

National Digital Health Strategy



2023



Foreword from the MINISTER OF HEALTH

It is my pleasure to present the National Digital Health Strategy 2023.

The sixth strategic principle of the Bermuda Health Strategy 2022 – 2027 is ‘*Harnessing Healthcare Technology*’. It emphasises the importance of using technology to improve access to healthcare services, healthcare delivery, and the monitoring of health outcomes. The National Digital Health Strategy (“NDHS”) establishes a system-wide vision and recommended approach for an integrated digital healthcare environment for Bermuda.

The NDHS is foundational to the Government’s ongoing commitment to strengthening Bermuda’s health system and delivering [Universal Health Coverage \(“UHC”\)](#) for its residents in an efficient and people-centric way.

It is important to note that [digital health](#) is much more than the implementation of electronic medical records. Digital health is at the core of any successful healthcare ecosystem. Done well, it seamlessly integrates technology throughout the broad range of health services and along every point of a person’s health care journey. This in turn allows people and service providers to have better access to accurate personal health information to be able to make better health decisions and achieve improved health outcomes.

The work and recommendations contained within this NDHS were developed by a multidisciplinary working group. Findings and recommendations are based on both an internal and external review, as well as learnings from other international jurisdictions that have implemented national digital health strategies. The working group’s recommendations were supported by a workforce assessment conducted by Edinburgh Innovations and Interactive Health and a community assessment conducted by KPMG.

Bermuda’s health system is broad and complex. Implementing a national digital health strategy will be a years-long, collaborative process that will require ongoing partnership between all stakeholders. Of note, is the critical importance of having the oversight of a strong governance model for national digital health.

As we consider the recommendations within this document and move into the next phase of planning and implementation, we do so knowing it is critical to continue building trust in the current health system strengthening efforts. This includes ensuring that data is stored safely and remains private. It also includes having both the health service providers and the people they serve able to experience the benefits of digital healthcare sooner rather than later.

The Hon. Kim N. Wilson, JP, MP
Minister of Health



Foreword from KIRSTEN BEASLEY

With great pleasure, we introduce the National Digital Health Strategy for Bermuda, a comprehensive roadmap forging a digitally integrated and sustainable healthcare ecosystem. As Chair of the development working group, I am honoured to present this transformative strategy, poised to strengthen our healthcare system and enhance our population's well-being.

Bermuda stands at a critical juncture: our healthcare system, one of the World's most expensive, intersects with rising rates of chronic illnesses within the population. This confluence highlights the pressing need for a progressive digital health strategy underpinning an equitable, affordable, and sustainable health system.

During development, stakeholders such as healthcare professionals, policymakers, researchers, and community representatives were actively engaged to inform a holistic approach rooted in Bermuda's unique context. Their insights were instrumental in shaping this strategy to address our system's multifaceted needs and challenges effectively and I extend my gratitude to all those who contributed their time and expertise.

The National Digital Health Strategy's purpose is clear: to harness digital health and technology's prowess to improve healthcare quality, safety, and accessibility. Integral to this vision is real-time data access, facilitating informed and timely decision-making across all levels of care. By embracing digital innovation, we can enhance patient outcomes, drive efficiency, and foster a patient-centric healthcare experience facilitated by instantaneous insights and seamless information flow. A bedrock of our strategy is robust governance, anchored in stringent oversight, clear guidelines, and ethical standards.

Though challenges will surface during the National Digital Health Strategy implementation, this strategy offers a solid foundation to build upon, demanding shared responsibility and collaboration to ensure successful execution.

Amidst a rapidly evolving digital landscape, vast opportunities await. Embracing innovation, adopting emerging technologies, and nurturing digital inclusion and equity can unlock a future where every individual in Bermuda can access affordable, high-quality healthcare services.

As both Chair of the working group and a Universal Healthcare Steering Committee member, I am dedicated to supporting strategy implementation and closely collaborating with stakeholders to drive its success. I encourage healthcare professionals, policymakers, and community members to join our digital health journey.

I invite you to explore the National Digital Health Strategy and embrace the opportunities it presents. Together, we can realise the transformative potential of digital health and pave the way to a healthier, more interconnected Bermuda.

Sincerely,

A handwritten signature in black ink, appearing to read 'KBeasley', with a stylized flourish at the end.

Kirsten E. Beasley

Chair, National Digital Health Strategy Working Group

Executive Summary

Introduction:

The National Digital Health Strategy (“NDHS”) for Bermuda presents a comprehensive plan to harness the power of digital technologies in healthcare.

Purpose:

The NDHS addresses the need to transform Bermuda’s healthcare system by leveraging digital technologies. It aims to improve access to quality care, enhance health outcomes, and help support the goal of achieving Universal Health Coverage (“UHC”) in Bermuda. The main challenge is to integrate digital health solutions effectively and efficiently within the existing healthcare landscape.

Methodology or Approach:

The development of the NDHS involved a collaborative and interdisciplinary approach. Stakeholders from various sectors, including healthcare providers, government agencies, and technology experts, were engaged in extensive consultations, research, and analysis. Best practices and international models were adapted to suit Bermuda’s unique context.

