secure mechanism to enable individuals to access health data and digital health functions from existing and proposed digital health platforms.

c. Recommendations

- **Integration of digital health across Government policy** – Integrate digital health into the government's health strategy led by the Food and Health Bureau, IT strategy (e.g. Innovation Hong Kong) led by Innovation and Technology Bureau and the GBA working plan as well as underpinning its role in the government's Smart City Blueprint (under the *Smart Living* pillar) and the next evolution to planning Resilient Cities. The Chief Executive may consider including digital health in the Policy Address as a means of promoting self-management health and preventative care. Digital health does not have to be a stand-alone topic or project, but an element to be embedded in policies for different industries.

- **International Learning and Collaboration** – the HKSARG can learn from the experiences of other countries, particularly Estonia, which has successfully implemented digital health and several other digital solutions in all its government systems.

- **Global Digital Exemplar** – Enhance Hong Kong's status as a global digital exemplar by achieving and retaining HIMSS Level 7, the international technical standard which assures the systematic use of digital to materially improve outcomes and patient safety.

- **Stakeholder consultation** – Start consultations with stakeholders in the GBA to collect views and thoughts on digital health. It will help the government to better understand the latest efforts in the private sector and consumers' demand, laying the groundwork for the development of an overarching digital health strategy.

- **Development of New Industries** – Hong Kong can take the regional lead in developing new industries. For example, a home care industry – this should include bringing proven technology developed elsewhere for use in Hong Kong. This could include IoT medical devices for use in the home setting but linked to health staff, robotics for self-care and companionship in the elderly care setting and reduce the demand burden on acute health services. Nurturing the necessary talent so people think creatively and can design, develop and implement new models of care will be an essential task for the education systems in Hong Kong.

- **Modernising the Construction Process** – promoting and adopting further the use of digital technology in the design, construction, logistics, operations, maintenance, and the management of healthcare buildings that have digital technologies at the core. It is now particularly important to ensure the health and wellbeing of building occupants. The use of BIM *throughout the whole* design and construction process and other construction management and integration technologies should also be embraced. This a great opportunity for collaboration across the GBA, by blending Hong Kong's property management skills with Shenzhen's technology expertise. In addition, there is an opportunity to use further the

manufacturing facilities and capabilities in the GBA for Design for Manufacture and Assembly ('DfMA') projects in Hong Kong.

d. Conclusion

International experience has led to a global consensus that a collaborative digital health ecosystem inclusive of both public and private sectors – designed with accessibility, interoperability scalability, replicability, security and resilience from inception – is imperative to improve people's wellbeing in an era reliant on information.

With the implementation of the GBA Outline Development Plan, articulating and executing a local and region-wide digital health strategy is crucial for Hong Kong to take the leading role in healthcare and related technology within the GBA.

The adoption of affordable, scalable and sustainable digital health solutions, putting the patient at the centre, will empower people to better manage their own health and enable the health system to treat them more effectively. Additional tangible benefits include the ability to better prevent, detect and respond to epidemics, pandemics and non-communicable diseases – all of which will contribute to an improvement in health, wellbeing and livelihood for people in Hong Kong and across the GBA.

By leading a digital health strategy for the GBA, the HKSARG will achieve better health for the population with a more efficient and lower cost delivery system. This in turn will stimulate job creation in both health and the digital economy, stimulating growth and position Hong Kong as the regional leader in digital health and smart cities. The window of opportunity for Hong Kong to take the lead is narrow, and action on this is needed now.

Contributors

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Appendix

Selected examples of implementation of digital health applications by the private sector:

1. AECOM
2. Babylon
3. Pulse by Prudential
4. Quality Healthcare
5. Roche

AECOM

Big picture thinking to create operational efficiencies for health facilities through technology and logistics planning

Big picture thinking enabled by technology has underpinned AECOM's involvement d in the design and development of new, refurbished and temporary hospitals. Digital solutions have been deployed for the movement of goods and services in and around hospitals, harnessing new technologies to automate existing processes, as well as using BIM, Modular Integrated Construction, Design for Manufacture and Assembly (DfMA). Below are some examples.

