GLOBAL DIGITAL HEALTH PARTNERSHIP SURVEY ON DIGITAL HEALTH DEVELOPMENT

GDHP White Paper on Evidence and Evaluation

GDHP
Global Digital Health Partnership

ABOUT THE GLOBAL DIGITAL HEALTH PARTNERSHIP

The Global Digital Health Partnership (GDHP) is a collaboration of country governments, territory governments, and international organizations, formed to support the effective implementation of digital health services.

Established in February 2018, the GDHP provides an opportunity for transformational engagement between its participants, who are striving to learn and share best practice and policy that can support their digital health systems. In addition, the GDHP provides an international platform for global collaboration and sharing of evidence to guide the delivery of better digital health services within participant countries.

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1 NOTE FROM THE GDHP WORK STREAM CHAIR

Digital health technologies offer enormous potential to improve the delivering of healthcare, strengthening the health systems, and improving the quality of care. Evidence and evaluation of the effectiveness of the implemented digital health services and products are growing rapidly.

The sharing of international best practices is critically important. It allows governments to make wise investments on behalf of their citizens in digital health services and technologies that really have the opportunity to enhance patients and citizens' life.

Even if with different paths, countries are increasingly moving to the adoption of digital health systems and services, with a consistent, broad, international convergence in terms of requirements in the areas of transparency, health content, interoperability, and privacy and security.

In the past years, the Evidence and Evaluation Work Stream has elaborated methods and frameworks to support the evaluation of digital health benefits (with the White Paper "Measuring Benefits" published in 2019). The following year, the Work Stream has delineated the benefit categories governments and policy makers require evidence about, with the aim to guide critical analysis of digital health technologies and services (Sharing Insights, published in 2020).

Identifying and documenting different methodological approaches and frameworks (including the regulatory framework, the allocation of funding, the reporting of evidence, the uses of data, the communication of healthcare digitalization to people) are crucial to set the path for an international approach across GDHP participants. To address this challenge, we elaborated a questionnaire with the aim of highlighting how digital health is evolving globally, promoting a coordinated development of digital health practice.

This report presents our insights and examples of digital health evaluation frameworks, concrete examples of lessons learnt from existing digital health benefits evaluations and strategies for rapid knowledge sharing across participant countries.

We would like to sincerely thank all those GDHP participants who gave their support in the creation of this White Paper. We hope that these findings will help countries around the world in the strengthening of a digital health service that is efficient and evidence-based, and in leading our citizens and patients to move towards a more fulfilled and satisfied lives.

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Chair, GDHP Evidence and Evaluation Work Stream

2   EXECUTIVE SUMMARY

In a globalized world that is constantly changing, the adoption of digital health technologies and services is crucial for health care systems worldwide. Nonetheless, such technologies are not always easily implemented and they might encounter obstacles along the way. There is a global need to better understand and demonstrate the benefits of digital health technologies and services, identifying countries that are achieving value and help pave the way for others to follow their steps. Taking others as a positive example can foster international collaboration, resulting in better care for patients, health care providers and citizens alike.

In February 2019, the Evidence and Evaluation Work Stream of the Global Digital Health Partnership (GDHP) published an overview on the international benefits measurement frameworks and approaches to the evaluation and benefits measurement of digital health technologies and services among GDHP participant countries. In July 2020, it published a White Paper on the development of standard benefits and outcome measurements, aimed at providing a common framework for evaluation of digital health services and technologies among different countries, to be used for comparison of results.

On the wave of the aforementioned predecessors, this White Paper provides an overview of how digital health is evolving globally to provide a common basis for future development. The resulting insights on the differences between digital health adoption among different GDHP countries serves as a starting point to coordinate further progress on digital health worldwide, fostering evidence-based collaboration.

All GDHP country participants were offered the opportunity to contribute to the Evidence and Evaluation Work Stream White Paper. To capture the information from participant countries, a survey was distributed (a copy of the survey is at Appendix B). In addition, a review of available literature was performed in March 2021, searching for existing evidence on the topic, in academic databases and search engines.

The survey asked questions under six main sections:

Section 1. Priorities identification
Section 2. Relationship between national health plans and criteria for funds allocation
Section 3. Evidence about the development of digital health services
Section 4. Providing digital health evidence
Section 5. Collecting Data
Section 6. Strengthening and promoting digital health

Results were summarized in the following recommendations on the next steps to take:

- Clear identification of priorities
- Clear funds allocation
- Identify methods for data collection
- Better definition and sharing of an "Open data framework"
- Improve communication involving clinicians and population

The process of evaluation of the use and acceptability of digital health technologies is ongoing. With many countries and territories at the beginning of this journey, the opportunities for international growth in this sector are countless.

3   INTRODUCTION

3.1.   BACKGROUND

The implementation of digital health technologies and services is a complex issue to keep track. Digital health development strategies have been strengthened worldwide, though evaluating regulatory and non-regulatory policy aspects among different countries can be challenging. This includes communication barriers, cultural aspects and complex issues faced by countries working towards adoption of digital health technologies and services in their health care systems. Inconsistency among different countries might also result from having differences in the evaluating parameters they use, making it difficult to find similarities and differences where they actually exist.

The Global Strategy on Digital Health 2020-2025 was released by the World Health Organization (WHO) earlier in 2021. Its purpose is to strengthen health systems through the application of digital health technologies for consumers, health professionals, health care providers and industry towards patient empowerment and the achievement of the vision of health for all. It is a framework for action whose purpose is to assist countries in advancing digital health, improving health outcomes for populations globally. It should be noted that the WHO defines digital health "a broad umbrella term encompassing e-health, as well as developing areas such as the use of advanced computer sciences (for example, in the fields of "big data", genomics and artificial intelligence)", recognising its role in "strengthening health systems and public health, increasing equity in access to health services, and in working towards universal health coverage".

The Global Digital Health Partnership (GDHP) report of July 2020 entitled "Benefits Realisation: Sharing Insights" described international approaches to the evaluation of benefits measurement of digital health technologies and services among GDHP participant countries. Furthermore, the report of February 2019 entitled "Measuring Benefits" identified significant variations in evaluation approaches used among GDHP participant countries.

This report's findings were subsequently discussed at the 8th GDHP Virtual Summit on April 16th, 2021. The topics evaluated in the survey were divided in six sections, namely:

1) Priorities identification
2) Relationship between national health plans and criteria for funds allocation
3) Evidence about the development of digital health services
4) Providing digital health evidence
5) Collecting Data
6) Strengthening and promoting digital health.

3.2.   PROBLEM STATEMENT

The previous works by the GDHP Evidence and Evaluation Work Stream provide an international comparison of digital health services and technologies quality assessment among different partners. Providing an evaluation of use and acceptability of digital health services should lay the groundwork for collaboration between participant countries, towards a common pathway in guiding investment and development of digital health services and technologies, rather than a fragmented one in which different countries are not united in their way to the implementation of digital health.

3.3.   AIM OF THE RESEARCH

The aim of this research is to highlight how digital health is evolving globally and promote a shared approach to its future development. Also, revealing differences among GDHP countries will provide an advancement for the Evidence and Evaluation of GDHP workstreams and a starting point towards a coordinated development of digital health solutions into practice.

3.4.   WORK SCOPE

The scope of the report is to examine the acceptability of digital health technologies among Member States of the Global Digital Health Partnership. These include technologies such as patient portals, electronic health records, applications, application programming interfaces, medical devices, health information networks, telehealth, artificial intelligence, and remote monitoring. The survey was aimed at investigating aspects concerning:

- the regulatory framework,
- the allocation of funding,
- the reporting of evidence,
- the uses of data, and
- the communication of healthcare digitalization to people.

4   METHODOLOGY

In order to methodologically measure the use and the acceptability of digital health interventions, we decided to first conduct a rapid review of literature, collecting records and information regarding the international use and acceptability of digital health technologies. Secondly, we elaborated the questionnaire and provided it to each GDHP country's representative.

4.1.   METHOD: RAPID REVIEW OF LITERATURE

4.1.1.   Search Resources

The rapid review of literature was conducted during March and April 2021 to identify publications relating to the evaluation of a range of digital health technologies and innovations. Some of the included keywords in the search string were "digital health", "health digitalisation", "national plan", "WHO framework", "The digital competence framework", "questionnaire", "survey", "acceptability" related by Boolean operators.

Academic databases and search engines used included PubMed, Web of Science and Scopus. Grey literature research, using Google site search function, was conducted to identify related missing records.

The rapid review of the international literature concerned the evaluation methods and proximal measurements used in the field of digital health use and acceptability. Literature review data was supported by a nominal group consensus process to develop a pragmatic questionnaire to be administered to stakeholders in different countries who are considering performing digital health assessments.

4.1.2.   Inclusion and Exclusion criteria

Only papers written in English and with full texts available were included. The search was limited to literature published after 2010, with a focus on articles published after 2019 WHO "Digital Competence Framework" release. Literature was included if it:

1) referred to the evaluation of use and acceptability of digital health services and technologies;
2) administered a questionnaire;
3) was published in a peer-reviewed scientific journal or in the grey literature.

A grey literature scoping review was also performed to fill the resulting information gaps.

4.1.3.   Study Selection and Data Extraction

Articles screening based on title and abstract and full-text review were performed by two researchers (GF, AG). Data extraction was performed using a pre-piloted spreadsheet in Microsoft Excel® for Windows (Microsoft Corporation, Redmond, WA, USA). To standardize data extraction, a predefined spreadsheet was prepared by the team (FAC, GF, AG). Three authors performed data extraction (VP, AM, GA) and disagreements were resolved by a fourth reviewer (AG). Several qualitative and quantitative data were extracted from the original studies. Qualitative data recorded included the name of the first author, year, type of questionnaire, country, digital field. Quantitative data extracted included number of recorded answers, readers compliance, evaluated fields, duration of the survey.

4.2.   METHOD: SURVEY

A structured (multiple choice) questionnaire/survey (see Appendix B) was designed to gather data. The survey choices were extracted from research publications retrieved during the rapid review. In addition to answering the structured questions, respondents had the chance to elaborate their answers and to offer comments.

GDHP participant countries and territories were invited to participate in the analysis by responding to the survey. There was only one response allowed per country or territory. The survey asked questions under six main sections:

Section 1. Priorities identification
Section 2. Relationship between national health plans and criteria for funds allocation
Section 3. Evidence about the development of digital health services
Section 4. Providing digital health evidence
Section 5. Collecting Data
Section 6. Strengthening and promoting digital health

Complete responses were received from 10 participant countries and territories (Australia, Brazil, Canada, Hong Kong, Italy, India, the Netherlands, Poland, South Korea, United States of America). The responses to these questions were synthesized and are presented in the results and recommendations sections of this report.