Key Findings or Results:

The NDHS has identified key challenges and opportunities in implementing digital health in Bermuda. It highlights the importance of governance, health data standards, [interoperability](#), workforce development, community engagement, and financing. The findings emphasise the transformative potential of digital health to improve care coordination, efficiency, and patient-centricity.

Recommendations or Proposed Solution:

Based on the key findings, the NDHS proposes several strategic recommendations. These include establishing an independent governance body, mandating national health data standards, developing a secure digital health platform, strengthening the healthcare workforce, promoting community awareness and education, and implementing robust monitoring and evaluation mechanisms. Multi-track financing options and a change management-based implementation plan are also recommended.

Conclusion:

The NDHS provides a high-level roadmap for Bermuda to navigate the digital transformation of its healthcare system. By embracing digital health, Bermuda can overcome existing challenges and achieve its vision of universal health coverage, accessible care, and improved health outcomes. The proposed recommendations offer a comprehensive approach to guide the implementation of digital health initiatives and ensure the sustainability of the strategy.

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Vision, Mission, Design Principles

Vision

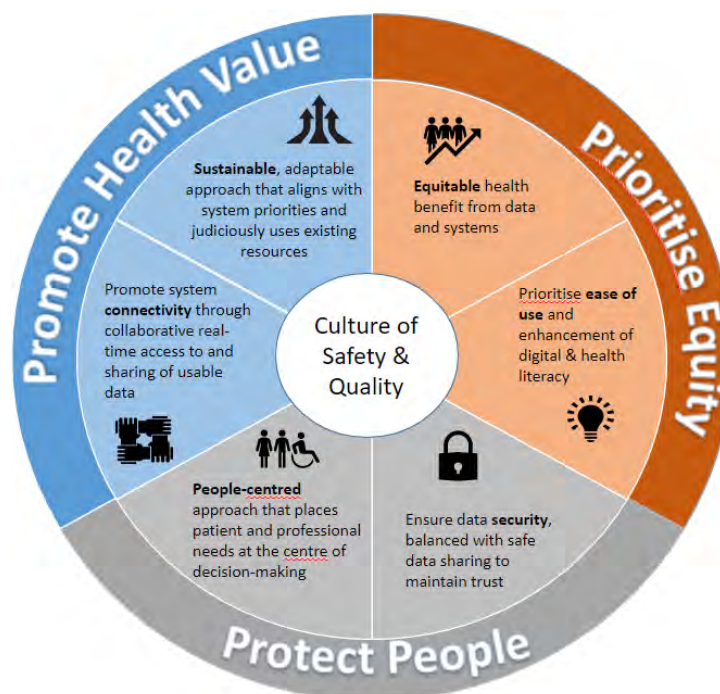
A sustainable and digitally integrated healthcare ecosystem designed to meet the diverse and often divergent needs of the community and health professionals, improve quality and safety, and drive better health for all.

Mission

Develop a contextualised and sustainable National Digital Health Strategy that is aligned with the Bermuda Health Strategy 2022 - 2027, assists in enabling its eight strategic principles, and provides a North Star document to guide development and prioritisation for implementing a digital health strategy for Bermuda.

Design Principles

The design principles included in the following framework will shape the work on digital health and support the development of a digital health culture that intends to enhance patient safety and quality of care.



Culture of Safety & Quality This is the core principle and rallying theme for the National Digital Health Strategy, which seeks to embed quality and safety in the design, development, implementation, and use of digital solutions and services.

Connectivity Represents joined-up care through systems integration and streamlined, real-time information flow. This principle encompasses a focus on agile collaboration to meet evolving and future needs of people, ensuring data quality and accessibility through national-level common standards and interoperability.

Sustainable Provides a phased strategic view that supports broader health system goals, leverages existing assets and capabilities, prioritises judicious use of public funds to deliver value for all, and is forward-looking to anticipate emerging needs and accommodate and enable innovation and adaptability.

Equitable Ensures equitable access to data-generated health value (i.e., access to electronic health tools and information is equitable), with consideration for the unique needs of vulnerable and marginalised groups; is designed to counter bias and health disparity.

Usable Focuses on ‘fit-for-use’ tools and services that account for the diverse needs of people in different settings by utilising accessible language to help plug knowledge gaps and enhance digital and [health literacy](#).

Secure Provides strong safeguards to ensure the health information of Bermuda’s residents is secure and their rights are protected.

People-centred Places patient and care provider needs and their context of use at the centre of this work.

Part 1: Developing The Plan

Background

We live in a world where the only constant is change. The ability to innovate and collaborate, and the speed with which innovation and change are introduced into most aspects of our lives, is driven by technology. The [digitalisation](#) of our everyday lives has become the expected norm and is the driver of accessibility, efficiency, and communication.

It should be no surprise that innovation through digital technology is a core requirement to reshape Bermuda's health system landscape and deliver on the vision of Universal Health Coverage ("UHC") in Bermuda.