Modular Integrated Construction and Design for Manufacture and Assembly (DfMA)

Modular integrated construction by AECOM on a number of hospital projects has enabled faster completion to provide capacity urgently during the coronavirus. In the case of the Grange University Hospital, Gwent, South Wales, although modular construction and off-site methods were already being deployed, when the coronavirus hit, they played a pivotal role in allowing construction to be fast-tracked and early completion of the £350 million 560-bed hospital. Just four weeks later, the hospital took possession of 50 per cent of the space and was able to put it into operation to provide support during the crisis. This would not have been possible had a standard build approach been planned.

The DfMA healthcare component and the associated workforce labour savings of 237,099 working hours (the equivalent of 5,927 working weeks) provided a 23 per cent overall planned programme saving. The installation of 821 precast columns led to an 85 per cent savings in working hours, while the installation of 1200 precast wall modules led to a 95 per cent savings in working hours.

The formal completion of the hospital is expected in November 2020. Once fully open, it will provide complex critical care treatment for more than 600,000 people in Southeast Wales.

Modular built hospital- Grange University Hospital by Laing O'Rourke. Photograph by Paul Davies
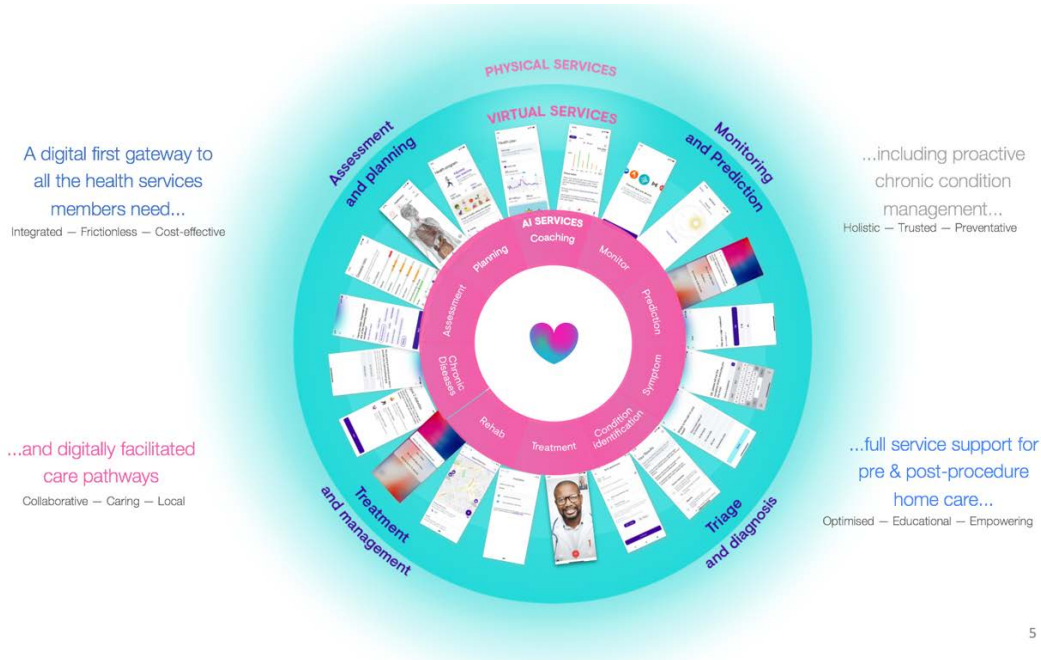
Technology solutions that save time and money

Traditionally, many of these services have involved manual operations with little automation and management on an ad hoc basis, independently of each other. However, AECOM is using a range of technologically sophisticated solutions to enable smarter ways to schedule and manage them effectively and to better respond to inter-dependencies.

