



DIGITALIZATION IN HEALTHCARE: EMERGENCE OF DIGITAL HEALTH PORTALS

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EXECUTIVE SUMMARY

THE WIDESPREAD ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TOOLS AND APPLICATIONS IS TRANSFORMING ALMOST ALL ASPECTS OF INDUSTRIES, AND THE HEALTHCARE SECTOR IS NO EXCEPTION.

Amid increasing public expectations of healthcare standards, the growing burden of ageing populations and chronic diseases also continue to overwhelm existing healthcare infrastructure and resources. Governments are under more pressure than ever to seek cost-effective alternatives to deliver healthcare to meet the ever-changing needs of citizens, businesses and health professionals.

Digital health is emerging as a viable solution to relieve the strain on healthcare resources by enhancing the quality and delivery of traditional healthcare service models in a cost-efficient manner.

The introduction of web-based digital health portals is a natural progression of such changes in the healthcare ecosystem, providing patients and healthcare professionals with easy access to health information no matter where they are.

While digital health portals are traditionally considered passive sources of consumer healthcare informatics, the proliferation of key IT enablers such as cloud computing, increasing broadband penetration and mobile technologies are adding new value by aiding the ability to integrate and share information across stakeholders. With advanced data analytics and sensory technologies, teledigital health is one service area where digital health portals can be further utilised for greater public healthcare availability, accessibility, and affordability.

As healthcare providers increasingly leverage digital health portals as a tool to improve patient engagement and satisfaction, elements pertaining to portal accessibility and user-friendliness become necessary. The attractiveness of a site's interface, ease of navigation and sophistication of search functions could decide if users choose to stay or leave the portal. Concerns about system resilience (i.e., data security) also arise for digital health portals in safeguarding personal health information.

Users need to be assured that digital health portals are taking measures to protect the privacy of their data before they even choose to use the portals for their health needs. Therefore, it is important for portal owners to consider all preferences and requirements of the target audience in designing digital health portals.

The deployment of digital health portals is expected to increase in the future with growing spending by both public and private owners. In this white paper, Frost & Sullivan provides an in-depth review of prominent digital health portals around the world, discussing the critical success factors that have enabled their rise in their respective countries. The report covers a discussion of the ideal digital health portal components for digital health portal providers to emulate and learn from, to maximise the benefits and usage of these portals in transforming healthcare delivery.

SPOTLIGHT ON DIGITAL HEALTH

Digital health refers to the use of ICT technologies for health purposes. Examples of digital health include the treatment of patients, tracking of diseases and monitoring of public health¹.

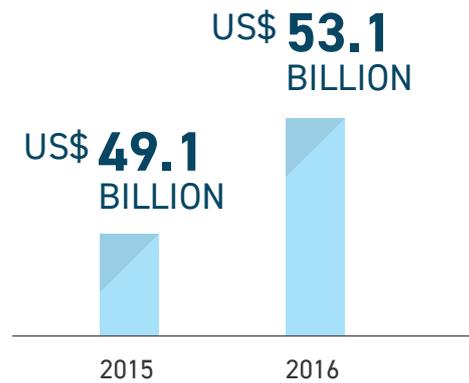
Frost & Sullivan adopts a similar definition of digital health, which also includes features such as remote monitoring, the digitisation of health records, disease tracking, early diagnostics, healthcare enterprise resource planning and eCommerce.

With advances in healthcare IT, governments and public agencies worldwide are harnessing digital health² solutions to improve the quality and service standards of healthcare services in their respective countries.

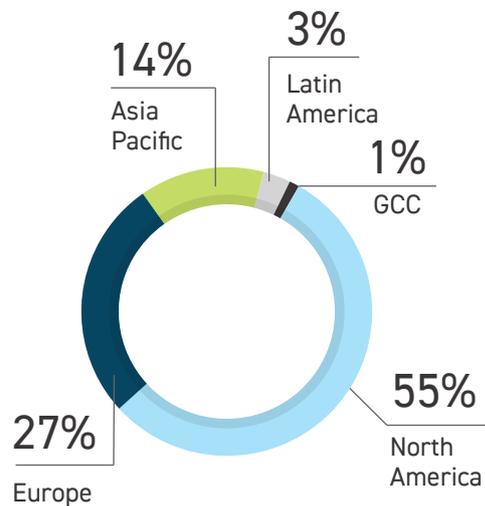
Healthcare IT³ is the fastest growing sector within the healthcare industry, with an 8.1% growth. It is projected to increase to US\$53.1 billion in 2016 from US\$49.1 billion in 2015. (The healthcare industry is expected to grow at 6.9% in the same period). North America is currently the largest market with 56% of sales in the global healthcare IT market.

Exhibit 1: Global Healthcare IT Market Revenue⁴

Healthcare IT Market: Revenue Forecast, Global, 2015-2016



Healthcare IT Market: Percent Sales by Region, Global, 2016



**ASIA PACIFIC IS EXPECTED TO BE
THE FASTEST GROWING REGION FOR
HEALTHCARE IT, WITH AN EXPECTED INCREASE
FROM 2014 (US\$5.9 BILLION) TO 2020
(US\$12.6 BILLION) AT A CAGR⁵ OF 13.2%.**

¹Source: World Health Organization (WHO), <http://www.who.int/topics/ehealth/en/>
²Digital health is a subset of the healthcare information technology (IT) industry.
³The healthcare IT market consists of software solutions and maintenance services sold to providers. It does not include hardware.
⁴Source: Frost & Sullivan, Global Transformational Health Research Team, "Asia-Pacific Healthcare Outlook, 2016 - Clinical Wearables, Regenerative Medicines and Biosimilars Set for Strong Growth" (April 2016)
⁵CAGR: Compound Annual Growth Rate

DIGITAL HEALTH DRIVERS & RESTRAINTS

DRIVERS

Governmental Focus on Healthcare and Digital Health

Governments are investing in digital health to raise the standards of healthcare services, as well as to develop and enact various roadmaps and national strategies. For instance:

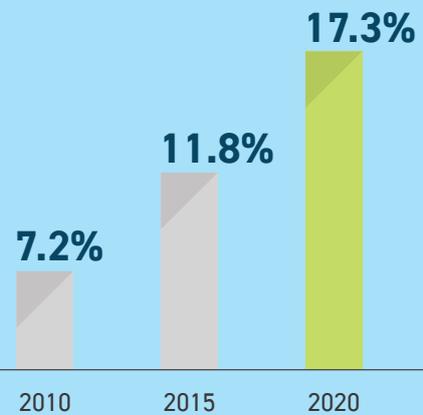
In 2011, National Health Service (NHS) Scotland introduced its second digital health strategy, redesigning digital health-enabled services and improving the healthcare system quality.

Singapore launched the Healthcare Vision 2020 Masterplan to increase the accessibility, quality, and affordability of healthcare services for the public.

Changing Demographic Patterns

Changing demographic trends such as ageing population and increasing chronic diseases are straining the existing healthcare infrastructure and resources. Better disease management and accessible care are necessary to cater to the growing healthcare requirements.

In Singapore, the proportion of elderly residents (aged 65 and above) has grown from 7.2% in 2000 to 11.8% in 2015⁶, while the number of elderly residents is set to increase to 17.3% by 2020⁷.



Chronic diseases account for almost two-thirds of all deaths worldwide⁸.

Moving forward, it is essential to accelerate the development of IT solutions to enhance coordination in chronic disease management and promote preventive care.

⁶Source: Department of Statistics, Singapore
⁷Source: Frost & Sullivan, Global Transformational Health Research Team, "Opportunities in the Aged Care Market in Singapore - Trends and Attractions for Stakeholders" (October 2015)
⁸Source: World Health Organization (WHO)

Growing Public Acceptance

Consumers, employers, and healthcare professionals continue to embrace digital health. With rising healthcare consumerism, consumers are increasingly demanding access and easy management of their healthcare data.

MAJORITY OF THE PUBLIC AND PHYSICIANS

are of the belief that patients should have the ability to download their health data online, and share these information with their physicians⁹.

65% OF AMERICANS

who do not have online access to their medical information deemed such access as being important¹⁰.

Employers are striving to reduce healthcare costs by advocating solutions that encourage healthy and preventive behaviours.

CERTAIN SERVICES

i.e. telemedicine are likely to be offered as part of employees' health plans in future, in a bid to reduce cost-of-care burden per employee.¹¹

Development of Digital Health Standards Guideline

Guidelines supporting the development of safe and effective digital health offerings encourage easier adoption of digital health solutions. For instance:

The WHO provides minimum requirements for an Electronic Medical Record (EMR) or Electronic Health Record (EHR)¹² system.

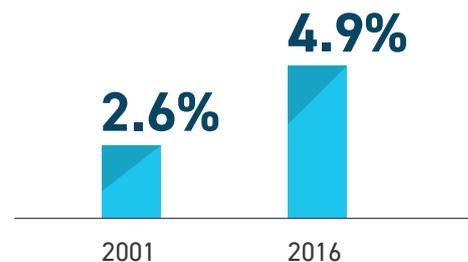
Digital Imaging and Communications in Medicine (DICOM) standardises the storage, transmittance, handling and reproduction of medical images and similar data along with file format definitions.

The International Organization for Standardization (ISO) publishes guidelines on Electronic Health Record Systems: ISO 10781:2015 highlighting the mandatory essential functions and features of an EHR system.

Increasing Global Healthcare Expenditure

Rising healthcare costs are driving demand for digital health. Governments are under tremendous pressure to provide citizens with adequate healthcare support and subsidies. For instance, total healthcare expenditure (% of GDP) in Singapore grew from 2.6% in 2001 to 4.9% in 2014¹³.

Total Healthcare Expenditure (% of GDP), 2001 and 2014



⁹Source: The Markle Foundation, "Markle Survey on Health in a Networked Life 2010", http://www.markle.org/sites/default/files/20110110_HINLSurveyBrief_0.pdf (January 2011).
¹⁰Source: National Partnership for Women and Families, "Making IT Meaningful: How Consumers Value and Trust Health IT", <http://www.nationalpartnership.org/research-library/health-care/HIT/hit-making-it-meaningful.pdf> (February 2012).
¹¹Source: Frost & Sullivan, Global Transformational Health Research Team, "2015 Asia-Pacific Healthcare Industry Outlook - APAC will Continue to Remain in Global Spotlight for Investment, Innovation, and Growth in Healthcare" (May 2015).
¹²EHR/ EMR refers to the systematised collection of electronically stored patient and population health information.
¹³Source: World Health Organization Global Health Expenditure Database, <http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS>

RESTRAINTS

High levels of investments

Due to the scale necessary for implementation, digital health projects usually require high levels of investments. The sustainability of government incentives for promoting healthcare digitalisation is a key challenge in emerging markets. Realising that digital health projects are not sustainable through public funding alone, governments are devising policies and strategies to attract private sector investment. For instance, the Malaysian government is encouraging the private sector to develop digital health infrastructure and adopt technologies through public-private partnerships.

Manpower Constraints

Most senior medical professionals are not trained to handle new technology with few medical IT courses available to equip them with the relevant skills. Consequently, digital health tools are usually underutilised. Healthcare professionals also worry about workflow interruptions from using digital health technologies. Data privacy concerns that arise also impede the adoption and progress of such technologies.