5 RESULTS

5.1. PRIORITIES IDENTIFICATION

The identification of key priorities can be considered as the first approach for the planning of the required actions for a strategic development of digital health [1]. Priority setting is the process of making decisions about how best to allocate limited resources to improve population health [2]. It is a complex inherently political process, committing multiple stakeholders, decision-makers, and actors whose beliefs are often imperfectly aligned [3]. Effective priority setting addresses these differing interests and motivations through a clear process focused on the use of evidence, transparency, and participation to identify the most appropriate programs and interventions to address population health needs [4].

In our survey government authorities are considered the main stakeholders of this evolving process.

For each proposed item it was requested to assign a value on a scale from 1 (very low) to 5 (very high) as the answer to the following question: "What are currently the digital health priority areas in your country?". It was then conducted a quantitative synthesis of the obtained answers.

Seven questions concerned "Health Technology Assessment (HTA) and transformation policies for digitalisation of healthcare", seven "Development of digital health integration", nineteen "Digitalisation of healthcare services". No statistically relevant differences were shown between the mean scores of the pooled nations inquired about the three fields.

Within the ten approached nations, Hong Kong and India showed the most drastically different results. Indeed, the lowest mean values referred to every section were attributed by Hong Kong (mean 1.96), suggesting either an already existing strong digitalized system that doesn't need further improvements or a low interest in health digitalization. The highest mean values referred to every section, instead, were attributed by India (mean 4.85), for which it could be assumed an opposite situation.

Most of the encountered differences between nations regarded the importance given to "HTA and transformation policies for digitalisation of healthcare". The approaches to "Development of digital health integration" and "Digitalisation of healthcare services", instead, resulted similar (as for mean values) for most of the evaluated answers.

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[1] Hollis C, Sampson S, Simons L, Davies EB, Churchill R, Betton V, Butler D, Chapman K, Easton K, Gronlund TA, Kabir T, Rawsthorne M, Rye E, Tomlin A. Identifying research priorities for digital technology in mental health care: results of the James Lind Alliance Priority Setting Partnership. Lancet Psychiatry. 2018 Oct;5(10):845-854. doi: 10.1016/S2215-0366(18)30296-7. Epub 2018 Aug 28. PMID: 30170964.

[2] PMAC. Priority Setting for UHC. Prince Mahidol Award Conference; 2016

[3] Terwindt F. Priority-setting for national health policies, strategies and plans. Soucat A, editor. World Health Organization; 2016

[4] Terwindt, Frank & Rajan, Dheepa & Soucat, Agnes. (2016). Chapter 4 Priority-setting for national health policies, strategies and plans.

In the "HTA and transformation policies for digitalisation of healthcare" answers section, the countries that showed the significantly higher coefficient compared to the mean of all the countries (3.64) were USA and India. The country with the lower mean coefficient was the Netherlands.

In the "Development of Digital Health Integration" section, all the evaluated countries showed mean scores not statistically significant different from the average score of 3.58, except for Hong Kong, which had a statistically significant lower score (2.04).

In the "Digitalisation of Healthcare Services" section, all the evaluated countries showed mean scores not significantly statistically different from the average of 3.49, except for Hong Kong, that had a statistically significant lower score (1.89) and India that had a statistically significant higher score (4.84).
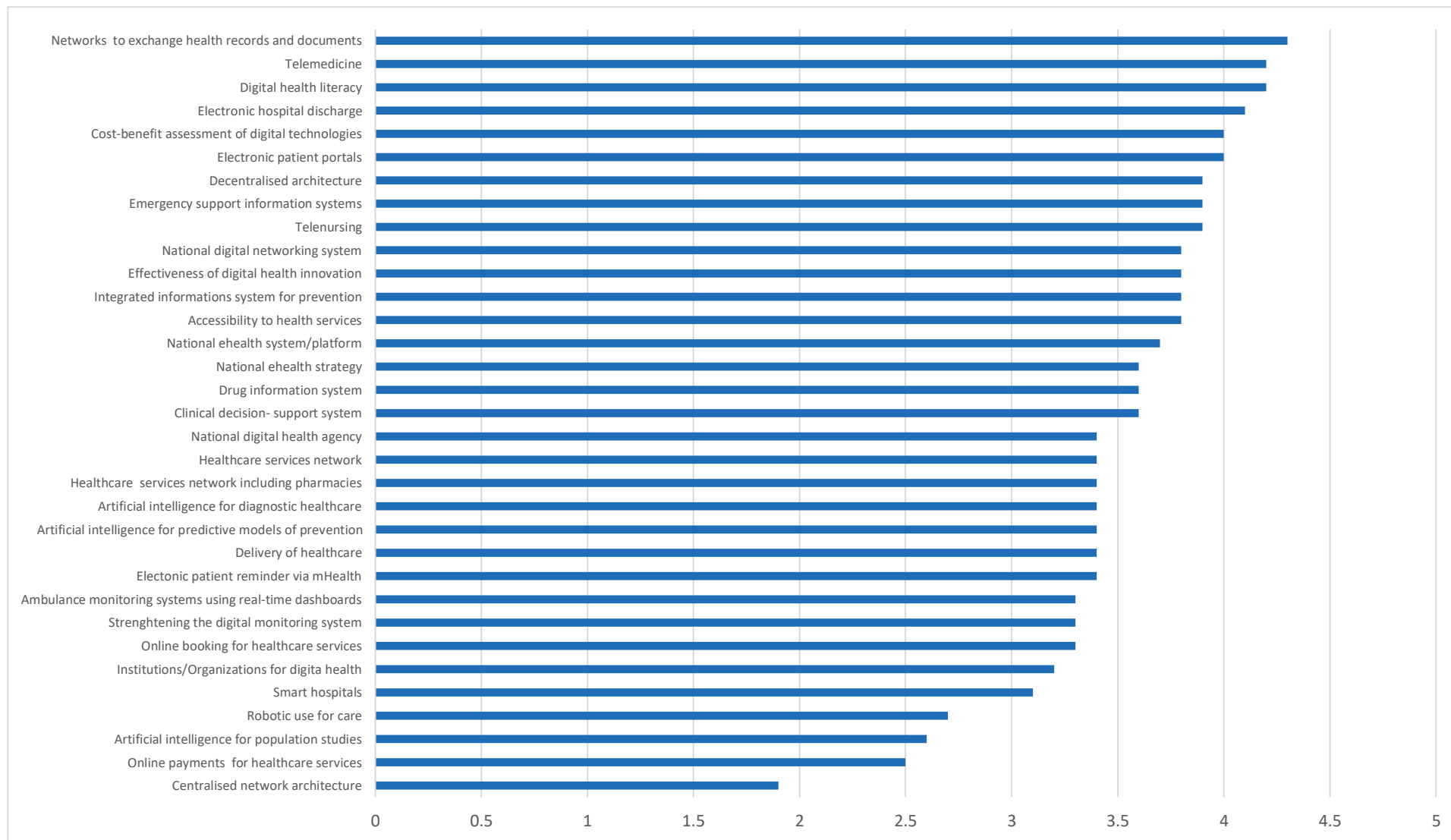
Figure 1. Most and least voted item as main priority in digital health

The priority that obtained the highest score was "Development of Digital Health integration", with the most voted item "Networks to exchange health records and documents" (4.3), followed by the "Digitalisation of healthcare services" with the items "Telemedicine" (4.2), "Electronic hospital discharge" (4.1) and "Digital health literacy" (4.2). Finally, in the "HTA and transformation policies for digitalisation of healthcare" field, the most shared priority resulted to be the "Cost-benefit assessment of digital technologies" (4.0).

The least voted item of all the proposed answers regarded the construction of a "Centralised network architecture" in the "Development of digital health integration" field. Most countries, indeed, attributed higher votes to the "Decentralised architecture" model, with a mean score of 1.9. Low priority was attributed to "Online payments for healthcare services" as well, with a mean score of 2.5 and to "Robotic use for care", with a mean score of 2.7, both in the "Digitalisation for healthcare services" group.

5.2. RELATIONSHIP BETWEEN NATIONAL HEALTH PLANS AND CRITERIA FOR FUNDS ALLOCATION

The transition to true digital health – where health systems can optimize existing services and innovate new services, improve efficiency of processes, contain expenditures, improve patient experience, and efficiently manage health facilities – requires adequate funding and resource allocation criteria must be defined. The criteria adopted may differ in different countries and areas of the world, for example as a result of changes in the respective budget and in the designated funding institutions.

The Digital Economy and Society Index (DESI) shows that both the EU and non-EU countries are making progress, but the gap between the digital pioneering countries and the less performing countries is still too wide. Efforts and investments are needed to bridge this gap and create a single digital market. [5, 6]

In our survey we looked at the criteria used by various governments,countries to allocate funds for digital health, which organizations and / or institutions are involved in deciding which criteria to use for the allocation of funds, and whether such funding is linked to the national health plan.

As a consequence of the importance of evidence in medicine, in our survey we decided to elaborate the theme of "Criteria Used For Allocation Funds".

We investigated the level of development of digital health in the countries in terms of successful implementation (from 1 = insufficient to 5 = very high).

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[5] *http://digital-strategy.ec.europa.eu/en/library/i-desi-2020-how-digital-europe-compared-other-major-world-economies*

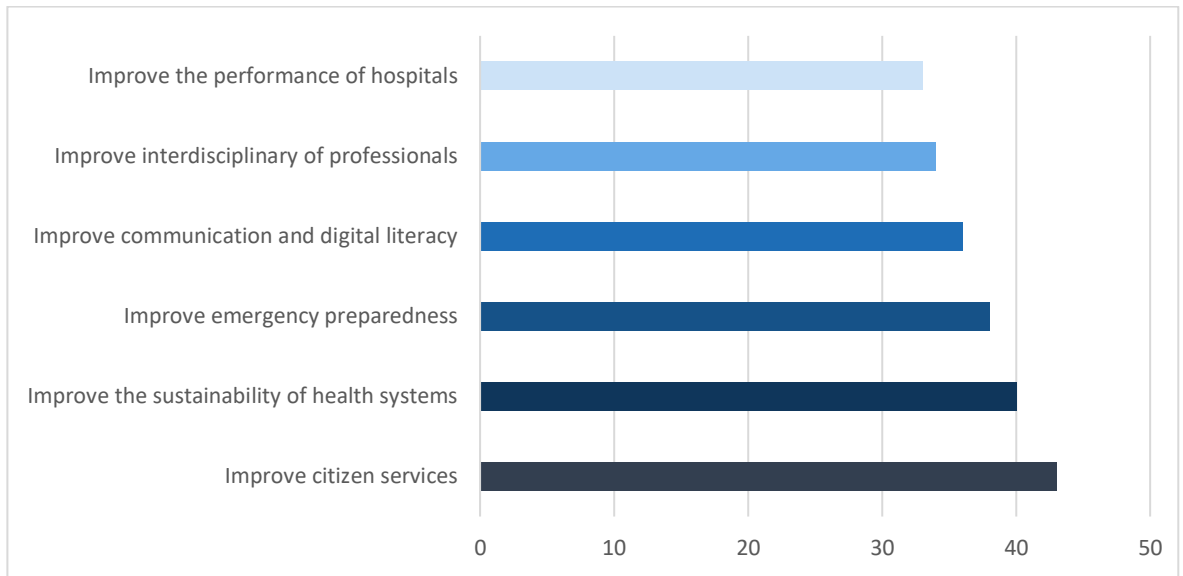[6] *https://digital-strategy.ec.europa.eu/en/policies/desi*

Figure 2. Criteria used for allocation funds

From the answers it emerges that solid importance is given to improving services to citizens and improving the sustainability of health systems, however improving the performance of hospitals seems to be less important.