In 2022, the Bermuda Government's Ministry of Health ("the Ministry") launched the Bermuda Health Strategy 2022 – 2027 "Bermuda Health Strategy". Its sixth principle, "Harnessing Healthcare Technology", clearly reflects how technology is foundational to improving access to healthcare services, delivering healthcare, and more effective monitoring of health outcomes.

In embarking on this work, the interdisciplinary National Digital Health Strategy Working Group ("the Working Group") considered the following explorations:

- What digital health goals will support the overarching goals of the broader healthcare system?
- What components need to be in place to achieve those goals?
- What are the needs of the diverse group of health system stakeholders related to digital health?
- What are the current enablers and barriers to implementing digital health in Bermuda?

The National Digital Health Strategy ("the Strategy"/"NDHS") considers worldwide trends relating to health digitalisation and how Bermuda's health system stakeholders can leverage technology system-wide to positively impact their access to quality healthcare.

Approach

Working Group

The Ministry of Health formed a working group comprised of interdisciplinary health and technology subject-matter experts as a subcommittee of the UHC Steering Committee. Its mandate was to deliver on the Bermuda Throne Speech 2021 promise to "develop a national digital health strategy to leverage technology that will streamline administrative expenses, so more funds can be spent on delivering healthcare services". The Working Group reports to the Minister of Health via the UHC Steering Committee. A list of Working Group Members can be found in [Appendix I](#).

As the Working Group progressed through its work, it was committed to ensuring there was a complete understanding of the digital health needs and status of Bermuda. It was steadfast in making certain that recommendations put forward fully considered patient confidentiality, their ability to access their health information, and that recommendations were grounded in future work adhering to international standards for best practice.

The Working Group prioritised the development of a robust governance structure, recognising that adopting best practice governance principles from the outset will serve as a catalyst for fostering essential collaborations during an interim period and in the long run as digital health implementation progresses and the overall digital health system evolves.

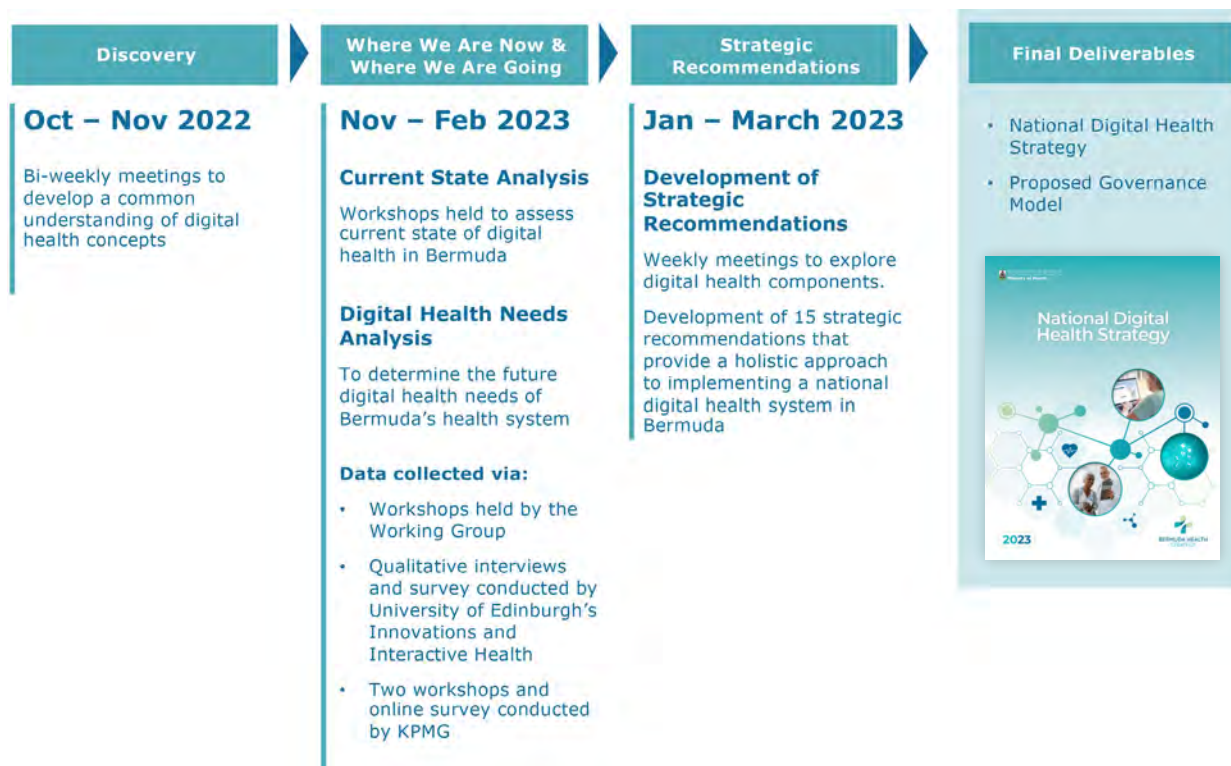
Scope

A successful strategy is grounded in developing an aligned understanding of the current situation, a clear vision of the desired future state, and a systematic approach to effectively bridging gaps. The process of developing Bermuda's National Digital Health Strategy involved a thorough assessment of the current

state of digital health in Bermuda, understanding the future digital health needs, and determining strategic recommendations. The recommendations contained within this report lay the foundation for a more detailed implementation plan to be developed.