Insufficient Regulatory Oversight

There is a general lack of regulations governing most aspects of digital health leading to inaccurate, misleading or even false claims by digital health companies, and putting consumers at risk. For instance, mobile health (mHealth) users in Australia are generally hesitant in sharing personal health information on any mobile platforms due to inadequate regulations monitoring mHealth¹⁴.

Immature Digital Health Business Ecosystem

The immature digital health business ecosystem is hampering the growth of the digital health market. One factor particularly inhibiting telemedicine adoption in Europe is the ambiguous and limited coverage of digital health services by insurance providers. For instance, in Germany, insurers provide only selective reimbursements under the Statutory Health Insurance (SHI) and Private Health Insurance (PHI); while in the United Kingdom, there is no special payment for physicians using teledigital health and telecare services to treat patients remotely.

There is a general lack of regulations governing most aspects of digital health leading to inaccurate, misleading or even false claims by digital health companies, and putting consumers at risk.



Source: Frost & Sullivan, Global Transformational Health Research Team, "2015 Asia-Pacific Healthcare Industry Outlook – APAC will Continue to Remain in Global Spotlight for Investment, Innovation, and Growth in Healthcare" (May 2015)

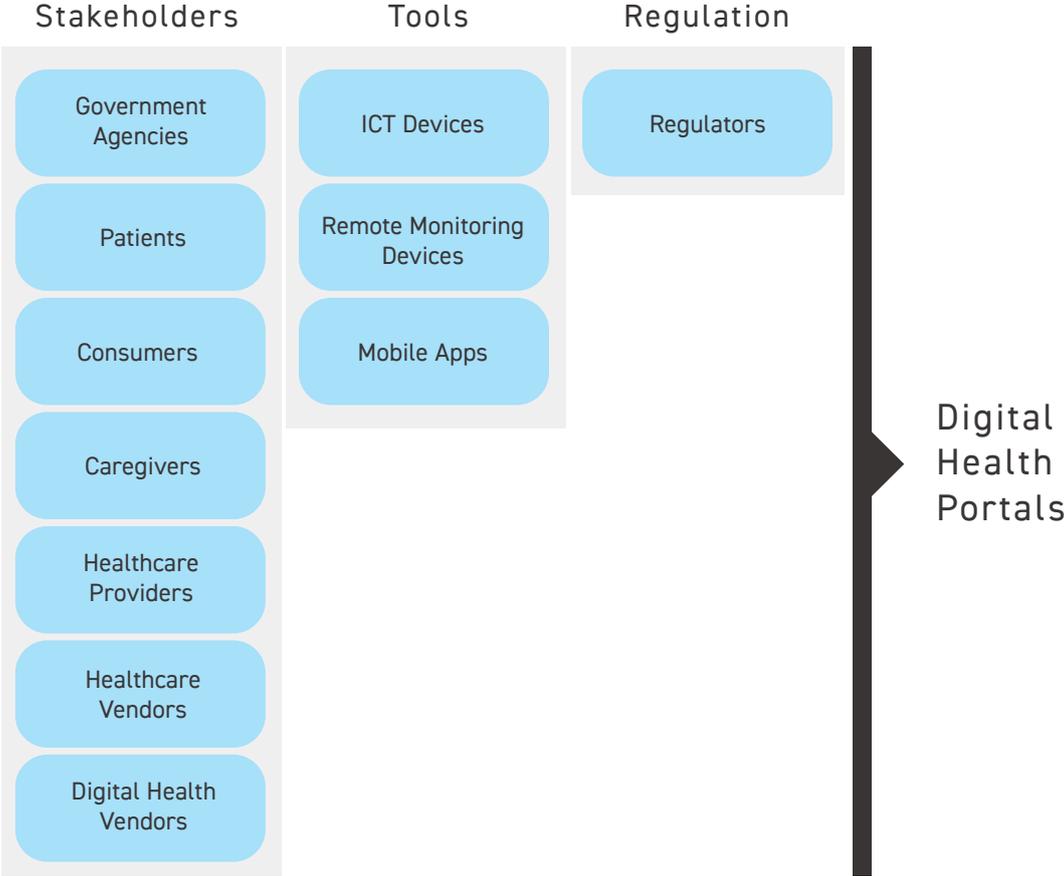
THE EMERGENCE OF DIGITAL HEALTH PORTALS

Public and private sectors are gradually harnessing digital health solutions to improve the quality and service standards of healthcare services. However, with no clear directives and regulations, the implementation of digital health features have been random and in varying degrees. To tackle this issue, the recent emergence of digital health portals serves to connect

the multitude of participants in the digital health ecosystem.

For the purpose of this report, we define a digital health portal as a web/ICT-based platform providing access to healthcare services and/or information.

Exhibit 2: Elements of a Digital Health Portal



DIGITAL HEALTH PORTALS DRIVERS & CHALLENGES

DRIVERS

Development of key IT enablers

| | | | |
|---|---|---|---|
| Rapid increase in global healthcare cloud adoption | Growth in data analytics solutions | Growth in broadband penetration for telemedicine | Advancements in sensory technology |
|---|---|---|---|

Four key IT enablers – rapid increase in global healthcare cloud adoption, growth in data analytics solutions, growth in broadband penetration for telemedicine and advancements in sensory technology – are expected to drive the growth of digital health portals.

Globally, healthcare cloud adoption rates are rapidly increasing, with SaaS¹⁵ penetration leading the healthcare cloud computing¹⁶ market. This trend is expected to continue until 2020. Examples of SaaS applications in healthcare include Electronic Health Records (EHR), Radiology Information Systems (RIS)¹⁷ and Computerised Physician Order Entry (CPOE)¹⁸.

Big Data analytics are increasingly being leveraged in healthcare to improve decision-making. Data-driven care delivery is gaining a foothold in specific aspects of diagnosis and determination of treatments. While current solutions are mostly targeting niche diseases, the trend is expected to accelerate exponentially towards more complex conditions, with solutions capable of integrating a broad spectrum of data streams.

In December 2015, Novo Nordisk and IBM announced a partnership to utilise IBM's supercomputer Watson to analyse health data from diabetes patients. This aims to create a "virtual doctor" for diabetes patients that could dispense treatment advice such as insulin dosage.

The increasing **broadband penetration** improves health data transfer speed and quality, and enhances the reach and quality of digital health portal services such as telemedicine. Global LTE¹⁹ deployments are slated to register a CAGR of over 40% between 2014 and 2019.

Global LTE
Deployment
2014-2019

CAGR >40%

While the highest LTE penetration is currently in the United States, Japan, and South Korea, APAC is expected to become a key growth market over the next few years, particularly in Australia, Singapore, Malaysia, and China²⁰.

Lastly, remote healthcare monitoring capabilities are enhanced by advancements in sensory technologies, e.g., wearable sensors and home biometric monitoring devices. This is expected to drive demand for digital health portal services in the future. In particular, the wearable sensors market is projected to grow rapidly, especially for activity trackers, wearable recordings, and smart glasses.

¹⁵Frost & Sullivan defines Software as a Service (SaaS) as a delivery model in which customers get access to applications on an on-demand basis, without having those applications deployed on their networks, and without paying any up-front capital expenses.
¹⁶Frost & Sullivan defines Cloud Computing as a pool of compute, memory and I/O resources, applications or operating environments with seemingly infinite scalability, delivered as a service over a network, be it private or public.
¹⁷Frost & Sullivan defines Radiology Information System (RIS) as an information system consisting of several modules used to manage data related to patients and radiology operations, such as scheduling and clinical financial reporting.
¹⁸Frost & Sullivan defines Computerised Physician Order Entry (CPOE) as a system or a software application that assists the healthcare providers in placing orders such as medications, referrals, diagnostic tests, and interventions, to respective departments. It uses software applications to issue medical orders electronically.
¹⁹Frost & Sullivan defines Long-Term Evolution (LTE) as the 4G standard for wireless of high speed data for mobile phones and data terminals.
²⁰Source: Frost & Sullivan, Global Transnational Health Research Team, "Analysis of the Telemedicine Market in Asia-Pacific – Affordable Telemedicine Services Are Enabling Business Model Evolution" (July 2015)

Changes in Healthcare Consumer Demand Patterns

With increasing IT literacy across the globe, consumers are increasingly demanding:

- Access to health data
- Access to healthcare applications
- Usage of mobile devices to engage with healthcare providers
- Usage of mobile devices to engage with healthcare providers
- Usage of multiple devices to access health-related tools and content
- Customer experience similar to their interactions with other industries such as retail, e.g., the ability to do online shopping and self-checkouts, with real-time information

RESTRAINTS

Lack of Interoperability²¹ Among Various Digital Health Platforms

The absence of unified ICT standards and systems, with various fragmented in-house-developed operating platforms are creating silos across and within healthcare organisations, making data capture unstructured and manual. In a well-connected health infrastructure, semantic interoperability, where there is continuous information exchange and interpretation between two IT systems, is desired.

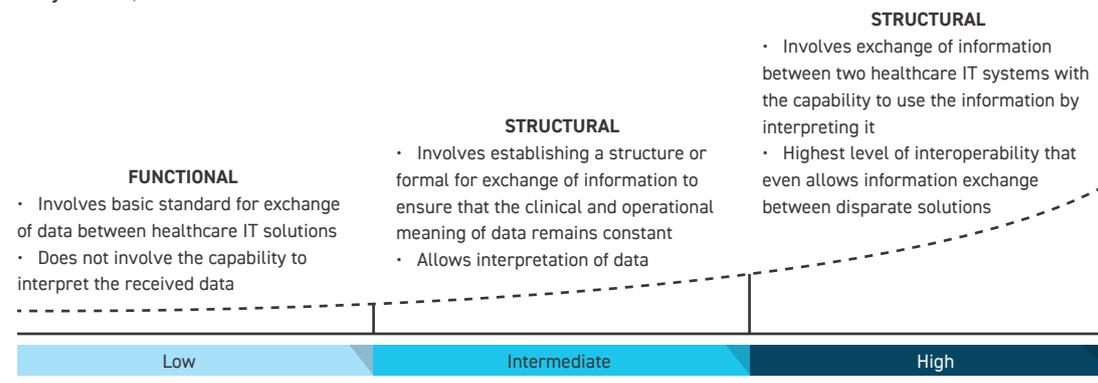


Exhibit 3: Levels of Interoperability in a Connected Health Infrastructure

Data Security Concerns

Data security, unauthorised access and exploitation of patient-specific information are critical concerns affecting digital health portal adoption. Through consumer surveys conducted across six countries²², 9.7% of consumers do not trust digital health portals to maintain confidentiality of their personal data.

- Patients are concerned about having their personal medical data available on the Internet, and the consequences of a data leak via hacking and phishing attacks.
 - Security measures such as secure log-ins, firewalls and encryption are implicitly expected by consumers to protect their data.
- Healthcare institutions are concerned about the overwhelming liabilities which may result from inadvertent privacy and security breaches.
 - Government regulations are required to push for standards and protocols.

²¹Interoperability is the degree to which "systems and devices can exchange data, and interpret that shared data." Healthcare solutions involved in data exchange are interoperable if they have the ability to communicate information between them and present the information meaningfully. (Healthcare Information and Management Systems Society (HIMSS))
²²The Frost & Sullivan Global Digital Health Portal Consumer Survey 2016 was conducted across six countries i.e., Singapore, Sweden, Denmark, USA, U.K and China.