The questionnaire also revealed as a significant fact that in all countries the criteria for the financing of digital health services are linked to the National Health Plan, attaching the relevant plan, with the exception of Canada and the Netherlands. We also assessed the satisfaction of the annual budget allocated for digital health (from 1 = very insufficient to 5 = very high).

From the questionnaire it emerges that 90 percent of countries consider the annual budget available to be sufficient or less than sufficient. Only Italy considers its budget very insufficient

In addition, all countries declare the difficulty of finding official data for the amount of spending on digital health, except for Italy, Brazil and Hong Kong which claim to have spent in 2018 respectively 1.43 billion euros, 165 millions dollars and 300 million dollars. There is a great variability of per capita expenditure between the 3 countries that defined the annual budget. This fragmentation stems from the fact that in the various countries such funds are provided by a mix of public and private organizations, there are different organizations or institutions involved in deciding which criteria are used for allocating the funds they control towards investments in digital health.

A contribution to this fragmentation is the great variability of the organizations involved in the range of criteria as emerged from the questionnaire.

5.3. EVIDENCE ABOUT THE DEVELOPMENT OF DIGITAL HEALTH SERVICES

The evidence around digital health technologies is generally of lower quality when compared with evidence available for drugs and devices. As a consequence, in our survey we decided to investigate the theme of «Evidence about the development of digital health services».

It emerged that 50% of countries (5 countries out of 10 responding countries) believe that their development of digital health in terms of successful implementation is at the midpoint, only one country out of 10 countries considers it insufficient, one sufficient, two high and one very high.

We also wanted to evaluate the impact of digital health technologies on specific medical fields. In particular, we were interested in: Genomics, Personalized medicine, Precision healthcare, Preparedness for emergency responses, Infection Prevention and Control for disease outbreaks (IPC), Risk Management and Patient Safety.

Country	Genomics	Personalized medicine	Precision healthcare	Emergency preparedness	IPC	Risk management, Patient safety
Brazil						
Canada	✓	✓	✓	✓	✓	✓
Hong Kong						✓
Italy				✓		✓
Netherlands	✓	✓	✓	✓	✓	✓
Poland	✓	✓		✓	✓	✓
South Korea	✓	✓	✓	✓	✓	✓
USA	✓	✓	✓	✓	✓	✓
India	✓					
Australia	✓	✓	✓	✓	✓	✓

Table 1. Evaluation of the impact of digital health technologies on specific medical fields.

It emerged that digital health advantages in the medical fields are differently expressed by countries. In particular, almost every country evaluates the impact of Risk Management and Patient Safety and the Emergency Preparedness in their digital health technologies. Australia, Canada, the Netherlands and USA stated that they evaluate the impact of digital health in all medical sectors proposed in the survey, while Poland

evaluate three sectors (Emergency Preparedness, Infection Prevention and Control for disease outbreaks, Risk Management and Patient Safety), Italy two sectors (Emergency Preparedness, Risk Management and Patient Safety), Hong Kong and India just one (Risk management, Patient safety and Genomics respectively), whilst Brazil do not assess the impact of digital health in any sector proposed.

In the same section of the survey we asked about the adoption of any process of evaluating evidence in digital health: efficacy (whether the digitalization produces the desired outcomes it was designed to deliver), effectiveness (health system performance over the time), equity (the accessibility of digital services of all the population and the absence of avoidable, unfair or remediable differences among groups of people), safety (preventing/avoiding medication/diagnostic errors, security and privacy, increasing trust of services and evaluating general threats), quality (technical aspects of technologies and improvement in healthcare processes), end-user experience (how the consumers/patients/clinicians interact with a digital health technology or service) and Return on Investment (ROI) (if resources are being used to get the best value for money). It emerged that 25% of the responding countries have a process of evaluating evidence across all the 7 digital health domains. Just one country (14%) does not evaluate any evidence.
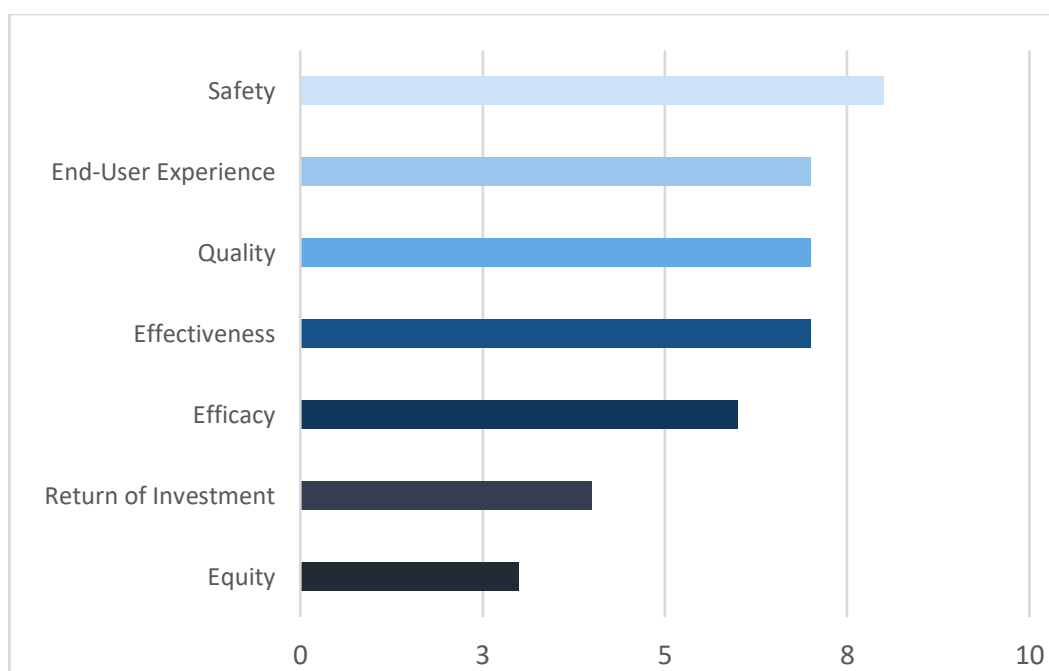

Figure 3. Number of countries or territories that adopted processes to evaluate evidence in digital health out of 10 participating countries.

An important topic investigated in our survey was the analysis of the benefits obtained from digital health.
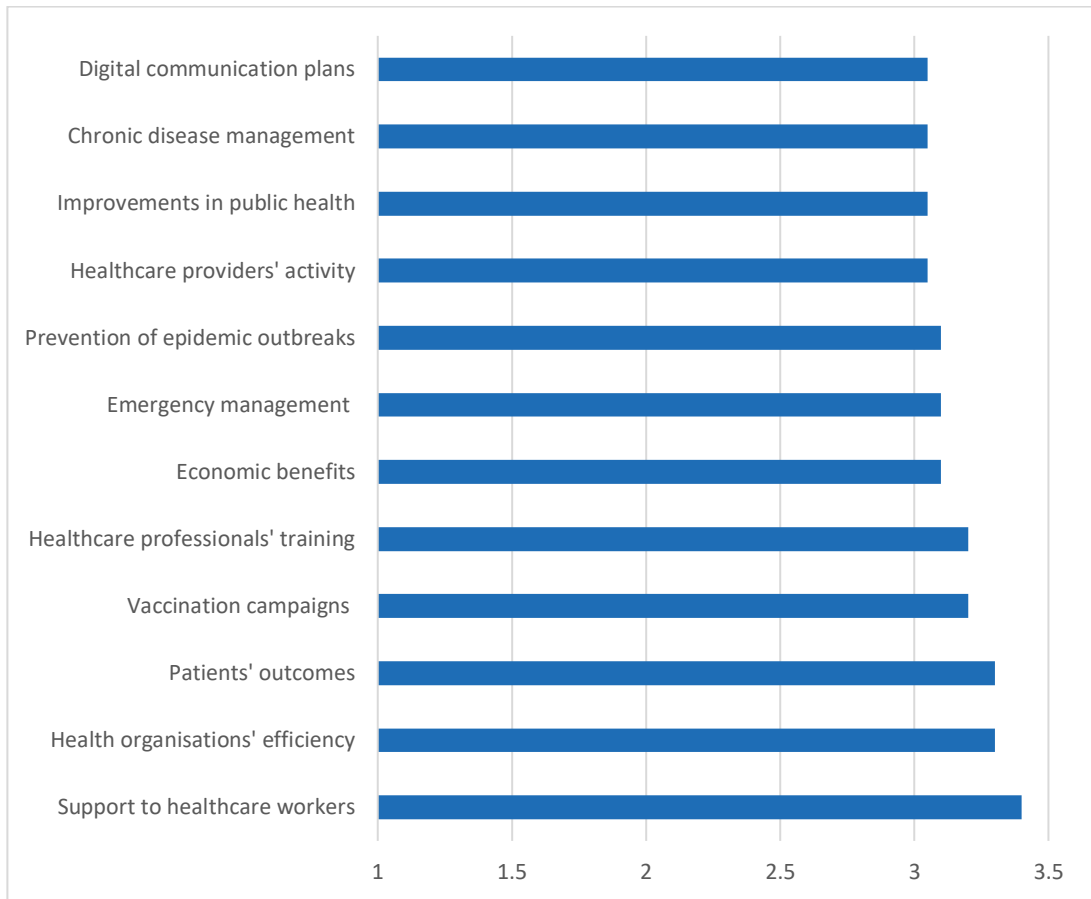
Figure 4. Benefits from digital health (whereas 1 indicates very low benefits from a given digital health technology, and 5 a very high benefits)

Support to healthcare workers, Patients' outcomes, Chronic disease management and Prevention of epidemic outbreaks emerged as the biggest achievement, while Improvements in public health and Healthcare professionals' training resulted to be less represented among the responding countries.