The Working Group's mandate was to adopt a comprehensive, interdisciplinary approach that examined each component of Bermuda's digital health ecosystem independently, while also considering the interplay and interactions among various levers within the health system. Several critical areas were continuously examined to ensure a comprehensive approach that accounts for Bermuda's context: governance, legislation and regulation, planning and finance, workforce, infrastructure, services and applications, and monitoring and evaluation.

Project Phases



Analysis and research were performed to ensure that the national digital health ecosystem recommended for development meets the specific needs of the community and health system stakeholders. The findings from the following endeavours have informed this paper and have been integrated throughout.

1. *Interdisciplinary Digital Health Working Group* - Weekly working meetings were held. Each session had a single focus area, during which Working Group members reviewed and discussed existing research, data, reports, etc., to affirm the current state in Bermuda and formulate strategic recommendations to progress digital health. Specific focus areas include governance, legislation and regulation, planning and investment, infrastructure, services and applications, workforce, and monitoring and evaluation.
2. *Community Engagement for the National Digital Health Strategy (April 2023)* – KPMG engaged community members and health sector stakeholders in two workshops (22 participants) and an online survey (400+ respondents)
3. *Bermuda Omnibus Survey (April 2023)* – In this syndicated quarterly survey of a representative sample of Bermuda residents, residents were asked about digital tools and services that could be used to improve healthcare services to residents.

4. *Digital Health Maturity in Bermuda Current State Assessment (January 2023)* – The University of Edinburgh conducted a literature review to assess Bermuda’s current digital health maturity level. The Assessment included 40+ health stakeholder interviews (primarily with physicians) to capture perspectives and needs surrounding the current state of digital health. A web-based survey was also conducted and focused on existing health information infrastructure uses and needs.

Part 2: Understanding the Context for Implementing Digital Health

Overview

Bermuda's health system is a complex ecosystem comprised of public, private, and non-profit (a.k.a., third sector) organisations. These organisations represent Government departments and services, regulators, health services providers, suppliers, payors (e.g., insurance companies), and most notably members of the community who must navigate their way through these organisations.

Data from the Bermuda Health Council's ("the Health Council") 2019 National Health Accounts show that national health expenditure represents 11.6% of Bermuda's GDP (representing a total healthcare expenditure of approximately \$739M annually). This ranks Bermuda as the third highest-spending country in the OECD for healthcare spending.

Health system expenditure grew 69% between 2006 and 2017. In 2018, the average per person spend on health system expenses was \$11,529. Total health spending continues to increase yearly, a trend that is expected to continue. This rate of spending is unsustainable and is one of the drivers of the current health reform efforts of the Ministry of Health.¹

Provision of Care

Most healthcare is provided by (and thus expenditure is within) the private sector (53%). Private health service providers include businesses, organisations, and facilities that provide a range of health-related products and services.

Given Bermuda's size, it is sometimes necessary for our residents to travel overseas for healthcare. Thus, private sector expenditure includes 12.6% or \$93M spent on overseas care.

Of the 46.8% of health expenditure in the public sector, Bermuda Hospitals Board ("BHB") accounts for nearly 90% (and a total of 41.7% of Bermuda's total health expenditure).

Nature of public services

Public healthcare services are predominantly provided by the BHB through its two hospitals – King Edward VII Memorial Hospital ("KEMH") and the Mid-Atlantic Wellness Institute ("MWI"), as well as the Lamb Foggo Urgent Care Centre and outpatient clinics. Between them, they provide:

- acute and inpatient care (includes long-term care)
- diagnostic services
- outpatient services
- mental health services
- other support services (e.g., National Tumour Registry, Medical Concierge, etc.)

Through the Department of Health, the Bermuda Government provides several health clinics and services out of its three clinics, located in Hamilton, Warwick, and the Town of St. George.

Regulation and Oversight

Bermuda's healthcare governance and regulatory structure is a hybrid model incorporating multiple entities, including:

1. *Ministry of Health* - holds overall responsibility for Bermuda's health system and sets the policy and regulation that guides the delivery of the Island's healthcare services. The Ministry works closely with the Health Council, Bermuda's independent regulatory authority for the health sector.

¹ Bermuda Health Council, 2019 National Health Accounts Report.