SERVICE OFFERINGS

The three service categories on digital health portals are consumer health informatics, healthcare administration, and telehealth.



CONSUMER HEALTH INFORMATICS

Consumer health informatics is the use of IT to provide health information and facilitate healthcare decision-making for consumers / patients. Its two aspects are:

- **Interactive:** Requires active inputs from the user; examples include health risk assessments, online tracking of specific health parameters, and rewards programmes.
- **Non-interactive:** Passive consumption of information; examples range from health and medical directories, health literacy articles to other information-based articles.



HEALTHCARE ADMINISTRATION

This is the use of IT to facilitate the administrative tasks related to visiting a healthcare professional. There are two aspects to this:

- **Clinical:** Processing of medical information and other follow-up tasks, such as electronic health records, referrals, and ePrescriptions.
- **Finance and administration:** Processing of non-medical information and follow-ups from patient interactions with healthcare professionals. Examples are appointment management and reminders, online patient registrations, and applications for medical/insurance schemes.



TELEHEALTH

Telehealth is the utilisation of advanced communication technologies to enable the patient to interact with a healthcare professional remotely. It encompasses:

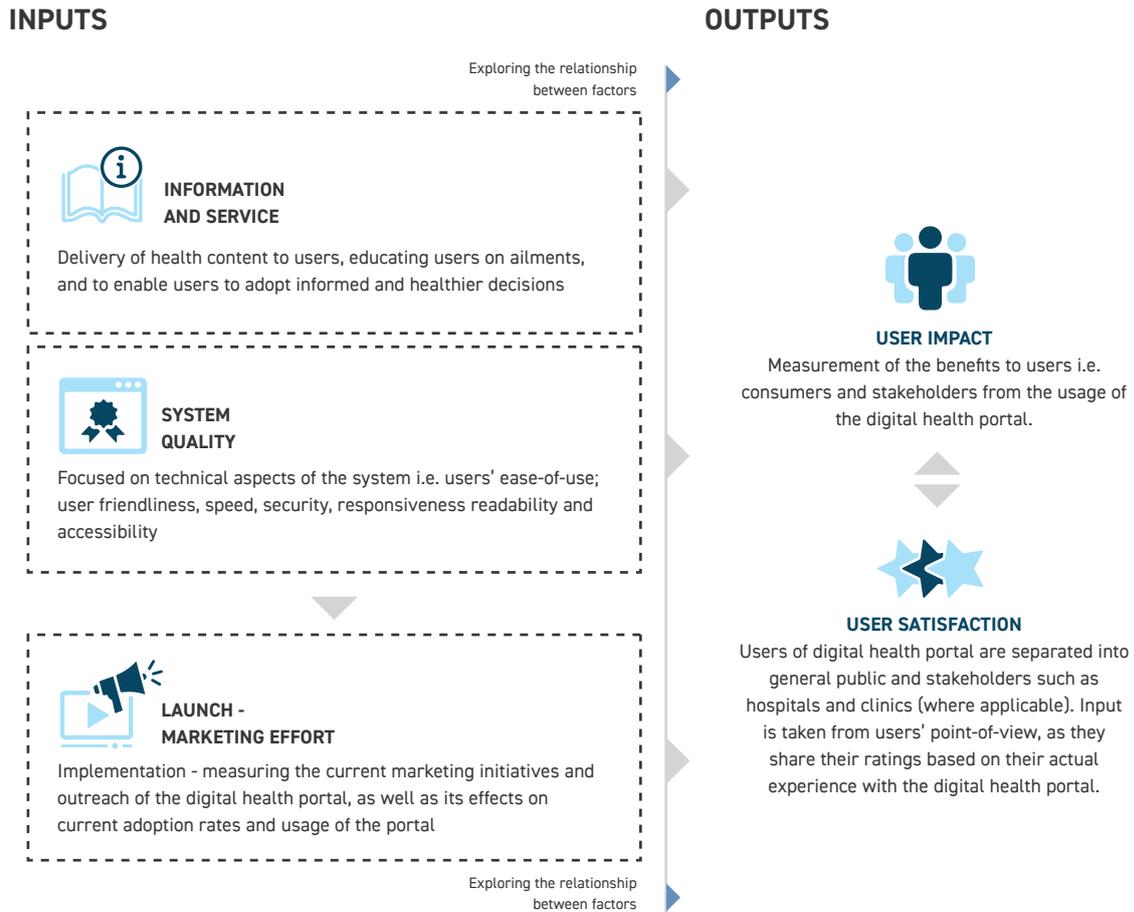
- **Telemedicine:** Provision of virtual healthcare support and on-call medicine to patients. Examples include video diagnostic consultations, remote doctor/specialist services, and giving patients access to doctors' notes.
- **Remote patient monitoring:** Tracking of patients' health outcomes outside conventional clinical settings. Examples are home and disease management monitoring, wellness programmes, and remote cardiac electrocardiogram (ECG).

The pervasiveness of mobile usage and technologies is also increasing the use of solutions such as mHealth to enhance healthcare delivery.

REVIEW OF GLOBAL DIGITAL HEALTH PORTALS

A modified version of the DeLone and McLean model²³ for evaluation of information systems is used to review the digital health portals in this white paper. The focus is on five key criteria.

Exhibit 4: Evaluation Framework of Digital Health Portals



²³DeLone, W.H.; McLean, E.R. Information system success: The quest for the dependent variable. Information Systems Research, 3(1),60-95, 1992.

INFORMATION AND SERVICE OFFERINGS

Many digital health portals are information-based with very few eServices offered, e.g., the UK's NHS Choices (publicly funded), Austria's Gesundheit portal (publicly funded) and the US's WebMD (privately funded). Some portals have a good mix of information and service offerings, for instance, Portugal's Do Utente (publicly funded) portal offers health risk assessments, electronic health records, ePrescriptions and appointment management services in addition to consumer health articles. It is also noted that few portals are currently able to provide telemedicine services to consumers.

Consumer Health Informatics:



Rewards and Deals



Live Chat with Medical Professionals



Health Risk Assessment / Monitoring



Community Forums



Medical and Lifestyle Directories / Health Events



Doctor Review



Articles to Promote Health

Healthcare administration:



Electronic Health Records



Referrals



e-Prescription



Appointment Management



Application for Medical / Insurance



Online Health Payment

Telemedicine:



Telemedicine



Remote Patient Monitoring

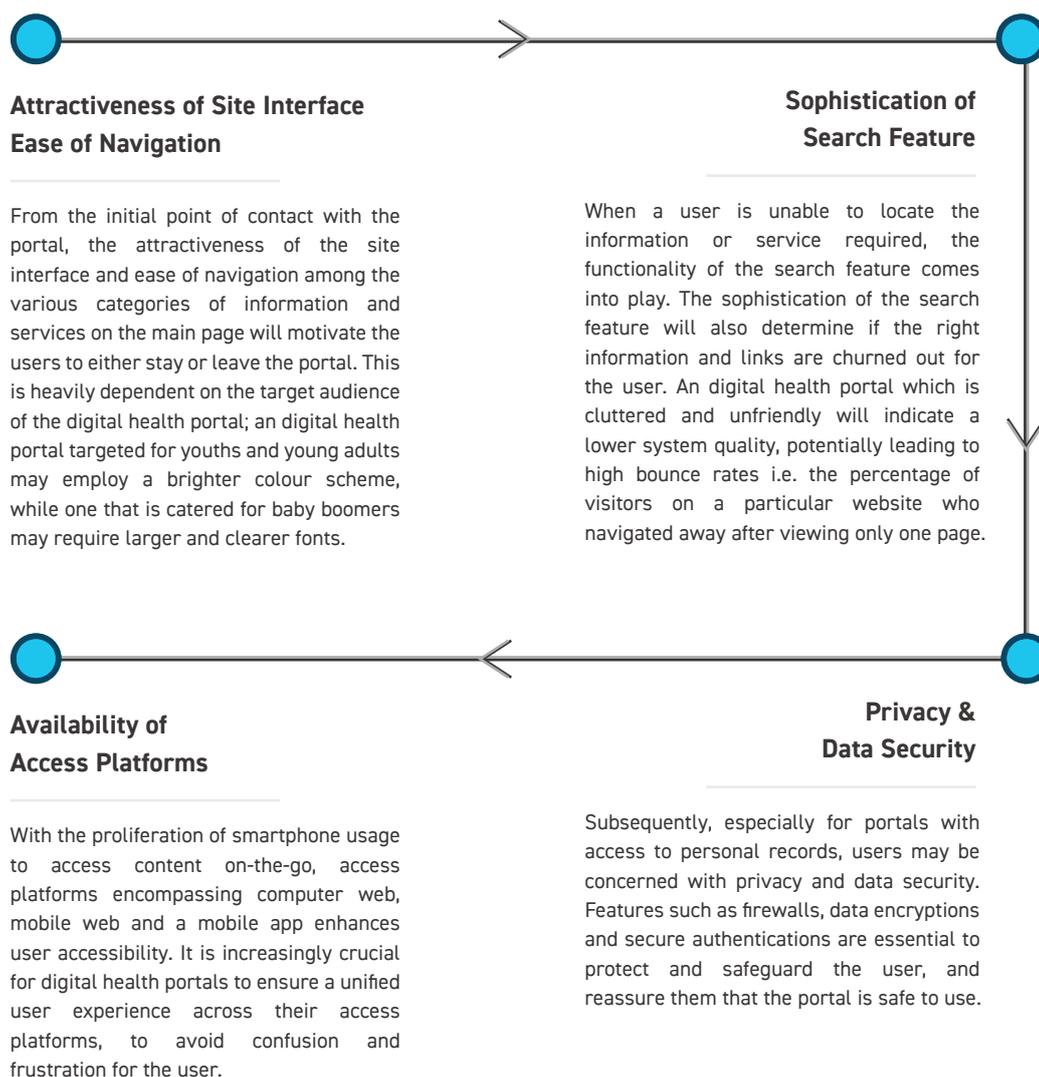
Exhibit 5: Information and Service Offerings of Digital Health Portals

Of the portals evaluated, China's WeDoctor (previously known as Guahao) is the only portal that incorporates all information and service offerings in the above figure.

SYSTEM QUALITY

System quality enables digital health platforms to be accessible and applicable for users. Poor system quality could compromise the full experience of information and service offerings, resulting in user dissatisfaction and ultimate rejection of the digital health platform. Mapping out the experience journey of a typical user helps to evaluate a digital health portal's system quality.

Exhibit 6: A Typical User Experience Journey



MARKETING EFFORTS

Users must be aware of the digital health portal before usage can occur. The marketing criterion evaluates the portal's outreach approach and assesses the number and types of medium employed to reach existing and potential users. Common outreach strategies include:



NATIONAL MEDIA COVERAGE

Newspapers, magazines, television commercials, radio stations and billboards to raise awareness among citizens.



SEASONAL HEALTH CAMPAIGNS

Aimed at educating users on common health issues and encourage them to visit the portal for additional information.



SOCIAL MEDIA OUTREACH

On popular channels such as YouTube, Facebook, Google+, Twitter, and LinkedIn to reach a wider base of users.