5.4. PROVIDING DIGITAL HEALTH EVIDENCE

In this section, we wanted to understand the process of providing digital health evidence.

All countries reported to use bottom-up strategies and six Countries also adopt top-down strategies (60% of respondents answered that both processes are used).

One country has strongly stressed that even if they adopt both processes, their organization is absolutely decentralized (the Netherlands).

After that, we desired to investigate sources and tools mainly used in the countries to collect information on digital health. The answers to this question were heterogeneous.
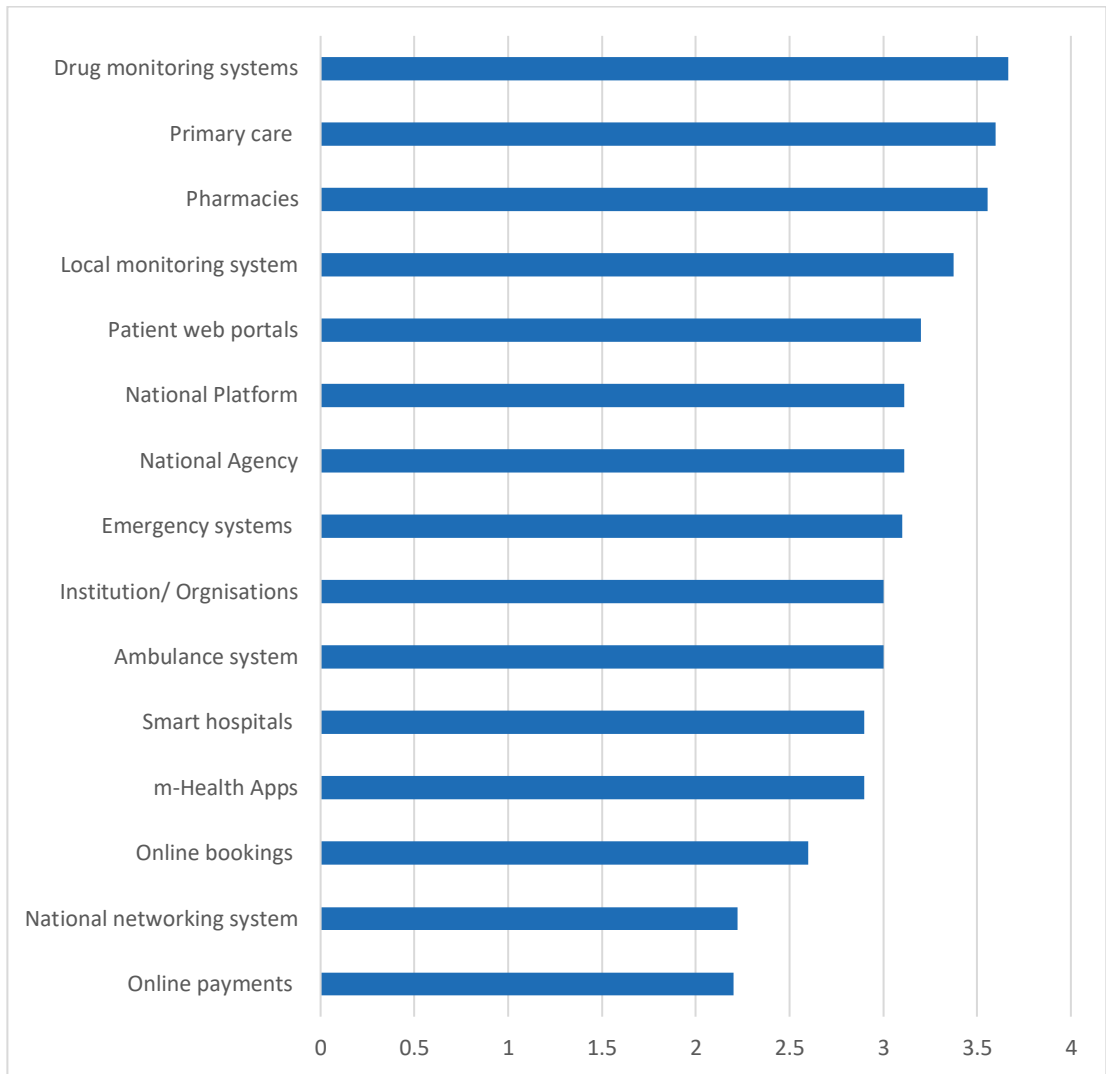
Figure 5. Sources and tools mainly used to collect information on digital health out of 10 responding countries.

Primary health resulted one of the most used sources, while it emerged that all countries do not adopt online booking very often.

5.5.   COLLECTING DATA

Health data can be collected from numerous sources [7, 8], including:

- **Administrative records,** generated in the course of providing and paying for healthcare.

- **Patient medical records,** which include a patient's medical history and care[9].

- **Patient surveys,** typically administered to samples of patients, capture self-reported information about perceived healthcare outcomes, treatments, service etc…

- **End users of technology surveys,** accessible to primary health care providers during the process of care

- **Vital records,** which include births, deaths, marriages, divorces, and fetal deaths.

- **Public health surveillance data[10],** which is a tool to estimate the health status and behavior of the populations served by ministries of health, ministries of finance, and donors.

- **Wearable devices,** from smartphones to smartwatches, estimated to generate more than 1 million gigabytes of health-related data in a persons' lifetime[11].

- **Anecdotal information,** which is gathered informally and describes personal experiences from healthcare consumers and their relationship with hospitals and healthcare professionals.

These different and ever-growing requests for electronic health data, for example comparative effectiveness, medical product safety and quality, to cite some of them, impose the development of efficient and safe networks for data collection. Two approaches can be identified: centralized and decentralized.

In a centralized network, a single authority maintains total control over all aspects of the system, coordinating them.

[7] *Data Sources for Health Care Quality Measures, https://www.ahrq.gov/talkingquality/measures/understand/index.html*

[8] *Health Data Sources, https://www.nlm.nih.gov/nichsr/stats_tutorial/section3/index.html*

[9] *Percentage of U.S. adults that have accessed their electronic health records (EHR) as of 2018, https://www.statista.com/statistics/829500/electronic-health-record-access-us/*

[10] *Public Health Surveillance: A Tool for Targeting and Monitoring Interventions.*

[11] *IBM Watson 2019 Estimate*

A central server processes all data and permissions, accommodating a number of requests from connected systems and managing who and under what conditions these resources can be accessed [12].

Efficiency is the primary advantage of this type of system architecture, as IT personnel can concentrate on keeping servers up-to-date; furthermore, requests and data travel shortly to their destination, with a gain in speed and overall performance. [13]

However, these systems tend to be highly susceptible to cyberattacks, as, if the central server goes down for any reason, this fault spreads to the whole system, and sensitive personal data, given that information sent to the server can be passed to third parties (such as authorities or analytics companies), can be abused or misused. [14]

On the contrary, in decentralized networks, every node of the system functions as a separate authority with independent decision-making power, and processing power and workload are distributed among connected servers. The final behavior of the system results from the decisions of the individual nodes. [15]

Simply adding another machine can increase the number of computing resources.

An important advantage of these networks is system reliability: every node is independent, which decreases vulnerability, in case of breakdowns or hackings.

However, there is no individual entity to either accept or answer to the request in these system architectures [16].

Rather than using a single server, decentralized networks require various machines with the constant need to update their functionality and security, so they're difficult to build and manage.

More machines imply more power consumption, an increased latency, with requests taking longer to be answered, and rigid structures, that may lead to search failures. [17]

The European data protection community agrees on the advantages of decentralized networks. The centralized approach requires sensitive data storing, with the fear that information such as location and health status can be violated. Despite that the majority

[12] *The comparison of decentralized and centralized structure of network communication in different application fields Zeyu Xi. 2020;118(Msie 2019):50-54.*

[13] *Greenhalgh T, Hinder S, Stramer K, Bratan T, Russell J. Adoption, non-adoption, and abandonment of a personal electronic health record: Case study of HealthSpace. BMJ. 2010;341(7782):1091. doi:10.1136/bmj.c5814*

[14] *https://www.vocal.com/video/p2p-network/.*

[15] *https://www.vocal.com/video/p2p-network/.*

[16] *https://www.vxchnge.com/blog/centralized-decentralized-.*

[17]*Brown JS, Holmes JH, Shah K, Hall K, Lazarus R, Platt R. Distributed Health Data Networks. 2010;48(6):45-51.*

of governments still rely on the centralized approach, which they consider a better fit for their policy-making.[18]

Decentralized architecture is the most frequently employed for reporting digital health evidence and results. Nevertheless, some countries, like Brazil, Hong-Kong and Poland mainly use a centralized approach. A miscellaneous approach is employed by Italy.

Where is the health data collected?

Business coalitions, entities supported with private funds, state health legislations, or federal actions contributed creating several kinds of health databases, networks and repositories, which share some features: they operate under a single authority, acquire and maintain information from various sources, managing it electronically, serve a specific geographic area, have inclusive population files, grant electronic access for real-time use.[19]

Data repositories share certain traits that make them more or less useful for research. The first important aspect is the number of patients included in the collection, which is a primary concern of researchers; the number of times data or access methods were modified from generation 1 data source is another important aspect.

The level of data integration is another variable, affecting how efficient their access might be.

Disposing of longitudinal data is another crucial aspect of servers which might be exploited, for instance, for observational and mechanistic studies. [20]

Other key features are accessibility to researchers, either within or outside a home institution, and data accuracy, consistency and completeness. [21, 22, 23]

Finally, some databases acquire further value thanks to biosamples and/or biomolecular data linked to phenotypic information.

[18] https://www.vocal.com/video/p2p-network/.

[19] Global OKI. Open Data Index. Published online 2015.

[20] Wade TD. Traits and types of health data repositories. Heal Inf Sci Syst. 2014;2(1). doi:10.1186/2047-2501-2-4

[21] Kahn MG, Raebel MA, Glanz JM, Riedlinger K, Steiner JF. A pragmatic framework for single-site and multisite data quality assessment in electronic health record-based clinical research. Med Care. 2012;50(SUPPL. 1). doi:10.1097/MLR.0b013e318257dd67

[22] Toward Precision Medicine: Building a Knowledge Network for Biomedical Research and a New Taxonomy of Disease. National Academies Press; 2012. doi:10.17226/13284

[23] Weiner MG, Embi PJ. Toward reuse of clinical data for research and quality improvement: The end of the beginning? Ann Intern Med. 2009;151(5):359-360. doi:10.7326/0003-4819-151-5-200909010-00141

Country	Central Repository	Unique Database at a central level	Regional Database	Hospital Database
Australia	N/A			
Brazil	✓		✓	✓
Canada	✓	✓	✓	✓
Hong-Kong	✓	✓		
India	✓	✓	✓	✓
Italy	✓	✓	✓	✓
Netherlands	✓	✓	✓	✓
Poland		✓		
South Korea	✓		✓	✓
USA	✓	✓	✓	✓

Table 2. Site of collection of health data.