2. *Bermuda Health Council* - was established in 2006 through the Bermuda Health Council Act 2004 'to regulate, coordinate and enhance the delivery of health services'². Its responsibilities are wide-ranging and currently include licensing health insurance providers, acting as the Registrar for five of the seven health professional statutory bodies, increasing cost-effectiveness across the system, monitoring health finance and expenditure³, approving healthcare services, and setting healthcare standards and guidelines.
3. *Bermuda Hospitals Board* - responsible for the hospitals' stewardship and overseeing the conduct of the business of the Board, including the Modernisation Project.⁴
4. *Bermuda Monetary Authority (BMA)* - provides regulatory oversight of Bermuda's private health insurers.
5. *Statutory Bodies* – established by law to provide regulatory oversight to specific health professions:
 - Bermuda Dental Board
 - Bermuda Medical Council
 - Bermuda Nursing and Midwifery Council
 - Bermuda Psychologists Council
 - Council for [Allied Health](#) Professionals
 - Optometrists and Opticians Council
 - Pharmacy Council⁵
6. *Private sector oversight* - several private sector bodies hold profession-specific oversight. These include:
 - Bermuda Dental Association
 - Bermuda Dietetics Association
 - Bermuda Medical Doctors Association (BMDA)
 - Bermuda Nurses Association (BNA)
 - Bermuda Occupational Therapy Association
 - Bermuda Pharmacy Association
 - Bermuda Physiotherapy Association
 - Bermuda Psychologists Association⁶
7. *Community-at-Large* - Members of the community have an essential voice and exercise the right to advocate for access to the highest quality, safest, and most affordable healthcare.

² Bermuda Health Council Act 2004.

³ Bermuda Health Council, www.healthcouncil.bm.

⁴ www.bermudahospitals.bm - Bermuda Hospitals Board Terms of Reference.

⁵ Bermuda Health Council, www.healthcouncil.bm.

⁶ Bermuda Health Council, www.healthcouncil.bm.

Health System Financing

The interconnectivity of all health sector stakeholders within Bermuda's current health financing system is highly complex, as reflected in Figure 1 below.

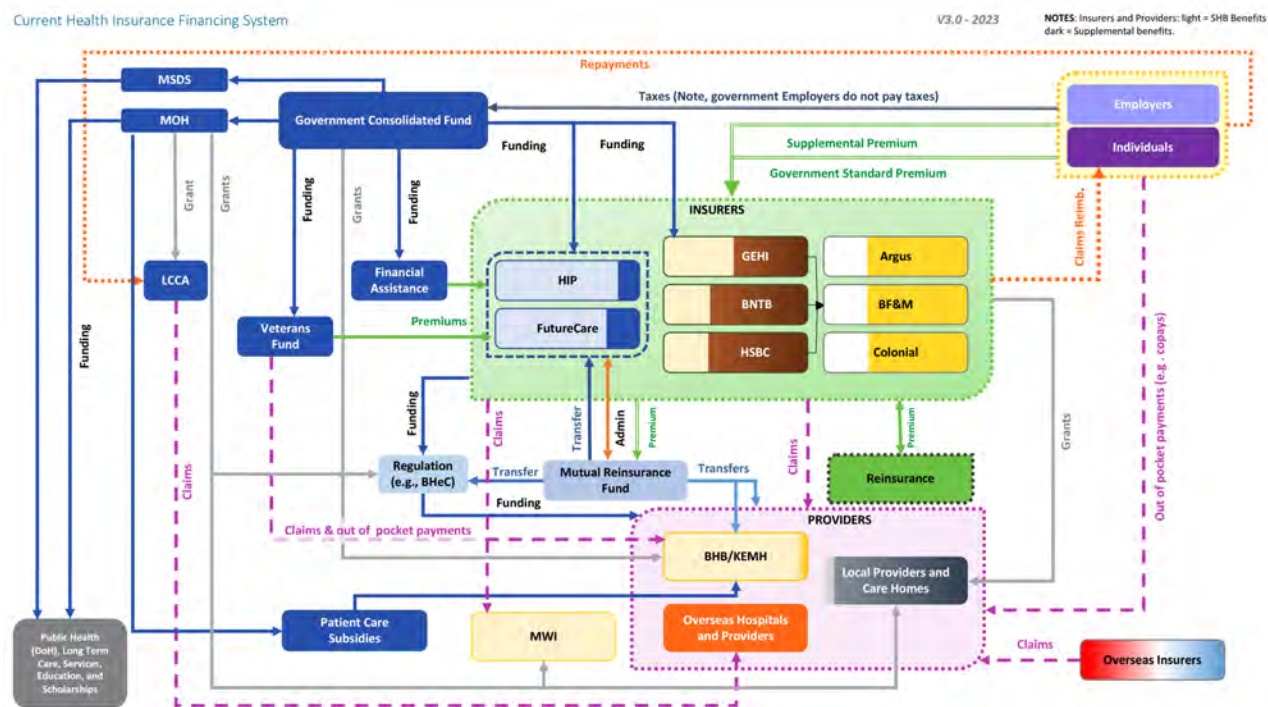


Figure 1. Current Health Financing System

National Health Accounts 2019 reveal that 77% of healthcare is financed through private mechanisms, including health insurance (61%) and 'out of pocket' payments (15%), whilst 26% is paid out of the public purse. This can be attributed to the legal requirement mandating employers and self-employed individuals to provide health insurance at a minimum level for all employees.