- Automatic Guided Vehicle (AGV) or Autonomous Mobile Robots (AMR) systems enable the automated transportation of goods, including food, linen, pharmaceuticals and medical supplies, from treatment areas to processing areas, such as laundry, waste, kitchen and sterile stores.
- Pneumatic Waste Chute System (PWCS) use vacuum technology to collect waste from various stations across a health facility for transportation to a waste compactus.
- Auto pharmacy solution options via automated handling and distribution of pharmaceuticals facilitate the dispensing of the correct dosage of medication.
- Inventory management system uses a bar coding system to better track inventory levels so that stock can be replenished in a more timely manner, potentially from an off-site storage facility, enabling a more efficient space utilization within a health facility. Technology interfacing with building systems, including barcode scanning and security systems, elevates accuracy and secure delivery

Babylon Health

Babylon's mission is simple: to deliver accessible, affordable healthcare to every person on earth. Babylon aims to optimize care delivery by integrating digital, virtual and physical services, starting with AI and digital tools that users can access 24/7 from their personal mobile devices (mobile phone, tablet, or computer). If a patient requires further support from a doctor or health professional, Babylon connects them virtually to a doctor within minutes, or direct them to physical examinations and intervention if clinically necessary. Babylon's continuous, integrated services provide an excellent patient experience (which increases engagement and retention) and can reduce cost by streamlining care provision.


Below is a snapshot of Babylon's journey so far:

Pulse by Prudential

Pulse by Prudential [25] is a free AI-powered digital health app offering consumers holistic health management tools and real-time information, such as symptom checker, health assessment, tele-medicine consultation, e-prescription, medicine delivery. Chinese medicine constitution, BMI Selfie, hospital/provider finder, to prevent, postpone, and protect against the onset of diseases. In addition, Pulse by Prudential also provides free COVID-19 protection, health advice (bite-sized videos and articles on specific conditions or tips on how to lead a balanced and active lifestyle) and other value-added services such as Air Pollution Index, Tax Calculator.

The mission of Pulse by Prudential is to make our customers healthier and wealthier. Health is the ultimate wealth. Pulse by Prudential[26] forms a key part of Prudential's strategy to provide affordable and accessible healthcare to everyone across Asia and Africa. It has attracted over *12 million downloads* in 10 different languages across 13 markets including Hong Kong. The AI Health Assessment and Symptom Checker have been carefully retrained using local epidemiological date that cover tropical diseases.
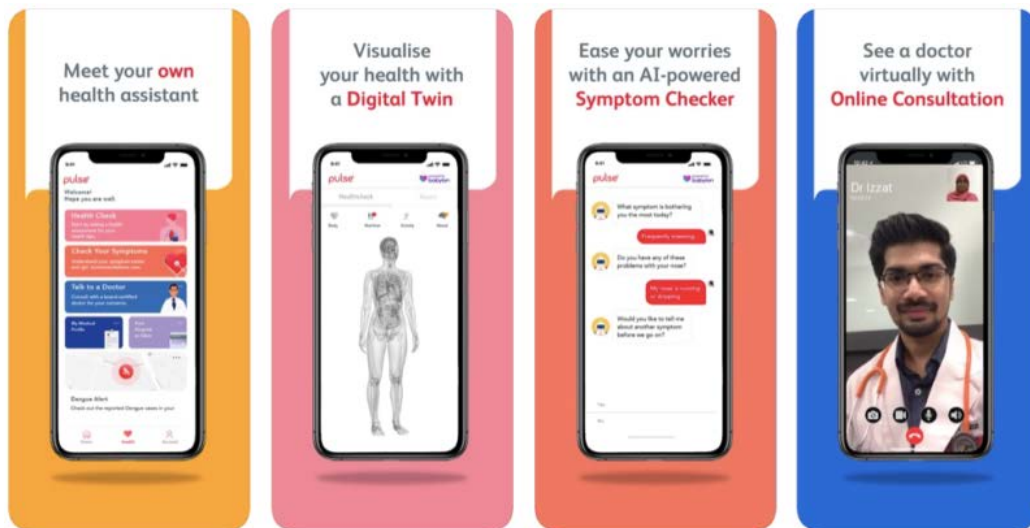
Help customers become healthier

- AI assessment and triage
- Lifestyle management and wellness
- Telemedicine consultations
- Medicine delivery
- Chronic disease management
- Manage health records