In nearly 60% of the countries, collection of data at a central level (using a central repository or a unique database) coexists with local databases both at regional and hospital level.

Hong Kong and Poland show a centralized data storage, while South Korea has a regional approach.

Australia displays an index set of national data repositories.

In Italy, a central repository for the Covid-19 emergency at the National Institute of Health (ISS) can be signaled; moreover, a unique database is at the Ministry of Health and another, not uniformly distributed, exists.

In the Netherlands is difficult to describe health data collection systems according to the criteria in the questionnaire: data (patient data, anonymized medical data, etc.) are stored at the local provider level, some have joined forces and exchange data at the regional level, some are stockpiled in national and international registries.

Open data registries

According to the European Data Portal, open data can be defined as "data that anyone can access, use and share. Governments, businesses and individuals can use it to pursue social, economic and environmental benefits" [24].

Open data becomes usable when interoperable and must be licensed [25], so that they can be transformed, combined and shared with others, even commercially [26].

Open Government data is data that, as well as being open, is produced or commissioned by public bodies.

According to the Eight Open Data Principles defined in December 2007 in Sebastopol, California, open data should be: complete (with no privacy nor privilege limitations), primary (data is collected at the source), timely (quickly available), accessible (available to the widest users for the widest purposes), machine processable, non-discriminatory (with no requirement for registration), non-proprietary (no authority has exclusive control over them).

Health information in government repositories is not always open and available online, as shown by a 2016 observational study. Open health data portals contain data on new diseases, directories of health institutions, and detailed descriptions of regulatory agencies that collect official data; nevertheless they lack of standardization and interoperability among countries.

All the countries interviewed with the exception of Poland have some sort of open data registries.

Australia has the "My Health Record" system. It is a secure online summary of an individual's health information, and is available to all Australians. Healthcare providers authorised by their healthcare organisation can access "My Health Record" to view and add to their patients' health information.

"My Health Record" does not replace existing health records. Rather, it supplements these with a high-value, shared source of patient information that can improve care planning and decision making. Information available through "My Health Record" can include, a patient's health summary, medication prescribing and dispensing history, pathology reports, diagnostic imaging reports and discharge summaries.

Brazil has two platforms, "Dados.gov.br" and "Opendatasus.saude.gov.br" respectively.

Canada has an open data portal where a variety of dataset is hosted and can be searched. In addition, Infoway collaborates with Dataverse to host a variety of past survey datasets.

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[24] OECD. Open Government Data. Published online 2013.

[25] OECD. Making Open Science a Reality. OECD Publ. Published online 2015.

[26] Enric Fuster Martí, SIRIS Academic Elisabetta Marinelli, Joint Research Centre Sabine Plaud SA, Arnau Quinquilla, SIRIS Academic Francesco Massucci SA. Open Data, Open Science & Open Innovation for Smart Specialisation monitoring. Published online 2020. doi:10.2760/55098

The Canadian Institute for Health Information (CIHI) and the Canadian Agency for Drugs and Technologies in Health (CADTH) host a variety of related reports and datasets ("open.canada.ca" and "dataverse.scholarsportal.info").

In Hong Kong, the government led a process to collate and make available data from a wide variety of sources, using the platform https://data.gov.hk.

Moreover, the Hospital Authority Data Collaboration Lab represents a big data analytics platform open to proposals from universities in Hong Kong.

In India three main registries can be found: The Clinical Trials Registry- India (CTRI), The Indian Registry of IntenSive care (IRIS) and The Open government data (OGD) platform India.

Italy created an open data registry for the Covid-19 emergency monitoring at the National Institute of Health.

In South Korea, the National Health Insurance Service, the Health Insurance Review and Assessment Service own a data platform individually and open the various data to the public via their platforms ("nhiss.nhis.or.kr" and "opendata.hira.or.kr").

Moreover, Using CDM based data systems, researchers are able to utilize National Health Insurance Qualification DB, Medical Utilization DB, National Medical Check-Up DB, Medical Resources DB. External researchers can access and use these DBs for their clinical research.

In the Netherlands there are many data platforms, some of which are open data; most aren't, due to them containing sensitive and/or personal data.

The United States government has HealthData.gov which is a site dedicated to making high value health data more accessible. Data on this platform can come from a number of sources and thus it consists of a number of data sets that provide insights on digital health.

Country	Healthcare Providers		Patients		Governments		Ministry of Health		Insurance Company		Pharmac. Enterprise		Pharmacist assiociation		Health Service researchers		Other	
	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A
Australia	✓	✓	✓			✓												✓
Brazil	✓	✓	✓	✓	✓		✓	✓	✓	✓								
Canada	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	
Hong-Kong	✓	✓	✓		✓			✓								✓		✓
India				✓		✓		✓										
Italy			✓				✓	✓										
Netherlands	✓	✓	✓			✓	✓		✓	✓	✓				✓	✓	✓	✓
Poland		✓		✓		✓	✓	✓										
South Korea	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓		
United States	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		

Table 3: who owns and who has access to data (O: owns data; A: has access to data)

Table 5 details who owns and who has access to data in every Nation. Nine out of ten evaluated countries (90%) define patients as the main data owners, with the only exception of India. Eight out of ten countries (80%) report healthcare providers as the main figures to have access to data. The only exceptions are India and Italy, where healthcare providers don't either own or have access to data. The same percentage is shared with the Ministry of Health, with the only exceptions of the Netherlands and Australia, where the Ministry of Health doesn't either own or have access to data. No one of the ten surveyed Nations reported pharmacist associations as data owners or having access to data. Governments own and have access to data in 70% of evaluated countries, although in Australia and India Governments have access to data without owning them, whereas in Brazil and Hong Kong they own data without having access to them. Italy is the only reported country where the Government doesn't either own or have access to data. Health service researchers only own and have access to data in 40% of cases, whereas insurance companies own data in 50% of cases and have access to them in 40% of cases. Pharmaceutical Enterprises own data in 30% of cases and have access to them only in two out of ten surveyed countries. Canada and the Netherlands reported "other" data owners, whereas Australia, Hong Kong and the Netherlands reported "other" figures having access to data.

5.6. STRENGTHENING AND PROMOTING DIGITAL HEALTH

Communication of digital health technologies

A variety of engagement and recruitment strategies for digital health interventions (DHIs) can be described.

Engagement can be defined as any process by which patients and the public become aware of or understand a DHI, for instance promotional efforts and marketing campaigns. These vary from advertisement to the involvement of health professionals, family and friends. Advertisement of DHIs make use of radio, print media (e.g. newspapers), personal letters, posters on notice boards, printed flyers and leaflets [27, 28], via electronic media (e.g. television), digital notice boards and online via email, social media, website and Internet communities or forums.

Engagement can be pursued also in more traditional ways, through consultations with health professionals [29, 30], employers, personal recommendations from family or friends or training sessions with research or management staff [31]. Finally, more creative initiatives,

[27] Murphy S. Data Warehousing for Clinical Research. In: Encyclopedia of Database Systems. Springer US; 2009:679-684. doi:10.1007/978-0-387-39940-9_120

[28] Kahn MG, Weng C. Clinical research informatics: A conceptual perspective. J Am Med Informatics Assoc. 2012;19(E1):e36-e42. doi:10.1136/amiajnl-2012-000968

[29] Enric Fuster Martí, SIRIS Academic Elisabetta Marinelli, Joint Research Centre Sabine Plaud SA, Arnau Quinquilla, SIRIS Academic Francesco Massucci SA. Open Data, Open Science & Open Innovation for Smart Specialisation monitoring. Published online 2020. doi:10.2760/55098

[30] Global OKI. Open Data Index. Published online 2015.

[31] Flynn D, Gregory P, Makki H, Gabbay M. Expectations and experiences of eHealth in primary care: A qualitative practice-based investigation. Int J Med Inform. 2009;78(9):588-604. doi:10.1016/j.ijmedinf.2009.03.008

as co-design activities, represent a new approach to involve the public in creating a DHI [32, 33, 34, 35].

On the other hand, recruitment is defined as any approach that involves people actively registering for or signing up to a DHI.

Enrollment strategies are also wide ranging, and involve people participating at different level: filling out paper-based registration forms[36] sending a SMS text message, creating an online account or profile either by themselves or assisted by health professionals, administrators or researchers.
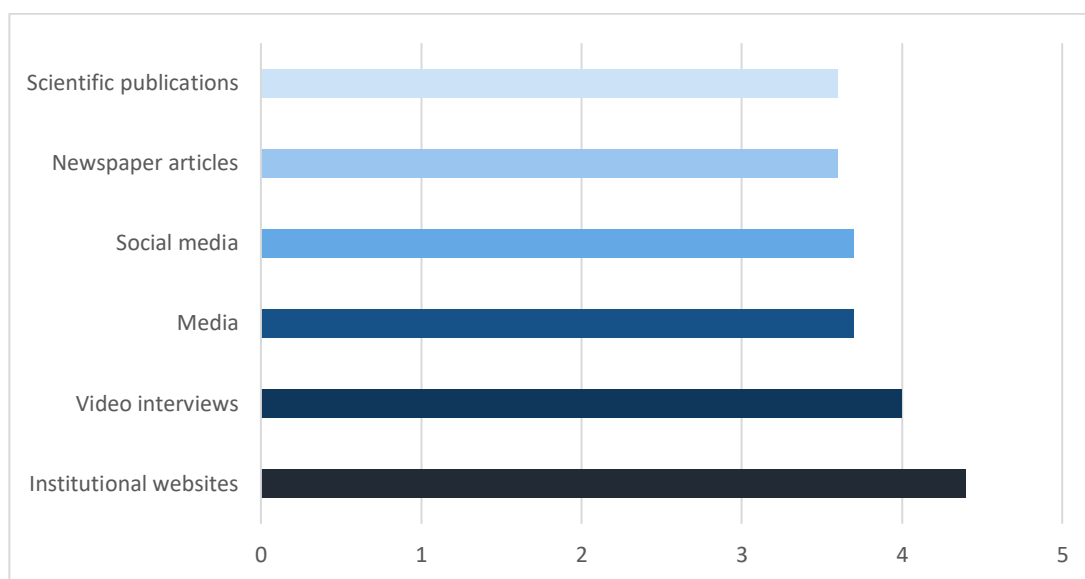
Figure 6. Tools used to disseminate digital health services.— On X axis: score ranging from 1 (rarely used) to 5 (widely used).

Media, institutional websites and social media are among the most employed strategies for communication and dissemination of results of digital health services.