Approximately 12% of Bermuda's residential population is uninsured.⁷ Another 23% of residents have unaffordable health insurance or are underinsured.⁸ This number is anticipated to grow as the ongoing negative economic impact of rising costs, including healthcare services and insurance, and our aging population continues to increase.

Bermuda's old age dependency ratio (the ratio of the population 65+ years to the population 20–64 years) is expected to increase to 43.6 in 2026 (from 28.0 in 2017). This means that by 2026 it is expected that there will be 44 seniors for every 100 people of working age. This is higher than the 2015 OECD average old-age dependency ratio of 30 people aged 65 or over for every 100 people of working age.⁹

As Bermuda's population continues to decrease, age, and as more people leave the workforce (for any reason), the tax base that we depend on to fund the public health system will continue to be stressed.¹⁰

⁷ Government of Bermuda, *Bermuda Health Strategy 2022 – 2027*, (2022).

⁸ Government of Bermuda, *Bermuda Health Strategy 2022 – 2027*, (2022).

⁹ OECD (2021), *Pensions at a Glance 2021: OECD and G20 Indicators*, OECD Publishing, Paris, <https://doi.org/10.1787/ca401ebd-en>.

¹⁰ Government of Bermuda Ministry of Economy and Labour, *Position Paper on Addressing the Challenges of an Ageing Population in Bermuda*, (January 2023).

Bermuda's Population Health Profile

According to the *Bermuda Health Workforce, 2017 Report*, which pulls from the 2014 population survey, *STEPS to a Well Bermuda*, 74.6% of Bermuda's population is overweight or obese (measured by a Body Mass Index ("BMI") of greater than 25kg per square metre). Additionally, 55% of individuals over 45 years of age have three or more chronic disease risk factors. This includes insufficient fruit or vegetable consumption, insufficient physical activity, being overweight, having raised blood pressure, or being a daily smoker.

Bermuda has the third-highest incidence rate of diabetes in the OECD, with more than 13% of residents diagnosed. 50% of residents have at least one chronic condition, such as diabetes, heart, or kidney disease. One in three residents has high blood pressure and or high cholesterol. \$29 million is spent annually on dialysis; demand grows by 10% each year.¹¹

According to *Bermuda's Population Projections 2016 – 2026*, Bermuda's birth rate is expected to decrease, and its death rate is expected to increase. Life expectancy is also expected to increase.

The recently published Joint Strategic Needs Assessment ("JSNA") provides insight into the current health and health needs of Bermuda's population. Findings include data on Bermuda's ageing population and the impact of increased life expectancy. The JSNA states, *"Whilst this is a positive consequence of improved health, the changing population profile is likely to result in an increased burden of long-term conditions, including people with multiple complex health needs."*

Technology in Bermuda's Health System

Bermuda has long been respected as one of the World's leading insurance and financial service centres. The quality of Bermuda's regulations and compliance regime driven by the Bermuda Monetary Authority ("BMA"), combined with a highly educated workforce and sophisticated infrastructure has allowed Bermuda's international business sector to thrive. Today, nearly every Fortune 500 company has some link to Bermuda, and the Island ranks as one of the World's top three premier insurance jurisdictions.¹²

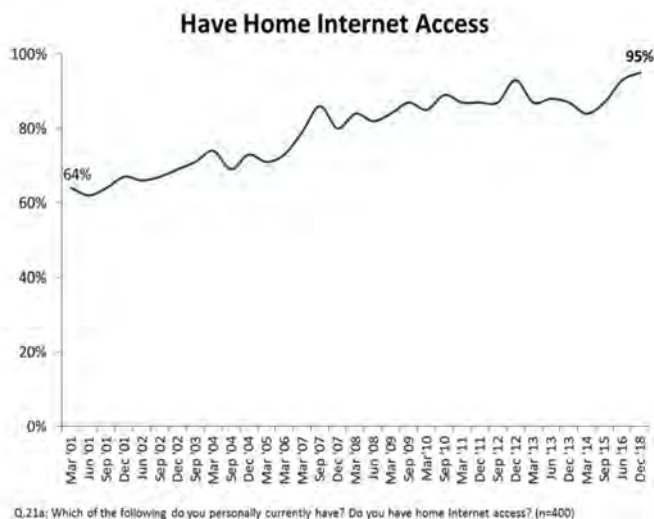


Figure 2. Q4 2018 Bermuda Omnibus Survey

These organisations and all that operate in Bermuda depend on the Island's sophisticated telecommunications infrastructure, with high-speed Internet, reliable mobile phone coverage island-wide, and ongoing innovation in this space.

Residential Internet access is extremely high, with 95% of residents indicating they have home Internet access.¹³

Further, a 2016 study on the *State of Information and Communications Technology* indicated that 91% of households owned at least one smartphone.

A more recent investigation into the Information and Communications Technology sector of the economy showed that whilst overall investment in ICT has been decreasing year over year for the past five years, there is broad usage (93.1%) of the Internet for business operations in Bermuda.¹⁴

¹¹ Government of Bermuda Ministry of Health, *Bermuda Health Strategy 2022 – 2027*, (2022).