WORD-OF-MOUTH INFLUENCE VIA PARTNERSHIPS WITH HEALTHCARE PROFESSIONALS AND CLINICS

This is particularly effective as healthcare professionals such as doctors and nurses have significant influencing power and are highly trusted by patients. An example of a portal using this approach is the US' WebMD (privately-funded portal), which publishes its WebMD magazine and distributes them free to physicians and clinics registered with them.



REFERRALS AND ENDORSEMENTS FROM ORGANIZATIONS

For instance, in countries comprising counties and municipalities, residents are more familiar with their county councils who refer them to the digital health portals for their healthcare needs via word-of-mouth or online advertising on their websites. This model is seen in countries such as Denmark and Sweden and described in greater detail in later sections of this paper.



AN INNOVATIVE METHOD TO RAISE A DIGITAL HEALTH PORTAL'S PROFILE IS THROUGH REWARDS AND DEALS

Discount coupons and rewards points are given to users for first-time and subsequent usage of the portal, or when they have referred another party to the portal. This helps to encourage repeat usage for existing users, and entice new users to adopt the portal. Another method is the use of advanced data analytics in the marketing approach – weekly trends involving clicked links, number of visitors and social media followers, and most visited pages are analysed and fed back into its service and information offerings to stimulate further usage.

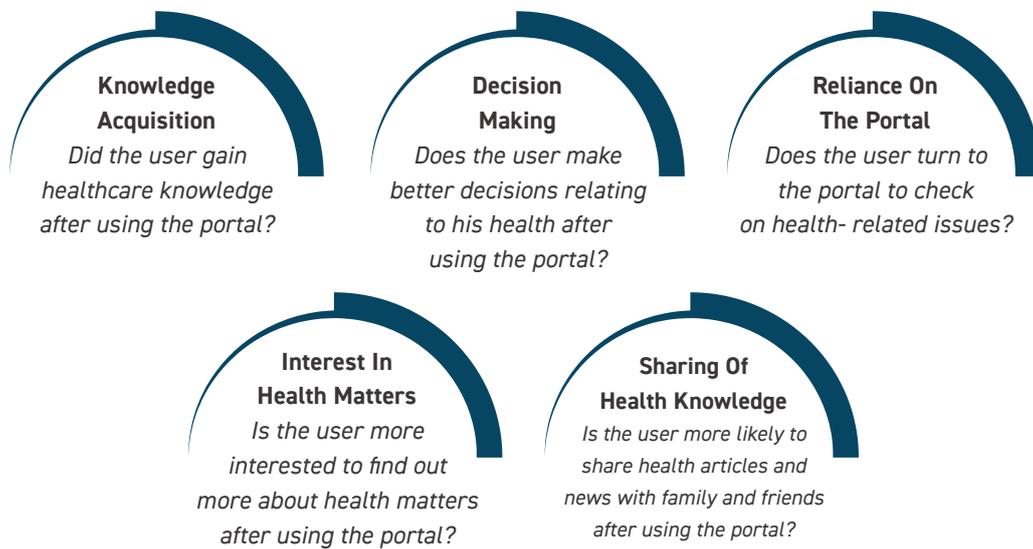
In their marketing strategy, most digital health portals usually adopt multiple outreach approaches and cater them to the specifics of their own country and target audience in order to optimize their outreach impact.

USER IMPACT AND SATISFACTION

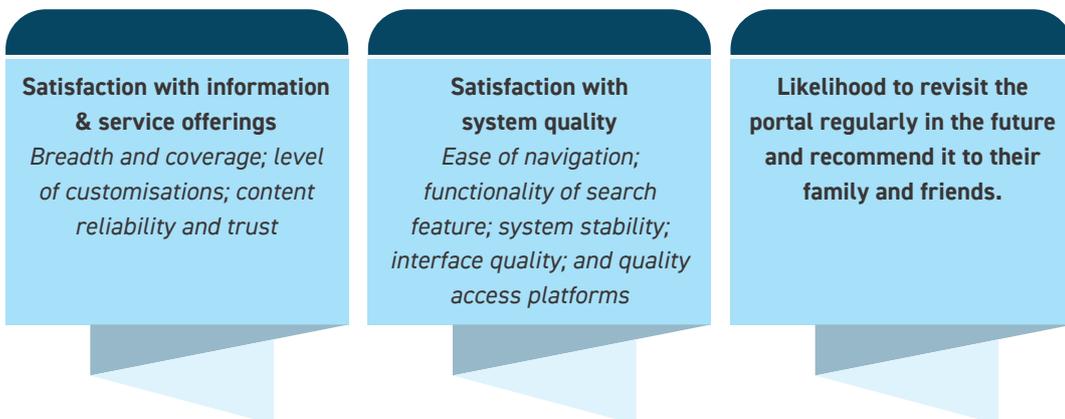
The digital health portal is used for myriad reasons. Some use it to gain healthcare knowledge, while others view it as convenient storage for their healthcare records. Towards the end of the user experience journey, insights from information and service offerings, system quality and marketing efforts are used to evaluate the digital health portal's performance. This paper focuses on two aspects, i.e., user impact and user satisfaction.

Given that both elements are dependent on the experience and characteristics of each user, Frost & Sullivan carried out a Global Digital Health Portal Consumer Survey 2016 in countries with prominent digital health portals to gain a better understanding of country-specific users' perceptions.

For user impact, survey participants were asked about their perceived trust and reliability in the digital health portal and the effects of using the portal in five aspects:



For user satisfaction, survey participants were asked to rate aspects relating to the portal's service and information offerings and system quality:



In general, consumers are satisfied with current available digital health portals with a score of 8.09 out of 10²⁴.

BEST PRACTICES IDENTIFIED

Public Portals with Comprehensive Offerings

Private Portals with Comprehensive Offerings

Public Portals with Niche Offerings

Private Portals with Niche Offerings

31 Portals

Top Comprehensive Portals: have a wider range of service offerings covering the digital health categories (consumer health informatics, healthcare administration, and telehealth)

Top Niche Portals: focus on or are strong in a specific digital health category (consumer health informatics, healthcare administration and telehealth)

Shortlisting 13 portals

Presence of Awards/ Endorsements by Multilateral-orgs (e.g. EU, WHO)/ Attract higher levels of funding (where applicable)

Capabilities of service offerings provided within each digital health category

Shortlisting 6 portals

Denmark, Sundhed



United Kingdom, NHS



Sweden, 1177



Singapore, HealthHub



China, GuaHao



USA, WebMD



* Countries listed are the countries of origin of listed portals.

PUBLIC DIGITAL HEALTH PORTALS

Denmark – sundhed.dk²⁵

LAUNCHED IN DECEMBER 2003,
SUNDHED.DK IS JOINTLY OWNED BY
DENMARK'S MINISTRY OF INTERIOR
AND HEALTH AND THE ASSOCIATION
OF COUNTY COUNCILS DENMARK.

The portal, covering all public health institutions in 98 Danish municipalities, is designed to empower citizens and provide better tools to General Practitioners (GPs) and patients to improve healthcare quality.

²⁵A new version of sundhed.dk was launched in late September 2016. As the white paper covers the evaluation period from January to September 2016, the pictorial depictions are features of the prior version of sundhed.dk.

Usage Trends

OVER 860K
MONTHLY
UNIQUE VISITS

AVERAGE OF
3.63
PAGES PER VISIT

OVER 3.1M
MONTHLY
PAGE VIEWS

Information and Service Offerings

The sundhed.dk offers a comprehensive range of services from consumer health informatics, healthcare administration and telemedicine. Information and services include:



Remote patient monitoring – Patients currently on anticoagulants can use remote patient monitoring services to report their daily health statistics to their therapists through the AK-Online platform via sundhed.dk.



Apps developed for healthcare professionals - Apps such as Mobile Clinic and Kronika include specialised tools and knowledge on specific diseases to improve the quality of care healthcare professionals give to their patients.



Electronic health records – Various medical records, e.g., Health Journal (for General Practitioners and hospitals), medication, and laboratory results are available on sundhed.dk portal. The records are available for a duration of two years for medication history, and since 1977 for treatments in hospitals.



E-Services – Options to register for living wills, screening programmes, organ donations, blood donations, egg donations, and volunteering are available via the portal.



Proxy access – All Danes 15 years old and above can grant permission to proxies to access their hospital and laboratory results. Proxies can be family members, friends or other adults, with no restrictions once approval is obtained.

Approval and withdrawal of access can be done through the sundhed.dk portal, after signing into their own personal pages. For Danes aged below 15, it is not yet possible for parents to access their health records. The only exception is the ability to view the child's medications.



Telemedicine – Patients have the option to consult their registered physicians via email, along with the ability to attach images for clarity. The physician will then assess if the enquiry is suitable for email or a face-to-face consultation. If the physician is able to diagnose via email, prescriptions will then be issued to the patient; if not, the patient will be directed to make an appointment with the doctor.



Appointment management & E-Prescriptions - For clinics that have upgraded their clinic management platforms, e.g., aftalebogen, cure4you, and laegevejen, patients can sign in with their NemID, or social security number and password to book appointments and/or renew prescriptions.



Consumer health informatics - Content is aggregated from various organisations and health authorities in Denmark, i.e., five Danish regions and 98 municipalities, the Ministry of Health, Danish Health Authority, Statens Serum Institut (Health Research Organisation), and the Institute for Rational Pharmacotherapy. Articles highlighting specific trends and happenings targeting the users' region in the country are churned out on a weekly basis.

Ease of Navigation



Source: sundhed.dk

- Split into information-based health articles and directories and electronic health record, ePrescriptions, and appointment management service
- Special needs (e.g., reading-out-text programmes) available for free
- Support queries via direct hotline and email
- Search functions – find addresses and waiting times for GPs; locate certain information within the portal

Access Platforms

- Access modes via computer Web and mobile Web with the same coverage and quality of information and service offerings
- Limited functionality (medical directories) available on the sundhed.dk app
- Other apps available (as described above)

Quality of Interface

- Simple colour scheme ensures users are able to view content easily
- Addition of pictures will help increase the portal's visual appeal

Security & Privacy



Source: sundhed.dk

Emphasise data privacy to safeguard citizen records:

- Only healthcare professionals have access to patients' data
- Patients can check records/review history and privatise certain information (in eJournal)
- Proxy access granted only by patients
- Annual system audit
- Two-factor authentication process for login

System Stability

- The portal has good system stability
- Around 60% of respondents²⁶ have never experienced technical issues
- Slightly more than 20% experienced recurring technical issues

Marketing

The sundhed.dk portal relies mostly on word-of-mouth influence from physicians and healthcare professionals. Online news and articles and word-of-mouth influence are the two main channels for introducing Danes to the sundhed.dk portal. In all, the sundhed.dk portal adopts a mix of these marketing channels to reach out to citizens:

HEALTH CAMPAIGNS



Health campaigns from relevant associations educate citizens on health issues. This raises consumers' exposure to sundhed.dk in their search for related health information online.

NATIONAL MEDIA COVERAGE



The Danish government rolls out media advertising (i.e., newspapers, magazines, television, radio stations) to promote information and services available on the sundhed.dk portal.

SOCIAL MEDIA



Employment of social media channels such as YouTube, Facebook, Google+ and LinkedIn to engage users and raise awareness of services and information available on sundhed.dk.