On the contrary, in Hong Kong newspaper articles and video interviews, together with institutional websites are the main instruments of communication.

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[32] *Martin EG, Law J, Ran W, Helbig N BG. Evaluating the quality and usability of open data for public health research: a systematic review of data offerings on 3 open data platforms. J Public Heal Manag Pr. Published online 2017.*

[33] *D'Agostino M., Samuel N.O., Sarol M.J., de Cosio F.G., Marti M., Luo T., Brooks I. EM. Open data and public health. Rev Panam Salud Publica. Published online 2018.*

[34] *Greenberg CJ, Narang S. World health organization member states and open health data: An observational study. Epidemiol Biostat Public Heal. 2016;13(3):1-9. doi:10.2427/11950*

[35] *Greenhalgh T, Wood GW, Bratan T, Stramer K, Hinder S. Patients' attitudes to the summary care record and HealthSpace: Qualitative study. BMJ. 2008;336(7656):1290-1295. doi:10.1136/bmj.a114*

[36] *Jaakola A, Kekkonen H, Lahti T MA. Open data, open cities: experiences from the Helsinki Metropolitan Area. Case Helsinki Region Infoshare. Stat J IAOS. Published online 2015. doi:10.3233/SJI-150873.*

In Australia and Brazil, scientific publications and newspaper articles and social media are not often used as a vehicle for institutional communication.

Barriers to implement digital health use
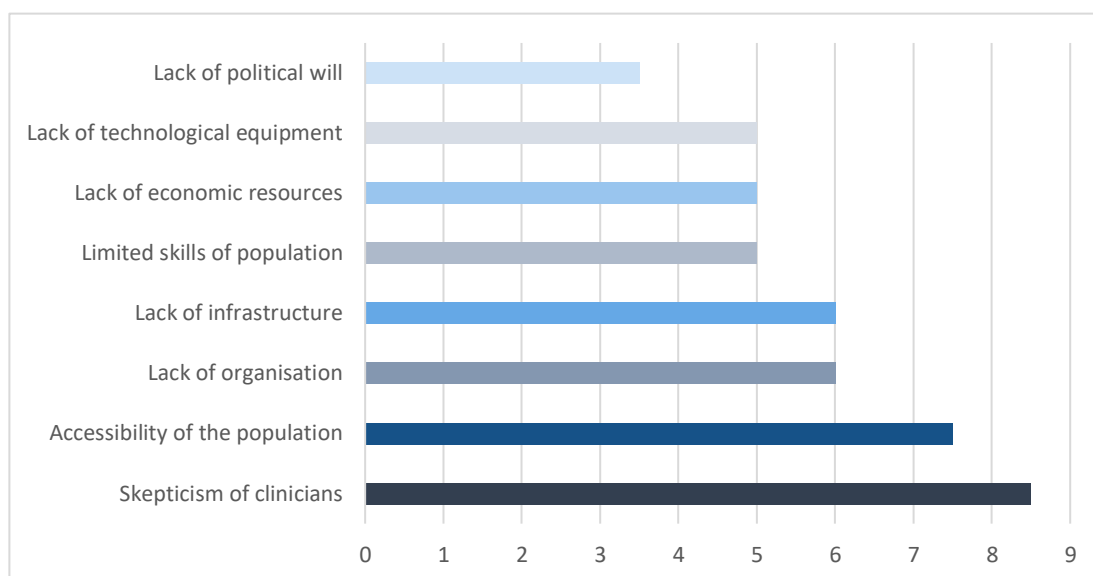
Figure 7: number of barriers to implement digital health use out of 10 responding countries

Figure 7 details what barriers were found by the surveyed countries to digital health use implementation.

The main barrier described was skepticism by clinicians of digital health technology, shared concern by every Country but Italy and Poland.

The second most reported limit was accessibility of digital health technology among the population, shared by 7 out of 10 evaluated countries (70%), except for the Netherlands, Poland and Hong Kong. Following soon after lack of infrastructures and lack of organization, both considered a limit by 60% of respondents.

Five out of ten countries referred to lack of technological equipment, lack of economic resources and limited skills of the population as a barrier.

The least voted alternatives were lack of political will, reported by 30% of countries and "other", reported by 20% of countries.

What are the tools your Government/Country uses for communication/dissemination of results of digital health services?

Country	Personal Data	Medical Data	Population data	Wearable Data	EHR (with permission)	Population case studies	Laboratory Reports	Diagnostic Reports	Treatment Reports	Discharge letters
Australia										
Brazil			✓				✓		✓	✓
Canada			✓			✓				
Hong-Kong		✓	✓	✓			✓	✓	✓	✓
India			✓		✓	✓				
Italy			✓			✓				
Netherlands										
Poland										
South Korea		✓	✓		✓	✓	✓	✓	✓	
United States		✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 4: Data that can be used as open data

Table 6 describes data used by single surveyed Government/Country for communication and dissemination of results of digital health services.

The main reported instrument was population data, shared by 70% of countries, except for Australia, the Netherlands and Poland. The second most voted item was population case studies on epidemic data, highlighted by 5 out of 10 countries.

The following most voted items were laboratory reports and treatment reports, both reaching the 40% of share.

No one of the evaluated countries reported personal data as a communication/dissemination tool.

All the remaining suggested options, medical data, data collected through wearable devices, electronic health records communicated by patients, diagnostic reports and discharge letters, didn't go further than 30% of votes, possibly showing a deficiency either in using ability or resources for data communication/dissemination.

Country laws	National laws	Advertising campaigns	Communication campaigns	Training of healthcare professionals	Professional courses promoted by universities	Advances university courses	School programmes	Increasing the awareness of the population	Patient engagement
Australia		✓	✓	✓	✓	✓		✓	
Brazil				✓	✓	✓			✓
Canada		✓	✓	✓	✓	✓	✓	✓	✓
Hong-Kong	✓	✓	✓	✓	✓	✓		✓	✓
India		✓	✓	✓	✓			✓	✓
Italy				✓	✓				✓
Netherlands		✓	✓	✓			✓	✓	✓
Poland	✓	✓	✓	✓				✓	✓
South Korea	✓	✓	✓	✓	✓	✓	✓	✓	
United States	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 5. Actions at a national level to develop communication of digital health technologies.

With the exception of Italy and Brazil, all countries have diversified their strategies to develop a consolidated communication of digital health technologies.

The most employed strategies are information and advertising campaigns on the importance of digital health, communication campaigns on the usefulness, usability and availability of digital health, training and engagement of healthcare professionals, professional courses promoted by universities, increasing the awareness of the population through media and press and patient engagement.

Interestingly, South Korea is one of the few countries that invested in all strategies of communication but patient engagement.

6 RECOMMENDATIONS AND NEXT STEPS

The results and findings of the "Practicing the Evidence" questionnaire have provided invaluable insights into how use of digital health intervention is monitored and evaluated, identifying areas of significant opportunity and challenges that need to be addressed.

As a consequence of the analysis, the work team identified several recommendations and steps that will facilitate the progress in the GDHP Evidence and Evaluation Work Stream. The following next steps are recommended:

1. Clear identification of priorities:

The most pressing recommendation is for GDHP to identify a clear list of priorities to focus on. The present work has demonstrated that the strong heterogeneity present in the Countries and Territories of the GDHP is reflected by the answers and the priorities identified in the survey. The evidence translation and implementation occur through the efforts applied to different fields (HTA and policies, data collection, promotion of digital health, development of digital health integration). Next steps should attempt to focus the international attention to common and shared goals.

2. Clear funds allocation:

Digital health is a broad definition that includes a large variety of healthcare services: patient portals, telemedicine, wearable devices, mobile health, health information technology, big data analytics, cloud repository, etc. COVID-19 pandemic accelerated the shift to digital health and drove unprecedented investments in the health tech space. However, many countries declared difficulty in finding official data for the amount of spending on digital health. Therefore, there is the strong need to identify specific criteria to properly track the allocation of funds toward digital health.

3. Identify methods for data collection:

While data are collected by a broad range of health and health care entities, these data do not flow among different services and structures in a cohesive or standardized way. This survey reports the presence of different data repositories (at hospital, regional or national level), collecting several types of health-related data (clinical data, administrative data, electronic health records, insurance claims data, patient survey), but not communicating in an integrated manner. In order to be able to appropriately access, exchange, and use health data, all stakeholders need common and shared standards to digitize data. Different methods can be used to collect and store data but they can be easily shared if common standards are used. Common standards to collect data also represent a milestone for an international "open data framework" and the next steps for GDHP should relate to the establishment of this open data space, with a focus on how to overcome the presented legal and juridical barriers.

4. Improve communication involving clinicians and population:

The report clearly shows that among major barriers to the implementation of digital health there skepticism among clinicians of digital health technology and lack of accessibility to digital health technology for the general population. For that reason, identifying strategies that would communicate the value of health care information technology to healthcare professionals and identify ways to increase accessibility of

digital health technology to populations is a particular imperative. Lack of communication creates situations where medical errors can occur, undermining the foundations of the doctor-patients relationship. Medical errors, especially those caused by a failure to communicate, are a pervasive problem in today's health care organizations. Effective communication between clinicians and population and an improved digital health literacy (both for clinicians and citizens) will be the key for the real implementation of future digital health technologies.

7 LIMITATIONS

The GDHP is an international collaboration and consists of countries and territories that are at varying maturity levels in terms of developing approaches to assess the use and acceptability of digital health intervention and technologies. In this report, we report the survey's results and we tried to provide a generalization of countries' status in terms of where they are at in measuring the utilization of digital health innovations.

That said, we recognize that there are intra-jurisdictional variations in terms of the degree of progress, implementation, use and acceptability of digital health technologies. Differences in the healthcare systems in different countries and territories affect how respondents answered the survey questions, so the answers may not be strictly comparable.

In addition, there may be other possible questions and topics related to the assessment of the utilization of digital health that are not addressed in this questionnaire, due to the narrow scope of this white paper that cannot provide a comprehensive view.

We acknowledge that submissions only represent a small sample of countries and territories most of which have made significant efforts to apply digital health, and do not represent a global picture. The working group reviewed plans and deliverables periodically, providing important insights during the authoring of the white paper.