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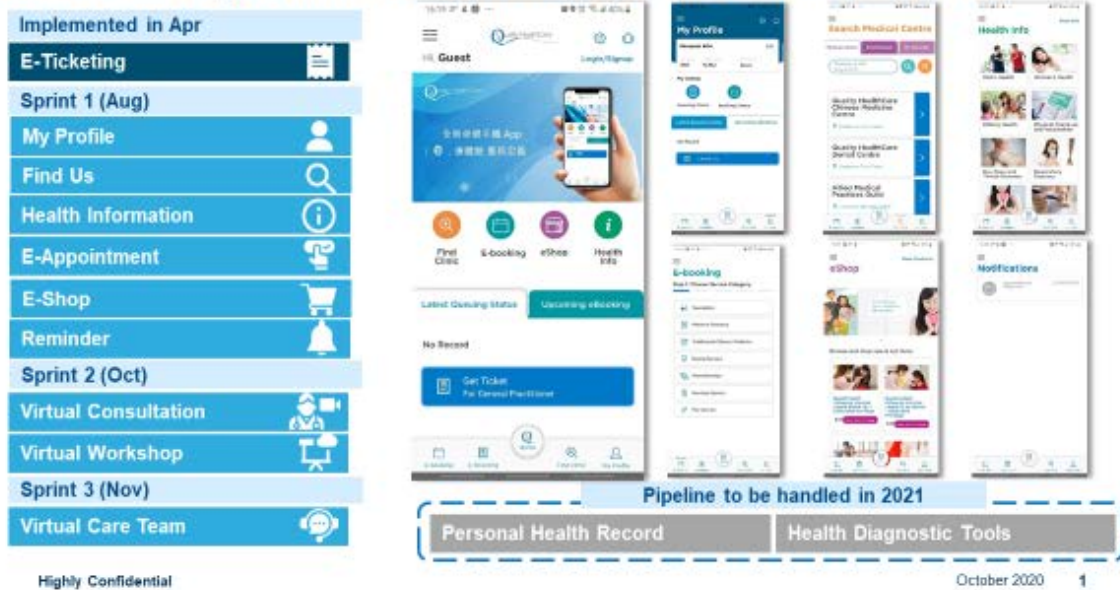
[25] https://youtu.be/BUKxI_594no
[26] https://onepulse.page.link/aHR5bayFAc9Rqo7D9

Quality Healthcare Patient Portal

Patient Portal to provide holistic care and improved customer experience

The new Quality HealthCare patient portal provides an integrated online and offline solution to customers.

With digital ticketing and appointment booking, patients can gain access to a clinic with ease and minimize their waiting time. For any situation requiring a video consultation, they can access a medical doctor via the app. Their personal health record contains a health dashboard which keeps the individual's health indicator updated with tailored wellness recommendations to step reduce their health risks.

Quality Healthcare will be partnering with technology companies to introduce mature and advanced health diagnostic tools to Hong Kong patients to improve the treatment quality and patient/ provider experience.

Roche

Next Generation End to End Healthcare Community Support System

A next generation end to end healthcare community support system is a blockchain technology basis healthcare ecosystem, which provides teleconsultation, prescription, patient journey data exchange, medication home delivery and proof of delivery record track and trace capabilities. Further with the plug in of the untouched drug serialization, online education & e-labelling enablers, the whole healthcare industry will be accelerated, by this pilot project, to personalize healthcare directly to the patient's home.

The vision is to create interoperability, removal of silos and open but ID authenticated secured platform for everyone under healthcare sector including patients, HCPs, clinics, pharmaceutical companies and other eco-system members. Their participation will contribute to and subsequently benefit from analyzing the non-clinical healthcare data.

Data is generated throughout the day to day interactions but often we are drowning in it rather than using its full potential. Under the right use of the disruptive technologies in AIOT, big data analytics & 5G technologies, the data lake under the blockchain ecosystem will unleash the power of data to reform the whole medical research development and healthcare landscape to next dimension.