WORD OF MOUTH INFLUENCE



Materials available on the sundhed.dk portal can be printed for use in general practices, hospitals, and pharmacies for distribution to the patients.

User Impact & Satisfaction²⁷

After using the sundhed portal, users have seen positive changes in:

Checking the portal for health-related matters, with an average score of

7.29 OUT OF 10

Overall healthcare knowledge and impact, with an average score of

5.67 OUT OF 10

Interest in health matters, with an average score of

5.43 OUT OF 10

93.3%

of respondents expressed likelihood of visiting the portal regularly in the future and recommending it to friends and family.



27 Source: Frost & Sullivan Digital Health Portal Consumer Survey 2016

United Kingdom – NHS Choices

LAUNCHED IN JUNE 2007, NHS CHOICES IS OWNED BY PUBLIC HEALTH ENGLAND AND IS ONE OF THE MOST VISITED CONSUMER HEALTH WEBSITES IN THE UK.

It is largely a consumer health informatics site and strives to be the leading multi-channel portal with articles and videos to help users make better lifestyle and healthcare decisions. Users are able to read in-depth analyses in healthcare articles and review doctors and services of healthcare clinics on the site.

Usage Trends

OVER 36M
MONTHLY
UNIQUE VISITS

AVERAGE OF
1.97
PAGES PER VISIT

OVER 71M
MONTHLY
PAGE VIEWS

Information & Service Offerings

NHS Choices is focused on consumer health informatics, with services and information ranging from health risk assessments to doctor reviews. The portal also supports online healthcare payments and first-time referrals. Its information and service offerings include:



Reviews & ratings – Option to view and leave reviews and ratings for healthcare institutions. Statistics on individual healthcare professionals are also available in a beta version, to promote transparency of information within the healthcare system.



Referrals - Patients are able to book and manage their referrals and first appointments with hospitals via the eReferral service through the portal.



Online healthcare payments – Prescription prepayment certificates (PPC) can be purchased from the portal. A PPC helps patients who require multiple medicines in a year to save money on their prescriptions and the portal offers the quickest way to buy a PPC. The online service also allows users to specify their preferred start dates.



Health apps library – Health apps are integrated into the various campaigns such as One You and NHS SmokeFree campaigns. While NHS Choices used to have a health apps library, it closed in late 2015 due to speculated data security concerns. This has greatly affected consumer confidence in using the apps from NHS Choices; content security will be an important driving factor for the portal moving forward.



Consumer health informatics – NHS Choices has a dedicated team of editors and journalists, with frequent and regular generation of articles, i.e., at least once per weekday. To date, there are 27,000 pages of different types of content on the NHS Choices portal. Additionally, the section “Behind the Headlines” provides unbiased evidence-based assessments of published health news and stories for the public. After selection of key stories by NHS Choices, they will then be sent to a 3rd party vendor²⁸ engaged by NHS Choices to analyze the research behind these articles, for publication in this section.

²⁸Vendor is Bazian, a leading provider of evidence-based healthcare information in U.K. Bazian's clinicians and scientists are responsible for the research and analysis of selected health stories to be published in NHS Choices' "Behind the Headlines".

Ease of Navigation



Source: NHS Choices

- Key services are spread across the entire web page
- 104 language options available

Access Platforms

- Access modes via computer and mobile Web – same coverage and quality of information and service offerings
- No official NHS Choices app

Quality of Interface

- Appropriate font size and color
- Visually appealing with addition of some pictures at the top of articles

Security & Privacy

- Strict adherence to security and privacy standards:
 - Part of Information Standard, i.e., the protection of health and social data in the UK
 - eServices can only be accessed via email and password
 - Annual system audit

Security concerns and breaches affected in recent years

- Publicised security breach where hundreds of pages were infected with malicious code that redirected visitors to malware-laden sites in 2014

System Stability

- The portal has good system stability:
 - More than 70% of respondents²⁹ have never experienced technical issues
 - Slightly less than 10% experienced recurring technical issues

Marketing

The NHS Choices portal relies on national health campaigns and media to cover its developments and spread awareness of its information offerings to citizens. Word-of-mouth, online news and articles and television are the three main channels Britons are introduced to the portal. Word-of-mouth influence is most prominent in generating awareness for NHS Choices, signaling that people are talking about the portal, and NHS Choices' marketing campaigns are working. In all, the NHS Choices portal adopts a mix of these marketing channels to reach out to citizens:

PUBLIC HEALTH CAMPAIGNS

The NHS Choices portal covers information from existing and new NHS health campaigns. This increases consumer exposure to NHS Choices. The recent One You Campaign, launched in March 2016, urges adults to maintain healthy habits and exercise more frequently. An online lifestyle checker is also available for Britons to rate their lifestyle choices, which then generates advice about where they can get help and what they need to do to change their lifestyles. Links on the One You website are tied to the NHS Choices website, to help generate more traffic to the portal.

NATIONAL MEDIA COVERAGE

Various print mediums, i.e., brochures, leaflets, posters, and advertisements are used. Commercials are also aired on national television, billboards, and radio stations.



SOCIAL MEDIA

NHS Choices employs social media channels such as YouTube, Facebook, and Twitter to engage users and raise awareness of information available on the portal. Its team tracks traffic and number of followers on social media platforms, and publishes social and digital media reports monthly to capture trends and hot topics relevant to UK citizens.



DATA ANALYTICS AND TRENDS

NHS Choices' editorial team analyses web metrics and traffic reports to provide more relevant and accurate content to visitors.

User Impact & Satisfaction³⁰

After using the NHS Choices portal, users have seen positive changes in:

Reliance on the portal for health-related matters, with an average score of

8.06 OUT OF 10

Overall healthcare knowledge and impact, with an average score of

7.99 OUT OF 10

Making better decisions relating to health, with an average score of

7.69 OUT OF 10

~99%

of respondents expressed likelihood of visiting the portal regularly in the future, and of recommending the portal to friends and family.

LAUNCHED IN 2010, 1177.se IS OWNED BY THE STOCKHOLM COUNTY COUNCIL, ON BEHALF OF ALL SWEDEN'S COUNTY COUNCILS AND REGIONS.

Its development is driven by the Swedish Healthcare Direct, i.e., a collaboration of various counties and regions in Sweden, with the aim of being a one-stop health portal for citizens to find healthcare-related information and access their health records. Its current focus is on making health records and basic eHealth services available for citizens in the country.

Usage Trends

OVER 3M
MONTHLY
UNIQUE VISITS

AVERAGE OF
1.81
PAGES PER VISIT

OVER 6M
MONTHLY
PAGE VIEWS

Information & Service Offerings

1177.se has a comprehensive range of services from consumer health informatics and healthcare administration. However, all services are not readily available across Sweden as some clinics and healthcare institutions are still using incompatible clinical management systems. County councils across Sweden are accelerating efforts and initiatives to encourage healthcare practitioners to upgrade their systems within the next two years. Its information and service offerings include:



Appointment booking - Access to physicians' page to book, change or cancel appointments.



Electronic health records - Medical records (since July 1, 2014) - primary care, hospitalisation, prenatal, laboratory test results, referrals, vaccinations, drug allergies, health limitations, serious illnesses. Rheumatic patients are able to input their daily statistics to monitor progress.



Proxy access - Parents can access the records of their children aged 13 and under. To add records, users must be official guardians listed on Sweden's population register. Verification is done through the system in real-time.



E-Services - Renewal of existing prescriptions and access; electronic sending and downloading of medical certificates; and quick and easy ordering of copies of medical journal.



Clinic reviews & ratings - Aggregated scores on general components of healthcare service and quality; information and reviews on specific doctors are not available.



Community forums - Expounded on community-based sharing, and by guest bloggers



24/7 support - Ask anonymous questions - waiting time of less than 7 days; offers users national telephone service to call 24/7 - all calls answered by nurses.



Consumer health informatics - Dedicated staff to develop content; content generated based on user comments, survey results, and trend analysis; county-specific content; more than 350 healthcare experts engaged to review and revise content before publication.

Ease of Navigation



- Split into health informatics, directories, and eServices
- Language options available for some content sections
- BrowseAloud (available for free) enables content to be read out loud
- Support queries – online form and direct hotline (with limited availability)
- Categorisation of search results into articles, directories, and Q&A

Access Platforms

- Access modes via computer and mobile Web – same coverage and quality of information and service offerings
- No official app

Quality of Interface

- Appropriate font size and color
- Visually appealing with addition of some pictures at the top of articles

Security & Privacy

- Strict adherence to security and privacy standards:
- Compliance with Patient Data Act enacted in 2008
- Use of eID and password to access eServices (eID is Sweden's own form of electronic identities management)
- Maintenance of log statements (of people who have accessed an individual's records)
- Annual system audit
- No external security certificate present

System Stability

- The portal has good system stability:
- More than 60% of respondents³¹ have never experienced technical issues
- Slightly more than 20% experienced recurring technical issues

Marketing

The 1177.se portal relies on word-of-mouth influence and referrals from county councils and healthcare practitioners to raise awareness of the portal and its profile among citizens. The 1177.se portal has also adopted other marketing channels to reach out to its citizens:

HEALTH CAMPAIGNS

Health campaigns educate citizens and raise consumer exposure to 1177.se in their search for health information. Each county council is responsible for its own marketing, which caters for its county's health trends and demands. For instance, for the Stockholm county, the 1177 Health Care Guide is published periodically to inform citizens on relevant healthcare issues.

REFERRALS - COUNTY COUNCILS



County councils' websites are the first portals citizens go to when they are looking for government-related services. On the main page of the county council website, there is a referral link to 1177.se for citizens to visit if they require healthcare advice.

SOCIAL MEDIA



Employment of social media channels such as YouTube and Facebook to engage users and raise awareness of services and information available on 1177.se.

WORD OF MOUTH INFLUENCE

Physicians and healthcare professionals advise patients to view their health records on the site, or book appointments through the 1177.se portal.

User Impact & Satisfaction³²

After using the 1177.se portal, users have seen positive changes in:

Reliance on the portal for health-related matters, with an average score of

7.05 OUT OF 10

Overall healthcare knowledge and impact, with an average score of

6.81 OUT OF 10

Making better decisions relating to health, with an average score of

6.27 OUT OF 10

~95%

of respondents expressed likelihood of visiting the portal regularly in the future, and of recommending the portal to friends and family.

Source: Frost & Sullivan Digital Health Portal Consumer Survey 2014

LAUNCHED IN OCTOBER 2015, HEALTHHUB IS A JOINT COLLABORATION BETWEEN THE HEALTH PROMOTION BOARD (HPB), MINISTRY OF HEALTH HOLDINGS (MOHH) AND INTEGRATED HEALTH INFORMATION SYSTEMS (IHIS).

A relatively new portal on the digital health scene, HealthHub aims to aggregate content and services to influence health behaviour and simplify interaction with health service providers on the same platform, hence, increasing the health literacy of Singaporeans.

Usage Trends

OVER 200K
MONTHLY
UNIQUE VISITS

AVERAGE OF
2.15
PAGES PER VISIT

OVER 400K
MONTHLY
PAGE VIEWS

HealthHub enjoyed the highest page views (almost a million) and pages/visit during its launch in October 2015.