¹² Association of Business International Companies, www.abic.bm.

¹³ Narrative Research (Bermuda) Ltd., *Bermuda Omnibus Survey* (Q4 December 2018).

¹⁴ Government of Bermuda Department of Statistics, *Information and Communication Technology Profile* (2021).

The Bermuda Government has prioritised establishing Bermuda as a global leader in technology (e.g., fintech and insurtech). A robust regulatory and legislative framework was developed and put into place by the BMA that governs digital asset companies and establishes Bermuda as a digital sandbox for fintech.

As a matter of priority, the Bermuda Development Agency and other private sector organisations are working to attract new businesses looking to test ideas, develop their products, and build their businesses internationally. This includes companies in the healthcare technology space.

The [digitalisation](#) currently happening in a broad range of industries continues to expand. Integrating technology throughout Bermuda's health system is a crucial enabler for successfully implementing UHC. People will benefit from having a higher level of transparency and more control over their healthcare experiences. Equally, healthcare providers will benefit from more efficient operations and the ability to provide their patients with a more seamless and effective experience throughout the various care pathways.

We live in a world of constant change. The technology landscape continues to evolve as technology drives innovation. Recent progress with artificial and augmented intelligence and 3D printing is expected to impact healthcare delivery in the future. Bermuda must thoughtfully and strategically navigate how to harness these technologies to support the safe and affordable delivery of quality healthcare.

Considering how healthcare in Bermuda is provided, funded, and regulated, in addition to the overall cost of the system, current health, and health needs of the community, the structure of Bermuda's existing health system is unsustainable. Technology and innovation are central to the reform efforts and managing the Island's health expenditure challenges to gain better access to affordable and high-quality healthcare.

Part 3: Digital Health and its Benefits

Digital Health Defined

Digital health embraces the integration of technology, people, and systems to organise and deliver healthcare services and data effectively. It emphasises individuals' active participation in managing their health, enabling access and control of health information, and fostering shared decision-making and communication. A crucial foundation of digital health is data sharing, which facilitates improved care coordination and informed decision-making, ultimately leading to better health outcomes. Digital health's ultimate goal is to bring efficiency to healthcare delivery, while enhancing access to affordable, quality care.

Digital health solutions

- *Health Data Sharing* refers to the electronic exchange of health information among different healthcare providers and organisations that facilitates care coordination, reduces duplication of tests and procedures, and improves the continuity of care.
- *Health Information and Analytics* involves the collecting, analysing, and interpreting of health data to support decision-making and improve health outcomes at both a patient and population level.
- *Mobile health applications* allow users to access health information, monitor their health conditions, communicate with health providers, or manage their medications on smartphones or tablets.
- *Electronic health records (EHRs)* store and share health information among authorised health providers and organisations within a region, community, or country.
- *Wearable devices* track and measure various health indicators, such as physical activity, heart rate, blood pressure, sleep quality, or glucose levels.
- *Telehealth and telemedicine* enable remote healthcare services and consultation delivery through videoconferencing, phone calls, or online platforms.
- *Personalised medicine* that uses [genomic data](#) and artificial intelligence to tailor treatments and therapies to individual patient's characteristics and needs.