APPENDIX A: LIST OF GDHP PARTICIPANT RESPONDENTS

GDHP Participant Country	Name and title	Organization
Commonwealth of Australia	**Amy Winter** A/g Director Privacy and Policy **Rick Sondalini** Senior Policy Advisor	Australian Digital Health Agency
Federative Republic of Brazil	**Dr Márcia Elizabeth Marinho da Silva** Health Data Dissemination Coordinator **Thaís Lucena de Oliveira** General Coordination of Innovation in Digital Systems	Ministry of Health, Department of Informatics (DATASUS)
Canada	**Michael Green** President and CEO **Simon Hagens** Senior Director, Performance Analytics	Canada Health Infoway
Hong Kong SAR	**Dr. Ngai Tseung Cheung** Head IT & Health Informatics **Ms. Joan Hung** Principal Assistant Secretary (Health)	Hospital Authority Food and Health Bureau
Italian Republic	**Dr. Fidelia Cascini** Assistant Professor of Hygiene and Public Health Digital Health Expert at the Ministry of Health, General Directorate for Digitalization	Department of Life Sciences and Public Health, Università Cattolica del Sacro Cuore
Republic of India	**Govind Jaiswal** Director (eHealth) **Lav Agarwal** Joint Secretary	Ministry of Health and Family Welfare, Government of India
The Netherlands	**Herko Coomans** International Digital Health Coordinator **Roger Lim** Senior Policy Officer	Ministry of Health, Welfare and Sport, The Netherlands
Republic of Poland	**Hubert Życiński** Deputy Director, Department of Innovation	Ministry of Health
Republic of South Korea	**Hun-Sung Kim** Associate Professor	The Catholic University of Korea, Seoul ST. Mary's Hospital
United States of America	**Aisha Hasan** Head of Global Health IT	The Office of the National Coordinator for Health IT. U.S. Department of Health and Human Services

APPENDIX B: SURVEY INSTRUMENT

Work stream Practicing the Evidence
Global Digital Health Partnership Survey on Digital Health Development

To: All GDHP Members

Rome, 28.01.2021

Dear Colleague,

As chief of the GDHP Work Stream on Evidence and Evaluation, my working group and I are performing a survey to collect information on how digital health development strategies have been strengthened worldwide. The aim of this survey is to investigate aspects concerning: 1) the regulatory framework; 2) the allocation of funding; 3) the reporting of evidence; 4) the uses of data; 5) the communication of healthcare digitalization to people.

Results from this survey will allow us to prepare a White Paper with the aim of highlighting how digital health is evolving globally and of promoting a shared approach to its future development. The survey will further reveal differences among GDHP countries, an advancement not just for the evidence and evaluation of GDHP Work Streams, but also a starting point as we move towards a coordinated development of digital health solutions into practice.

We have designed the following questionnaire to fulfil these objectives and are kindly asking for your cooperation in completing it as soon as possible to share its results during the next GDHP meeting. We would really appreciate if you could return this questionnaire to Dr. Fidelia Cascini (fidelia.cascini1@unicatt.it) before February 28th. It will take on average 3 hours to be completed.[37]

We really thank you for your participation into this project.

Yours faithfully,

Walter Ricciardi

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[37] *Before completing the questionnaire, please note the following: 1) where an official document in English exists on the topics included in the questionnaire, we would really appreciate if you could please attach them, either by email or by including the web link. 2) We are sending the questionnaire as GDHP Survey-EE workstrem.doc and .pdf files. We suggest you save the file GDHP Survey-EE workstrem.doc in your own computer as GDHP Survey-EE workstrem_answer.doc before filling in the questionnaire.*

General Information

Surname:	Title:	Initials:

First name:

Position in the Institute:

Institution/Organisation:

Telephone and fax numbers:	Country code:	Area code:
Tel (1)	Tel (2)	Fax (1)	Fax (2)

E-mail (1)	E-mail (2)

Other information that may help us contact you:

If we need to contact you for clarifications and you are not available, who else can we contact?

Surname:	Title:	Initials:

First name:

Institution/Organisation:

Telephone and fax numbers:	Country code:	Area code:
Tel (1)	Tel (2)	Fax (1)	Fax (2)

E-mail (1)	e-mail (2)

Other information that may help us contact him/her:

Does your Government/ Country have a website where findings on digital health are shown?

☐ Yes
☐ No

If you chose yes, please put the link in this box.

Section 1. Priorities identification

1.1 - Please report the name(s) of the advisory institutions or the organisations involved in the identification of national digital health priorities, if any.
Additional comments (optional):

1.2 - Please succinctly describe the process of identification of digital health priorities in your country.   • Design your own scheme using the following as examples: • Healthcare workers' input → facility reporting → regional collection of data → national definition of priorities   • National regulations and policies → regional implementation → involvement of healthcare providers
Additional comments (optional):

1.3 - What are currently the digital health priority areas in your country? ,
For each option, please choose an order on a scale from 1 (very low) to 5 (very high).

	1	2	3	4	5
Health Technologies Assessment (HTA) and transformation policies for digitalisation of healthcare					
National eHealth strategy	☐	☐	☐	☐	☐
National eHealth system/platform	☐	☐	☐	☐	☐
National digital health agency	☐	☐	☐	☐	☐

Institutions/Organizations for digital health	☐	☐	☐	☐	☐
National digital networking system	☐	☐	☐	☐	☐
Cost-benefit assessment of digital technologies	☐	☐	☐	☐	☐
Effectiveness of digital health innovation	☐	☐	☐	☐	☐
Electronic data collection					
Electronic health records	☐	☐	☐	☐	☐
Electronic prescriptions	☐	☐	☐	☐	☐
Data standardization process	☐	☐	☐	☐	☐
National health data warehouse	☐	☐	☐	☐	☐
Regional IT health registry	☐	☐	☐	☐	☐
Machine learnings algorithms	☐	☐	☐	☐	☐
Bio-surveillance platforms	☐	☐	☐	☐	☐
Modelling for health prevention and planning	☐	☐	☐	☐	☐
Effectiveness of healthcare services	☐	☐	☐	☐	☐
Integration of data from wearable devices	☐	☐	☐	☐	☐
Digitalisation of healthcare services					
Emergency support information systems	☐	☐	☐	☐	☐
Ambulance monitoring systems using real-time dashboards	☐	☐	☐	☐	☐
Development of digitalisation and increased use of technological infrastructure (smart hospitals)	☐	☐	☐	☐	☐
Strengthening the digital monitoring system	☐	☐	☐	☐	☐
Online bookings for healthcare services	☐	☐	☐	☐	☐
Online payments for healthcare services	☐	☐	☐	☐	☐
Artificial intelligence for diagnostic healthcare	☐	☐	☐	☐	☐
Artificial intelligence for population studies	☐	☐	☐	☐	☐

Artificial intelligence for predictive models of prevention	☐	☐	☐	☐	☐
Accessibility to health services (i.e., waiting lists)	☐	☐	☐	☐	☐
Delivery of healthcare	☐	☐	☐	☐	☐
Telemedicine	☐	☐	☐	☐	☐
Telenursing	☐	☐	☐	☐	☐
Electronic patient portals	☐	☐	☐	☐	☐
Electronic hospital discharge	☐	☐	☐	☐	☐
Clinical decision-support system	☐	☐	☐	☐	☐
Robotic use for care	☐	☐	☐	☐	☐
Electronic patient reminder via mHealth	☐	☐	☐	☐	☐
Digital health literacy	☐	☐	☐	☐	☐
Development of digital health integration					
Networks to exchange health records and documents	☐	☐	☐	☐	☐
Integrated information systems for prevention	☐	☐	☐	☐	☐
Healthcare services network	☐	☐	☐	☐	☐
Centralised network architecture (single server)	☐	☐	☐	☐	☐
Decentralised architecture (multiple servers)	☐	☐	☐	☐	☐
Healthcare services network including pharmacies	☐	☐	☐	☐	☐
Drug information system	☐	☐	☐	☐	☐
Other					
If you chose other, please specify.					
Additional comments (optional):					

1.4 - Is there an official document on the subject of digital health priorities and a specific plan to implement digital health technologies? *Mark the appropriate option with an X.*	Yes ☐	No ☐

If you chose yes, please e-mail or indicate its web address.

Additional comments (optional):

1.5 - Has your country taken a pragmatic approach to improve health services through digital health? *Mark the appropriate option with an X.*	Yes ☐	No ☐

Please briefly describe.

Additional comments (optional):

1.6 - Has national legislation been passed recently to implement digital health? *Mark the appropriate option with an X.*	Yes ☐	No ☐

If you chose yes, please e-mail or indicate its web address.

Additional comments (optional):

1.7 - Have measures been put in place in order to capture and harness the lessons learnt (successes and failures) from countries that are more progressed in digitalization of healthcare? *Mark the appropriate option with an X.*	Yes ☐	No ☐

Please briefly describe.

Additional comments (optional):

Section 2. Relationship between national health plans and criteria for funds allocation

2.1 - Are the criteria for digital health services funding related to the national health plan? *Mark the appropriate option with an X.*	
☐ We don't include digital health in our national health plan	☐ Yes, we consider digital health in our national health plan
If you chose yes, please attach the document or indicate the national health plan web address.	
Additional comments (optional):	

2.2 - What criteria does your Government/Country use to allocate funds for digital health?
Please for each option give an order in a scale from 1= very low to 5= very high.

	1	2	3	4	5
Improve citizen services	☐	☐	☐	☐	☐
Improve communication and digital literacy	☐	☐	☐	☐	☐
Improve interdisciplinarity of health professionals	☐	☐	☐	☐	☐
Improve the performance of hospitals	☐	☐	☐	☐	☐
Improve the sustainability of health systems	☐	☐	☐	☐	☐
Improve emergency preparedness	☐	☐	☐	☐	☐
Improve communication and digital literacy	☐	☐	☐	☐	☐
Improve interdisciplinarity of health professionals	☐	☐	☐	☐	☐

Additional comments (optional):

2.3 - Which organizations or institutions are involved in deciding which criteria are used for the allocation of funds for digital health?
Please select one or more options with an X.

☐   Healthcare providers

☐   Insurance companies

☐   Patients' associations

☐   Governments

☐   Ministry of Health

☐   Pharmacists' associations

☐   Health services researchers

☐	Informatic engineers
☐	Technology companies
☐	Pharmaceutical companies
☐	Other

If you chose other, please specify which organizations or institutions are involved.

Additional comments (optional):

| 2.4 - Is there a national board for digital health? *Mark the appropriate answer with an X.* | Yes ☐ | No ☐ |

If you chose yes, please specify the profile of the members and where the affiliations are.

Additional comments (optional):

2.5 - Could you please indicate the annual budget (in US dollars) of your country for digital health?
Please write the value in numbers and in full characters.

Additional comments (optional):

2.6 - How do you rate the annual budget for digital health at the national level?
Mark the appropriate option with an X.