Information & Service Offerings

HealthHub has a strong focus on consumer health informatics, while eServices under healthcare administration are relatively new and basic. Since its launch, HealthHub has been ramping up its information and service offerings with quarterly updates and releases. Details of information and services available on HealthHub are as follows:



Rewards – Users can earn Health points for various activities on the site, i.e., sharing of articles, events and participating in quizzes, and exchanging them for supermarket vouchers.



Deals - Exclusive offers and discounts with selected HealthHub merchants in the Food, Fitness, Wellness, Recreation and Healthcare categories; and coupons via HealthHub app to enjoy discounts on-the-go.



Customized Tools – Quizzes released on mobile app each month on a series of topics. On the HealthHub site, Colours of the Mind, and Find Your Inner Awesome are available for kids and youths.



Electronic Health Records – Records (lab test results, discharge summaries, HPB screening programmes, immunisation records and health vitals for chronic-disease patients) are available for adults. Only specific health data from public hospitals and polyclinics are available.

**No records of individuals with HIV/AIDS, or psychiatric conditions are shown. While inconvenient, this is HealthHub's deliberate move to protect the privacy of these individuals in the event of a data breach.*



Proxy access – Parents can access children's health records via HealthHub. Additional records available include child immunisation, school health assessment summaries, school dental records, and school referral and reminder letters.



Consumer health informatics – Emphasises localised, citizen-centric content with the use of "Singlish" (Singaporean English) and local dialects in the articles. There are also frequent updates on HealthHub by its team of writers to generate content with two-tier checks by subject matter experts before publication.

System Quality

Ease of Navigation



Source: Healthhub.sg

- Categorized into main information and service offerings, alongside a brief description when the user's mouse hovers over a category
- A scroll-down summary of categories available on main site
- Search results based on HealthHub's information and service offerings
- Support queries such as telephone, email or web page requests readily located on the site

Access Platforms

- Access modes via computer and mobile Web offering same coverage and quality of information and services
- Official HealthHub app with enhanced functionalities (additional quizzes)

Quality of Interface



Source: Healthhub.sg

- Appropriate font size and color that is adjustable to users' needs
- Visually appealing with pictures throughout articles to aid understanding

Security & Privacy

- Exceed Singapore government's standards for public institutions:
- Compliance with Personal Data Protection Act
- Presence of external security certificate i.e., Entrust
- Access to health records via SingPass³³, i.e., a two-step verification process

System Stability

- The portal has good system stability:
- More than 57% of respondents³⁴ have never experienced technical issues
- Close to 20% experienced recurring technical issues

³³SingPass is the authentication key for most government e-services.
³⁴Source: Frost & Sullivan Digital Health Portal Consumer Survey 2016.

Marketing

Online news/articles, social media and newspapers are the three main channels Singaporeans use to obtain information on HealthHub. This corresponds with HealthHub's strategy of using national health campaigns and media to cover its developments. There is also strong word-of-mouth influence generating awareness for HealthHub, signaling that HealthHub's marketing strategies are working.

PUBLIC HEALTH CAMPAIGNS



Health campaigns from the Health Promotion Board educate citizens on healthy living, and raises citizens' exposure to HealthHub. A recent campaign by the HPB is "Eat, Drink, Shop Healthy and Win Big" which incentivise users to adopt healthier lifestyle choices. These health campaigns, while not organised by HealthHub, helps direct traffic to HealthHub.

NATIONAL MEDIA COVERAGE



Launch of HealthHub by the Minister of Health, Gan Kim Yong, ensures coverage on all national publications, i.e., newspapers, radio stations and television channels. In addition, the media is informed of new features via HealthHub's quarterly updates and releases, reminding users from time-to-time to visit the portal.

SOCIAL MEDIA



Promotion of HealthHub on social media platforms of various local health organisations, e.g., HPB's Twitter and Facebook. Popular influencers are also asked to share news about the launch of HealthHub on their own social media sites.

PRINTED MEDIA & ADVERTISEMENTS



Brochures and 90,000 flyers have been printed for school children, to raise awareness to parents about accessing their children's records on HealthHub. Static advertisements on public transport services including bus stops, buses, MRTs, and taxis.

User Impact & Satisfaction³⁵

After using the HealthHub portal, users have seen positive changes in:

Overall healthcare knowledge and impact, with an average score of

6.90 OUT OF 10

Reliance on the portal for health-related matters, with an average score of

6.89 OUT OF 10

Likelihood of sharing health articles and news with their friends and family, with a score of

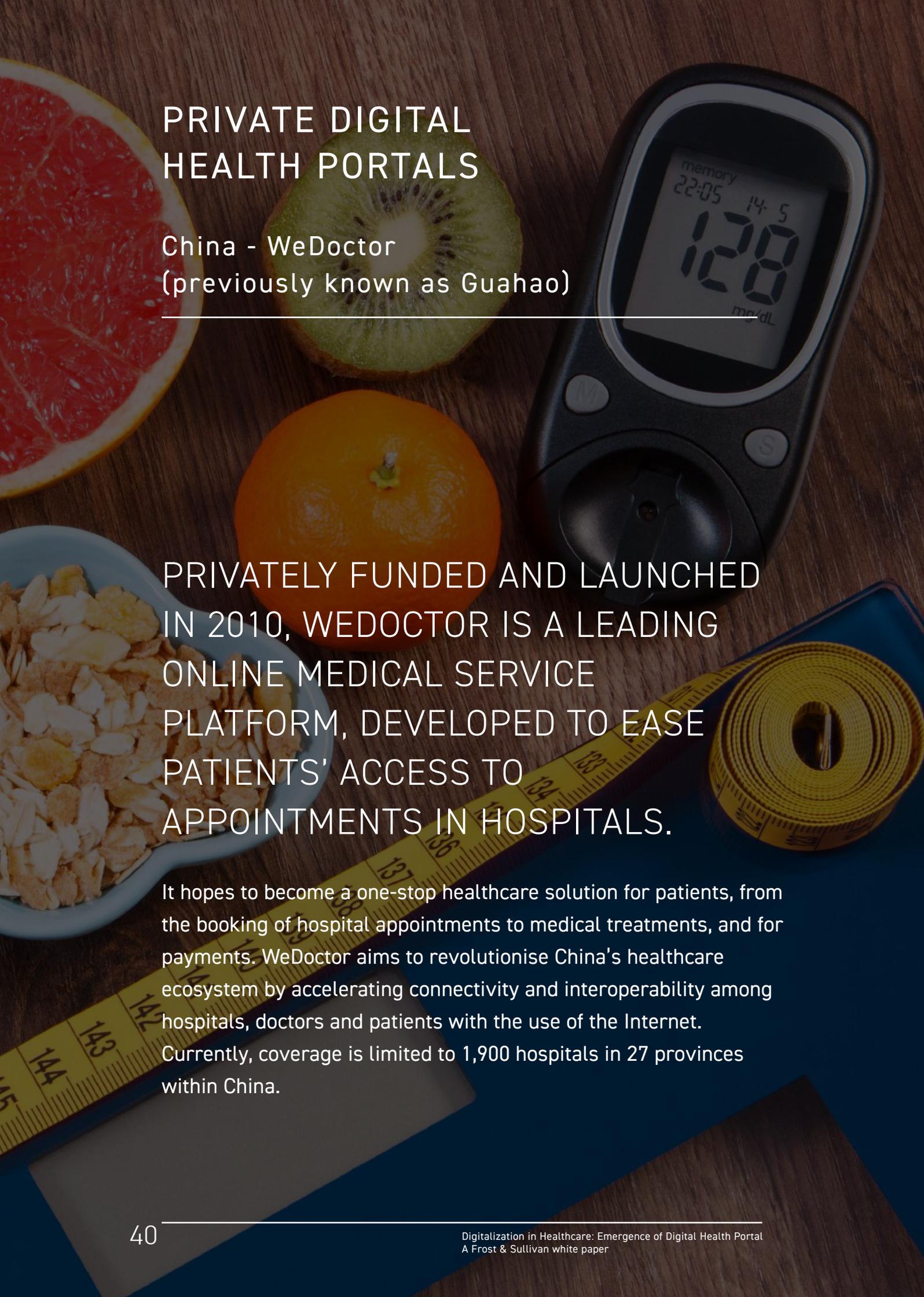
6.89 OUT OF 10

HealthHub has performed well for a portal that is less than a year old, with scores showing that they have met users' needs adequately. This shows great potential for HealthHub to grow and mature as a top-of-mind destination for Singaporeans to obtain their health information.

However, HealthHub has to further customise its services to Singaporeans' needs for them to derive greater benefits from using the portal, and strengthen retention ratios.

93%

of respondents expressed likelihood of visiting the portal regularly in the future, and of recommending the portal to friends and family.



PRIVATE DIGITAL HEALTH PORTALS

China - WeDoctor
(previously known as Guahao)

PRIVATELY FUNDED AND LAUNCHED
IN 2010, WEDOCTOR IS A LEADING
ONLINE MEDICAL SERVICE
PLATFORM, DEVELOPED TO EASE
PATIENTS' ACCESS TO
APPOINTMENTS IN HOSPITALS.

It hopes to become a one-stop healthcare solution for patients, from the booking of hospital appointments to medical treatments, and for payments. WeDoctor aims to revolutionise China's healthcare ecosystem by accelerating connectivity and interoperability among hospitals, doctors and patients with the use of the Internet. Currently, coverage is limited to 1,900 hospitals in 27 provinces within China.

Usage Trends

OVER 760K
MONTHLY
UNIQUE VISITS

AVERAGE OF
14.75
PAGES PER VISIT

OVER 11M
MONTHLY
PAGE VIEWS

Information & Service Offerings

WeDoctor is the only portal featured in this report with all services covered under consumer health informatics, healthcare administration and telemedicine. As mentioned earlier, coverage of these services is limited to hospitals and provinces in which WeDoctor has collaborations. Even so, within these provinces, not all services are available, e.g., ePrescriptions are only available in provinces where WeDoctor has obtained the necessary governmental approval for patients' health data. Details of information and services available on WeDoctor are as follows:



Self-assessment tools - Interactive self-assessment tools such as Symptom Checker allow users to quickly locate the information, customised to their requirements. Symptom Checker is available within the Health Self-Diagnosis section of the WeDoctor app for easy access. It is interactive, with male and female bodies' front and back views, including common symptoms for easy reference.



Consultation services - Multi-forms consultation services are available on the main page of WeDoctor as well as the WeDoctor mobile app. Users are able to contact doctors in multiple ways i.e., texts messages, pictures, phone calls, and videoconferencing in real time. Free consultation with less than 10 minutes' waiting time is supported by public hospital doctors and guaranteed for users. More than 12,000 distributing doctors would review patients' conditions and match patients to the relevant division/specialist to make appointments online. Seven thousand specialist teams covering diverse subjects would review and provide priority specialist appointments, group consultations, and other services.



Doctor reviews & ratings - Anonymous ratings and reviews of doctors provide reliable information for patients to choose the right doctor for an appointment and/or online consultation. Other statistics such as the number of appointments/consultations the doctors have had before are also available.

Ease of Navigation



Source: WeDoctor

- Quickly locate information via navigation panels
- Support queries – 24/7 online customer services, direct hotline
- Clearer eServices instructions are expected

Access Platforms

- Access modes via computer, mobile Web and official WeDoctor app - same coverage and quality of information and service offerings
- Further customised accessing is available based on search history

Quality of Interface

- Appropriate font size and colour
- Visually appealing with pictures and videos widely used

Security & Privacy

- Collaboration with the Chinese government to develop digital health industry security standards
- Strict adherence to international security and privacy standards
 - Compliance with the US HIPPA (including file transfer encryption, data integrity and dual-key security)
- Real name registrations with identity card numbers
- SMS verification and puzzle/code verification to log in
- Corporate third party (WeChat, Alipay) log-in is supported

System Stability

- System stability may have to be improved for the portal:
- Less than 45% of respondents³⁶ have never experienced technical issues
- More than 30% experienced recurring technical issues

Marketing

WeDoctor employs marketing strategies targeting different stakeholders, including hospitals, doctors, and patients.

COLLABORATIONS WITH GOVERNMENT AND HOSPITALS

Collaborations with local government agencies (i.e., firstly with the Health and Family Planning Commission), which are then promoted to hospitals. Mandated app downloading for patients/caregivers if using Wi-Fi provided by hospitals.

CORPORATE PARTNERSHIPS

Partners with employers and insurance plans to offer health management programmes and with private doctors to help keep participants healthy.



SOCIAL MEDIA AND OTHER ONLINE PROMOTIONS

Rewards points for doctors consultancy; online medical case discussion (forum) to attract doctors.

WeDoctor widely employs the use of social media such as WeChat and Weibo, which are popular among consumers in China to raise awareness of its services.



Ecommerce promotion strategy (e.g., consultant coupon).

STREET PROMOTERS

Street promoters and gifts are used to entice consumers to download and register the app.

User Impact & Satisfaction³⁷

After using the WeDoctor portal, users have seen positive changes in:

Overall healthcare knowledge and impact, with an average score of

8.03 OUT OF 10

Interest in health matters, with a score of

7.93 OUT OF 10

Reliance on the portal for health-related matters, with an average score of

7.92 OUT OF 10

~98%

of respondents expressed likelihood of visiting the portal regularly in the future, and of recommending the portal to friends and family.

ONE OF THE BEST-KNOWN HEALTHCARE SITES IN THE WORLD, WEBMD IS A PUBLICLY-LISTED PRIVATE HEALTHCARE PORTAL. IT AIMS TO PROVIDE CREDIBLE HEALTH INFORMATION TO USERS AND SUPPORT HEALTH COMMUNITIES AND NETWORKS WHILE SERVING AS A REFERENCE POINT FOR VARIOUS HEALTHCARE TOPICS IN THE FIELD.

WebMD focuses on generating good content for advertising revenue and employs a robust online marketing strategy to attract and retain users.

This white paper focuses only on the consumer-facing site of WebMD and excludes WebMD Health Corp's other medical sites (such as MedicineNet.com; RxList.com; and Medscape.com) in the evaluation.

Usage Trends

OVER 160M
MONTHLY
UNIQUE VISITS

AVERAGE OF
1.92
PAGES PER VISIT

OVER 305M
MONTHLY
PAGE VIEWS

Information & Service Offerings

WebMD is a niche portal with strong coverage in consumer health informatics. While it does not have any service offerings in healthcare administration or telemedicine, it offers health management programmes in partnership with corporations and insurance plans. Details of its information offerings are as follows:



Content offerings - Extensive and in-depth content library built up over the past 20 years, with thousands of health articles aggregated on the site. A wide variety of information within the same category is available. An assortment of content tools - apps, quizzes, articles, videos, and communities are available for the user to gain more information.

Users may be sceptical of advertisers and sponsors on the site. With its primary source of revenue stemming from advertisements and sponsorships, there had been numerous allegations of biased content in WebMD's articles, aimed at misleading users to certain medicines. While WebMD has denied all claims, such reports affected the portal's trustworthiness and reliability.



Medical directories - Patients can find information of physicians who have registered with WebMD.



Community forums - Users can connect with each other anonymously and discuss health issues. The forums are moderated by a WebMD employee to regulate and spur discussions.



Self-assessment tools - Symptom Checker and Pill Identification allow users to quickly locate the information, customised to their requirements.



Health management program - Specially developed for corporations and insurance plans. However, this is a private portal³⁸ open only to participants and is separate from the consumer WebMD.

³⁸On the private WebMD portal (for corporations), basic health information - hospitalisation records and medicine prescriptions are input into the system for the participant. WebMD has a health and fitness team to answer queries from participants and guide them towards managing their health better. Based on contract terms with employers, monetary rewards may also be given to participants who have actively worked towards their health goals.

Ease of Navigation

- Categorised into main information and service offerings via landing pages such as Women's Health, and Men's Health
- Programme to read content out loud – does not require prior download and installation
- Search results are not categorised and yield advertisements by Google
- Support queries through a direct web page request only

Various components, i.e., health topics, interactive tools, trending articles, and directory search are spread across the entire web page, which can be confusing for first-time or infrequent users of the portal.

Access Platforms

- Access modes via computer and mobile Web – same coverage and quality of information and service offerings
- Official WebMD app – limited content on the WebMD app compared to the web interface. However, functionalities in terms of personalised content is expanded with Healthy Target (a health improvement programme) and Healthy Living (a daily lifestyle magazine)

Quality of Interface

- Appropriate font size and color
- Addition of pictures would help increase the portal's visual appeal

Security & Privacy

- Not interoperable with health information systems of any public or private health providers
- Minimal personal health data are present on WebMD – personally input by users. Users have to sign up and authenticate before information can be uploaded
- External security certificate and accreditations – TRUSTe and URAC seal

System Stability

- The portal has good system stability:
- More than 72% of respondents³⁹ have never experienced technical issues
- Close to 15% experienced recurring technical issues

Given that WebMD started off as an online consumer health informatics site, most users came to know of it via online news/articles and social media. Many doctors use WebMD magazines, delivered free to them, to educate their patients on medical ailments. Search engines, e.g., Google are also popular media for directing users to WebMD, as WebMD results are usually prominently displayed among the top few searches. Marketing channels WebMD employ include:

CORPORATE PARTNERSHIPS



In recent years, corporate partnerships have been established e.g. with Sports Illustrated Group to create a three-part editorial series on injured athletes and their return to competition. WebMD also partners with employers and insurance plans, offering health management programmes to help keep participants healthy. This helps to create awareness for WebMD's content offerings.

PRINTED MEDIA



WebMD produces magazines, in both print and digital versions, eight times a year. Its healthcare practitioner subscribers receive the printed editions. Availing WebMD materials in the waiting rooms of clinics and hospitals increases patients' exposure to WebMD.

SOCIAL MEDIA



Social media platforms such as Facebook, Twitter and Pinterest are all used to promote WebMD to users. The newest tweets and Facebook updates can be found on the main WebMD site, and there are options for users to share articles with one another on social media.

CREATION OF ITS OWN COMMUNITY NETWORKS

WebMD creates its own community networks among professionals. One example is Physician Connect⁴⁰, an online social network where physicians can discuss about patients, drug information, and the latest studies and clinical trials. This helps to raise WebMD's profile among healthcare professionals, increasing word-of-mouth influence for the portal.

⁴⁰Physician Connect is part of the offerings from Medscape, one of WebMD's subsidiaries. While we recognise that Physician Connect is not the WebMD portal's offerings, we believe Physician Connect brings significant marketing benefits and synergies to the WebMD portal. Source: WebMD; WebMD Youtube Page

User Impact & Satisfaction⁴¹

After using the WebMD portal, users have seen positive changes in:

Overall healthcare knowledge and impact, with an average score of

8.55 OUT OF 10

Reliance on the portal for health-related matters, with an average score of

8.54 OUT OF 10

Making better decisions relating to health, with an average score of

8.19 OUT OF 10

WebMD has the highest scores across all featured portals, indicating its helpfulness in healthcare-related matters. Users are also highly satisfied with its content offerings.

This is consistent with WebMD's prominence in consumer health informatics, and with its loyal base of readers built up over more than 10 years.

~96%

of respondents expressed likelihood of visiting the portal regularly in the future, and of recommending the portal to their friends and family.

Source: Frost & Sullivan Digital Health Portal Consumer Survey 2016

LEARNING POINTS

EACH PORTAL CATERS FOR COUNTRY-SPECIFIC PREFERENCES, WITH INFORMATION AND SERVICE OFFERINGS AIMED AT IMPROVING HEALTH AWARENESS AND CONVENIENCE FOR THEIR RESIDENTS.

Nonetheless, there are areas where portals can learn from one another to enhance their user experiences and impact. Our evaluation of input factors (information and service offerings, system quality and marketing efforts), also considers results from our consumer surveys.

INFORMATION AND SERVICE OFFERINGS

Information Coverage & Quality

Three things differentiating a portal's information offerings are:



**Comprehensiveness
of content**

**Reliability of
content**

**Local relevance
of content**

All featured portals have managed to incorporate a wide variety of content within their portals, the most common being consumer health and lifestyle articles as well as directories. Moreover, portals also actively source and aggregate health content from other related and third party agencies, increasing update frequency and relevance of their health content for their users.

To ensure content reliability, most portals place controls, i.e., tiered checking by established subject experts. Authors, subject experts, and any referred scientific journals are listed for easy cross-referencing to information and queries.

Moving forward, it may be important for portals to cater for the taste and preferences of their target audience. Localised slang, familiar references, and length are some elements which can be modified for health content to appeal to and further engage readers.

Nonetheless, given WebMD's dominance and experience in consumer informatics for the past decade, it is not surprising to see it ranked among the top based on its superior content offerings.

WebMD has the most comprehensive contents library, spanning assorted health and living topics including health articles on common pets.

It also updates its content daily. WebMD has a strong editorial team of more than 50 medical journalists and doctors, coupled with active working relations with a team of over 100 nationwide health experts to ensure frequent and reliable content updates. It follows a stringent review process, and clearly states contributors for published articles. Any enquiry or question from the public obtains prompt responses from WebMD.

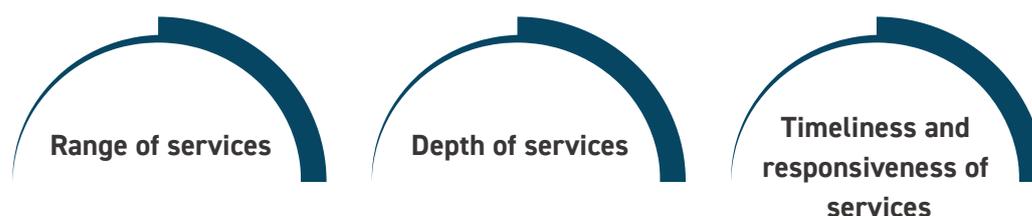
However, with past allegations of misleading articles, the integrity of WebMD's content is questioned. Going forward, it will be essential for WebMD to assure users of its high standards in content quality to sustain its strongest selling point.

Notable Mentions

While other portals have rather similar content offerings across the board, some have content catered for their local audiences. HealthHub, for instance, offers information pertaining to restaurant and shopping deals, and health and exercise events to health campaigns currently organised by various health agencies in Singapore. This enables HealthHub to position itself as a one-stop website for health-related happenings and events for residents. Additionally, HealthHub incorporates localised language, i.e., Singlish into its lifestyle articles, to further appeal to and engage local readers

Service Coverage & Quality

Three things that differentiate a portal's service offerings are:



An ideal health portal with eServices spanning healthcare administration to telemedicine will be useful for users to track their healthcare records and requirements. Even when a particular service is offered, it is important to consider the scope of the solution. For instance, different portals providing electronic health records may have different scope of information available online. The availability of eServices on the digital health portal may also be inconsistent and/or incompatible within a country due to differing regulations and clinical management systems used by physicians.