☐	Insufficient
☐	Sufficient
☐	Medium
☐	High
☐	Very high

Additional comments (optional):

2.7 - Please provide the names of the organizations (institutions/agencies) that fund digital health (national or regional, public or private) as well as applicable link.
Additional comments (optional):

Section 3. Evidence about the development digital health services

3.1 – How would you define the development of digital health in your country in terms of successful implementation? *Mark the appropriate option with an X.*
☐   Insufficient ☐   Sufficient ☐   Medium ☐   High ☐   Very high
Additional comments (optional):
3.2 – Has your Country put a process for the evaluation of digital health efficacy in place? (*As efficacy we mean whether the digitalisation produces the desired outcomes it was designed to deliver*) *Mark the appropriate option with an X.*

☐   No, there is not a process to evaluate digital health efficacy
☐   Yes, there is a process, based on specific models:
          If you chose Yes, please select one or more:
           ☐   Model 1: Evaluate the annual increase of electronic health records.
           ☐   Model 2: Analyse the digitalisation rate of hospitals.
           ☐   Model 3: Test the level of integration of health data.
           ☐   Other
            If you chose other, please briefly describe.
 	
☐   There is a process, but it is not based on a specific model.
          In this case, please briefly describe.

Additional comments (optional):

3.3 - Has your Country put a process for the evaluation of digital health effectiveness in place?
(*By effectiveness we mean the health system performance over the time*)
Mark the appropriate option with an X.

☐   No, there is not a process to evaluate digital health efficacy

☐   Yes, there is a process, based on specific models:

     If you chose Yes, please select one or more:

         ☐   Model 1: Evaluate the annual increase of electronic health records.

         ☐   Model 2: Analyse the digitalisation rate of hospitals.

         ☐   Model 3: Test the level of integration of health data.

         ☐   Other

     If you chose other, please briefly describe.

☐   There is a process, but it is not based on a specific model.

     In this case, please briefly describe.

Additional comments (optional):

	Yes	No
3.4 - Has your Country put a process for the evaluation of digital health equity in place? (*By equity we mean the accessibility of digital services of all the population and the absence of avoidable, unfair or remediable differences among groups of people*) *Mark the appropriate option with an X.*	☐	☐

If yes, please briefly describe.

Additional comments (optional):

	Yes	No
3.5 - Is there a process of evaluating digital health safety that is carried out by your Country? (*By safety we mean ,for example: preventing/avoiding medication/diagnostic errors, security and privacy, increasing trust of services and evaluating general threats*) *Mark the appropriate option with an X.*	☐	☐

If yes, please briefly describe.		
Additional comments (optional):		

3.6 - Has a check about digital health quality been carried out? *(By quality we mean technical aspects of technologies and improvement in healthcare processes)* *Mark the appropriate option with an X.*	Yes ☐	No ☐
If yes, please briefly describe.		
Additional comments (optional):		

3.7 - Has your Country put a process for the evaluation of digital health end-user experience in place? (*By end-user experience we mean how the consumers/patients/clinicians interact with a digital health technology or service*) *Mark the appropriate option with an X.*	Yes ☐	No ☐
If yes, please briefly describe.		
Additional comments (optional):		

3.8 - Is there a process to evaluate the ROI (Return on Investment) of healthcare digitalisation that is carried out by your Country? *(By ROI we mean if resources are being used to get the best value for money)* *Mark the appropriate option with an X.*	Yes ☐	No ☐
If yes, please briefly describe.		

Additional comments (optional):

3.9 - Do you evaluate the impact of digital health technologies on the following medical fields?

- ☐ Genomics
- ☐ Personalized medicine
- ☐ Precision healthcare
- ☐ Preparedness for emergency responses
- ☐ Infection prevention and control for disease outbreaks
- ☐ Risk management and patient safety

Additional comments (optional):

3.10 - Are there any healthcare fields where benefits from a given digital health technology or solution have been achieved?
For each option, please give an order in a scale from 1 (very low) to 5 (very high).

	1	2	3	4	5
Health organisations' efficiency	☐	☐	☐	☐	☐
Healthcare providers' activity	☐	☐	☐	☐	☐
Patients' outcomes	☐	☐	☐	☐	☐
Support to healthcare workers	☐	☐	☐	☐	☐
Economic benefits	☐	☐	☐	☐	☐
Improvements in public health	☐	☐	☐	☐	☐
Chronic disease management	☐	☐	☐	☐	☐
Emergency management	☐	☐	☐	☐	☐
Prevention of epidemic outbreaks	☐	☐	☐	☐	☐
Vaccination campaigns	☐	☐	☐	☐	☐
Healthcare professionals' training	☐	☐	☐	☐	☐
Digital communication plans	☐	☐	☐	☐	☐

Additional comments (optional):

<table>
<tr><td>3.11 - Is your country involved in international initiatives aimed at evaluating evidence/impact/assessment of digital health, other than GDHP?</td></tr>
<tr><td>Please specify what these initiatives are and which countries you are involved with.</td></tr>
<tr><td>Additional comments (optional):</td></tr>
</table>

Section 4. Providing digital health evidence

<table>
<tr><td>4.1 - How does your Government/Country get evidence on the use and impact of digital health technologies?
For example, specify the process using a scheme like those suggested here:
• Healthcare workers 'input → Facility Departments/wards wide collaboration → Regional Collaboration → National database
• National database → Involvement of all Facility Departments/wards → Healthcare workers' input</td></tr>
<tr><td></td></tr>
<tr><td>Additional comments (optional):</td></tr>
</table>

4.2 - What kind of sources and tools are mainly used in your country to collect information on digital health?
Please choose one or more options and please give an order in a scale from 1 (used least) to 5 (used most).

	1	2	3	4	5
Centralized infrastructure as:					
National eHealth system/platform	☐	☐	☐	☐	☐
National digital health agency	☐	☐	☐	☐	☐
Institutions/Organizations for digital health	☐	☐	☐	☐	☐
National digital networking system	☐	☐	☐	☐	☐
Other: _____					
Healthcare services as:					

Emergency support information systems	☐	☐	☐	☐	☐
Ambulance monitoring systems	☐	☐	☐	☐	☐
Smart hospitals and providers	☐	☐	☐	☐	☐
Local healthcare monitoring systems	☐	☐	☐	☐	☐
Online bookings for healthcare services	☐	☐	☐	☐	☐
Online payments for healthcare services	☐	☐	☐	☐	☐
Primary care	☐	☐	☐	☐	☐
Electronic patient web portals	☐	☐	☐	☐	☐
Mobile-Health applications	☐	☐	☐	☐	☐
Pharmacies	☐	☐	☐	☐	☐
Drugs monitoring systems	☐	☐	☐	☐	☐
Other:_____					
Additional comments (optional):					

Section 5. Collecting Data

	Centralized	Decentralized
5.1 - Is there a centralized or decentralized architecture/server in your Country for the reporting of digital health evidence/results? *Mark the appropriate option with an X.*	☐	☐
Please briefly explain the process.		
Additional comments (optional):		

	Yes	No
5.2 - Is there an open data registry/platform in your country? *Mark the appropriate option with an X.*	☐	☐

If you chose yes, please briefly explain the process.

Additional comments (optional):

5.3 - Where are the health data collected?
Mark the appropriate option with an X.

☐   Central repository with aggregated information
☐   Unique database at central level
☐   Local database at regional level
☐   Local database at hospital level
Other: _____

Additional comments (optional):

5.4 - Which health data can be used as open data?
Mark the appropriate answer with an X.

☐   All data collected
☐   Personal data
☐   Medical data
☐   Population data
☐   Data collected through wearable devices
☐   Electronic health records communicated by patients
☐   Population case studies on epidemic data
☐   Laboratory reports
☐   Diagnostic reports
☐   Treatment reports
☐   Discharge letters

Additional comments (optional):

5.5 - Who holds the digital health data? Who has ownership of the available health data?
Mark the appropriate option with an X.

☐	Healthcare providers
☐	Patients
☐	Governments
☐	Ministry of health
☐	Insurance companies
☐	Pharmaceutical enterprises
☐	Pharmacist associations
☐	Health service researchers
☐	Other

If you chose other, please specify.

Please indicate the web address of the regulation to which you're referring to, if any.

Additional comments (optional):

5.6 - Who has access to health data collected?
Mark the appropriate option with an X.

☐	Healthcare providers
☐	Insurance companies
☐	Patients associations
☐	Governments
☐	Ministry of health
☐	Pharmacist associations
☐	Health service researchers
☐	Engineers
☐	Technology and pharmaceutical companies
☐	Other

If you chose other, please briefly specify.

Additional comments (optional):

5.7 - Who can use data collected?
Mark the appropriate option with an X.

☐	Healthcare providers
☐	Insurance companies
☐	Patients associations
☐	Governments
☐	Ministry of health
☐	Pharmacists associations
☐	Health service researchers
☐	Engineers
☐	Technology and pharmaceutical companies
☐	Other

If you chose other, please briefly specify.

Additional comments (optional):

5.8 - For what purposes can the data be used for?
Mark the appropriate option with an X.

☐	Non-profit purposes
☐	Scientific research
☐	Epidemiological studies
☐	Healthcare organizational purposes
☐	Policies and governmental programmes

Additional comments (optional):

Section 6. Strengthening and promoting digital health

6.1 - What has been done at a national level to develop a consolidated communication of digital health technologies?
Please select one or more options with an X.

- ☐ National laws promoting the digitalisation of health at the population level
- ☐ Information and advertising campaigns on the importance of digital health
- ☐ Communication campaigns on the usefulness, usability and availability of digital health
- ☐ Training and engagement of healthcare professionals
- ☐ Professional courses promoted by universities
- ☐ Advanced university courses
- ☐ Programs for schools on digital health
- ☐ Increasing the awareness of the population through media and press
- ☐ Patient engagement

Additional comments (optional):

6.2 - What are the tools your Government/Country uses for the communication/dissemination of results of digital health services?
Please for each communication tool give an order in a scale from 1= rarely used to 5= widely used.

	1	2	3	4	5
Media	☐	☐	☐	☐	☐
Scientific publication	☐	☐	☐	☐	☐
Institutional websites	☐	☐	☐	☐	☐
Newspaper articles	☐	☐	☐	☐	☐
Social media	☐	☐	☐	☐	☐
Video interviews of institutional representatives	☐	☐	☐	☐	☐
Other					

If you chose other, please briefly specify.

Additional comments (optional):

☐   Lack of infrastructure
☐   Lack of technological equipment
☐   Lack of political will
☐   Lack of economic resources
☐   Lack of organisation
☐   Skepticism of clinicians
☐   Limited skills of the population
☐   Accessibility of the population
☐   Other

If you chose other, please briefly specify.

Additional comments (optional):

6.4 - Which are the three priorities areas that you would like to see future digital health directed towards?
Please answer the question by writing your answer in the box below.

1)

2)

3)

Thank you very much for answering this questionnaire. Should you have further inquiries, please contact Dr. Fidelia Cascini at the address below. We would appreciate if you could send the completed questionnaire by email to: fidelia.cascini1@unicatt.it

GDHP
Global Digital Health Partnership