It is also important to consider if services are completed in real-time, with no significant lag between execution and results. Support given by portals such as direct chat services, or telephonic services will be differentiating factors boosting users' confidence and usage in services provided.

In terms of coverage, WeDoctor is the only portal with functionalities completing the full spectrum of services within these three areas. Services provided are timely and responsive, with service transactions guaranteed to be completed within 10 minutes. Live chat services are also available to quickly resolve any difficulties faced by the user.

However, services offered by WeDoctor are not consistent across China due to restrictions in regulations. In response, WeDoctor is already talking to various governments in China's municipalities to expand its reach.

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Notable Mentions

Among the featured public portals, sundhed.dk is the only one which offers services in telemedicine. There are also plans to enhance communication further via videoconferencing. While tracking of health vitals are only available for patients on anti-coagulants at this point, this functionality is slated to include diabetics and their blood sugar data (beta version already available for patients enrolled in the project). Detailed patients' medical records – medication records, laboratory results, and hospital treatments can be accessed via sundhed.dk portal, including records on donors' registration and the presence of living wills. For added convenience, parental access is granted for children's medical card (current medications, prescriptions, and completed courses). Other portals - 1177 and HealthHub have expanded parental access to include all available records on the platform, providing added convenience and control to parents and children in their care. HealthHub even plans to extend access to third-party caregivers, to facilitate care for their dependents.

SYSTEM QUALITY

All portals performed well in system quality, with positive responses reflected via our consumer surveys.

A strong and stable system quality will ensure that users are able to obtain the required healthcare information and service anytime, anywhere to their convenience. This is especially important in healthcare decision-making. In particular, Singapore's HealthHub has strong performances in this aspect.

HealthHub's interface features enable users to readily locate the information and services. On the main site, instead of bombarding users with health headlines and captions, HealthHub has adopted a cleaner interface design explaining the main categories of offerings they have. The search function is also highly visible and distinct on the site, ensuring that users know where to proceed to obtain the information they require. However, HealthHub can further improve in enhancing its accessibility by considering the particular needs of certain disabled groups.

HealthHub is able to deliver the full spectrum of their information and service offerings via their mobile apps. To further boost regular usage of its mobile app, HealthHub has also pushed additional content in the form of periodic quizzes.

In terms of interface quality, HealthHub is highly attractive to users. The ability to adjust font sizes helps cater for user preferences to a certain extent, especially for the elderly who may have eyesight issues hindering their use of the portal.

Colour scheme is attractive and visually appealing, and many pictures and icons are also added to the site for illustrations and to boost visual appeal. The high interface quality exhibited by HealthHub helps to transform the clinical experience of obtaining health information and services into one that is fun and engaging for the user.

Another aspect of system quality HealthHub has performed well in is its security and privacy standards. The presence of external security certificates, the two-factor authentication procedures and other measures implemented help reassure users that their health data is safe on the site and will remain personal and private. In addition, certain sensitive health data has also been deliberately omitted by HealthHub to protect and safeguard the interests of some individuals. These data include health records of patients previously and/or currently afflicted with sexual diseases and mental illnesses. HealthHub notes that while this precautionary measure may be inconvenient, the repercussions of a data leak for such individuals may be too dire given Singapore's society norms and standards.

The performance of all the featured portals is summarised below:

Exhibit 9: System Quality of Featured Portals

| | Sundhed.dk | NHS Choices | 1177.se | HealthHub | WeDoctor | WebMD |
|-------------------------------|---|---|---|--|---|---|
| Ease of Navigation | <ul style="list-style-type: none"> Clear content layout Some special needs have been considered. | <ul style="list-style-type: none"> Messy content layout Language options available via Google Translate | <ul style="list-style-type: none"> Clear content layout Some special needs have been considered. 1177.se hotline is available 24/7. | <ul style="list-style-type: none"> Clear content layout Description of categories on main page - Brief section overview of each category Search function highly visible | <ul style="list-style-type: none"> Clear content layout Direct chat services | <ul style="list-style-type: none"> Clear content layout Special needs have been considered. |
| Access Platforms | <ul style="list-style-type: none"> No official app, however various apps available for patients and physicians | <ul style="list-style-type: none"> No official app | <ul style="list-style-type: none"> No official app | <ul style="list-style-type: none"> Enhanced functionalities on official app | <ul style="list-style-type: none"> 2 separate apps for patients and doctors, each offering services unique to the user group. Full functionalities on both apps | <ul style="list-style-type: none"> Limited information offerings on official app |
| Quality of Interface | <ul style="list-style-type: none"> Small font sizes Color scheme is simple white, gray and red Lack of pictures | <ul style="list-style-type: none"> Appropriate font size and colour Color scheme is simple white, blue and green Addition of few pictures | <ul style="list-style-type: none"> Appropriate font size and colour Colour scheme is simple white, gray and red Addition of few pictures | <ul style="list-style-type: none"> Ability to adjust font sizes Attractive colour scheme Addition of many pictures | <ul style="list-style-type: none"> Appropriate font size and colour Articles are seen as too wordy and difficult to read by some users | <ul style="list-style-type: none"> Small font sizes, with grey subtexts Web interface is seen as cluttered and messy by some users |
| Security & Privacy | <ul style="list-style-type: none"> Presence of external security certificates 2-factor authentication procedures Act on Processing of Personal Data Comprehensive security and privacy features implemented | <ul style="list-style-type: none"> Part of Information Standard; Data Protection Act Some security and privacy features implemented Publicized security breach in 2014 | <ul style="list-style-type: none"> Patient Data Act Some security and privacy features implemented | <ul style="list-style-type: none"> Presence of external security certificates 2-factor authentication procedures Personal Data Protection Act Some security and privacy features implemented | <ul style="list-style-type: none"> Identification number is required for account registrations No formal data privacy standards | <ul style="list-style-type: none"> Not interoperable with health information systems of any service providers Presence of external security certificates; URAC seal |
| System Stability | <ul style="list-style-type: none"> Low reported technical issues for all featured portals | | | | | |

MARKETING EFFORTS

A robust marketing approach ensures that users are aware of the portal and its offerings, and are enticed to use the portal.

Featured portals usually employ a combination of health campaigns, referrals, and social media platforms to reach out to their targeted users. Some have gone one step further, by employing innovative ideas within their marketing approaches.

WebMD's multipronged marketing strategy enables it to reach out to various stakeholders. For consumers doing a routine search on health ailments on common platforms such as Google, results featuring WebMD is usually among the first few results. Its Search Engine Optimisation (SEO) strategy is particularly effective in directing traffic to its portal. In addition, WebMD magazines are distributed for free to clinics. WebMD magazines are also specially designed to attract the attention of patients, with features of well-known celebrities and personalities to share stories of their health and fitness journeys. In 2015, each issue of the magazine was expected to have a circulation rate of approximately 10 million people. Lastly, WebMD's private portal services allow it to reach out and engage corporations and their employees, encouraging them to visit its consumer site to obtain more information to support their health management programmes and regimens.

Notable Mentions

HealthHub employs nationwide health campaigns – extensive advertising were carried out on various online and offline platforms to reach out to the widest audience. These campaigns help to encourage consumers to visit HealthHub to obtain more information, thereby increasing usage. For instance, the launch of HealthHub was tied to the Health Promotion Board⁴²'s National Steps Challenge⁴³ campaign, where free step trackers were given to participants. It was a widely popular campaign; over 35,000 Singaporeans signed up for their step trackers in just four days. Correspondingly, this generated much buzz and enthusiasm for HealthHub as well, which recorded the highest page views during its launch in October 2015.

Conversely, NHS Choices has a dedicated team of analysts to study weekly Web and social media traffic. This capability allows NHS Choices to have updated information on consumer trends and demands, thereby ensuring that content generated are always relevant and timely for users. Corresponding, relevant headlines can then be used on social media platforms to bring traffic to its site.

Similarly, WeDoctor is particularly strong in using an online approach to engage and boost usage. For instance, Wechat and Weibo, the two most popular social media platforms in China are updated every few hours with new and interesting snippets of health content. Digital discount coupons for health products and services are also given out to incentivise users for downloading its app. Additionally, WeDoctor has also partnered with hospitals, where patients have to fulfill the prerequisite of downloading its app before they could use the hospital Wi-Fi services. Such tactics help attract and retain large numbers of users for WeDoctor.

⁴²The Health Promotion Board is a governmental organisation that promotes health information and campaigns in Singapore.
⁴³In the National Steps Challenge, citizens registered with the HPB are given steps trackers and encouraged to walk 10,000 steps a day. Users who achieve this accumulate Healthpoints (linked to HealthHub) which can subsequently be exchanged for supermarket vouchers.

LAST WORD

MOVING FORWARD, DIGITAL HEALTH PORTALS WILL CONTINUE TO EVOLVE TO MEET THE FUTURE EXPECTATIONS AND REQUIREMENTS OF CONSUMERS.

This is a continual process of improvement, from the very first-generation portals that emerged in the last decade to cater for information organisation to the interactive consumer-centric portals we have today. Presently, with the advent of electronic health records (EHR), portals featured in this study are able to benefit from workflow efficiencies, as well as offer advanced patient engagement tools to facilitate meaningful and relevant information exchange for healthcare organisations. Tasks such as renewing medications, receiving diagnostic test results and scheduling appointments can all be done with the click of a button through these portals.

Data, and in particular, customised and personalised health data are expected to be the most important driver pushing the envelope of next-generation health portals. Portals are expected to function as sophisticated data repositories, setting the stage for analytics that can open doors to greater efficiencies, return on investments and better patient care. Organisations can use data for a targeted approach to patient engagement; to better coordinate care transitions and more easily manage patient care at the population level. Telehealth, remote monitoring, and artificial intelligence are expected to have extensive coverage in this future phase of health portals.

Exhibit 10: Evolution of Health Portals

| | | |
|--|--|--|
| <p>“Advanced Email Systems” Facilitate communication among providers, patients and healthcare organizations</p> | <p>“eHealth” Collect, disseminate and consolidate health information and services</p> | <p>“Digital Care” Facilitate the provision of health services remotely in a personalized and customized manner.</p> |
| <p>2000s 1st Gen</p> | <p>2016s 2nd Gen</p> | <p>2020s onwards 3rd Gen</p> |

In retrospect, portals featured in this paper have taken the lead with their superior information and service offerings. In particular, the youngest featured portal in this report, HealthHub, is coming up as a strong contender in the digital health portal space, with a variety of new services and upgrades introduced quarterly. With HealthHub’s regular focus group discussions and reviews on portal offerings and improvement areas, there is huge potential for it to develop itself as a market leader in the digital health sphere in the next few years.

In conclusion, digital health portals help to tighten interactions between various parties in the healthcare ecosystem. More efforts can be put in to enhance healthcare environments and infrastructure, to complement the provision and delivery of consumer healthcare. We believe more governments will be expected to follow suit in the future, to capitalise on the benefits of having a common digital health platform within the ecosystem.



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