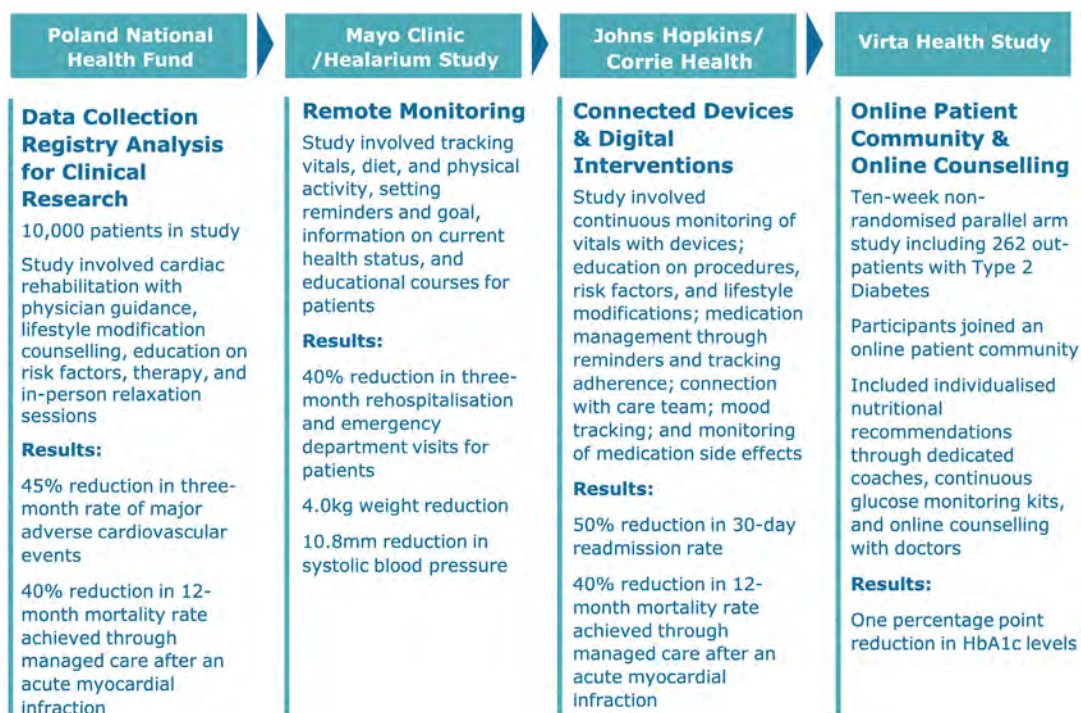


Figure 3. Examples of international digital health solutions from McKinsey

Benefits of Digital Health

A national approach to implementing digital health should provide many benefits to Bermuda, including improved healthcare delivery, enhanced public health management, increased healthcare system efficiency and cost savings, patient empowerment and engagement, and opportunities for innovation and economic growth.

Implementing digital health in Bermuda will be a key enabler for a more efficient, effective, and patient-centric healthcare system and universal health coverage overall.

Improved Healthcare Delivery

A well-designed digital health strategy can enhance healthcare delivery by leveraging technology to streamline processes, improve access to healthcare services, and enhance patient care. Digital health solutions can facilitate telemedicine and telehealth services, EHRs to improve information exchange among healthcare providers, and remote monitoring of patient's health status. These can lead to better health outcomes, increased patient satisfaction, and more efficient healthcare services.

Patient Empowerment and Engagement

Digital health strategies can empower people to actively participate in their healthcare, leading to improved health outcomes. Patient portals, mobile health applications, and other digital tools can provide patients with easier access to their health information, enable self-monitoring of health conditions, and better facilitate communication with healthcare providers. This can lead to increased patient engagement, improved patient-provider communication, and more consistent adherence to treatment plans.

Enhanced Public Health Management

Digital health strategies can help governments effectively manage public health initiatives, such as disease surveillance, outbreak management, and vaccination programmes. By leveraging data analytics and digital tools, governments can collect, analyse, and share health data in real time, enabling early detection and response to public health threats. This can lead to more effective public health interventions, better resource allocation, and improved health outcomes for the population.

Increased Healthcare Efficiency and Cost Savings

Digital health solutions can optimise processes, reduce administrative burdens, and lower healthcare costs. For example, EHRs can streamline documentation, reduce errors and duplicate tests, and improve coordination among healthcare providers, leading to cost savings. Telemedicine and remote patient monitoring can reduce the need for in-person visits, saving time and resources. Digital health strategies can also enable data-driven decision-making. Access to timely, accurate, and complete data supports governments and healthcare providers in identifying cost-effective interventions and allocating resources effectively.

Innovation and Economic Growth

Digital health strategies can foster innovation and economic growth by promoting the development of a vibrant health technology ecosystem. Supporting research and development, innovation hubs, and start-ups in the digital health space can drive technological advancements, create new jobs, and stimulate economic growth. It can also attract investment from domestic and international sources, positioning the Island as a leader in digital health and driving its competitiveness in the global healthcare market.

Overall Benefit	Value	Primary Stakeholder
Individual health enhancement	Using data to improve one's health and wellness	Patients
Organisational improvement	Using data to improve efficiency, effectiveness, marketability, etc.	The organisation that generates the data source
Evidence-based healthcare	Using data to assess and specify the best clinical treatments	Patients, Health Service Providers, Researchers
Population health management	Using data to manage the delivery of health services to a population to achieve improvement goals	Patients, Health Service Providers, Government, Researchers
Health system improvement	Using aggregated data to reduce costs and improve the quality and safety of health services	Society, Payors, Government, Researchers
Evidence-based pricing	Using data to justify prices of services, medications, etc.	Patients, Payors, Governments, Providers
Monetisation	Aggregating anonymised data for resale to other organisations	Data Brokers/Miners and their clients/partners

Figure 4. Stakeholder Benefits

Digital Health as a Foundation for Health System Strengthening

As stated previously, implementing a national digital health strategy can serve as an enabler for healthcare reform, supporting the development of a new sustainable healthcare model for Bermuda.

The NDHS will inform the implementation of digital health solutions in support of Bermuda's UHC Programme. By leveraging digital health solutions, this key healthcare reform effort can harness the potential of innovation, data-driven decision-making, patient engagement, and operational efficiencies to achieve improved health outcomes, enhanced patient experiences, and sustainable healthcare systems. However, this will only be possible if they are designed thoughtfully and utilised in ways aligned with public health values and human rights.

Purpose of a National Digital Health Strategy

Countries that aim to efficiently deliver digital health solutions to their population develop and implement a national digital strategy. This strategy:

- Ensures that efforts are aligned, fostering a coordinated and unified approach to implementing initiatives and achieving common goals across the system.
- Optimises resource utilisation, maximising their impact on healthcare delivery.
- Fosters collaboration, partnerships, and collective problem-solving to accelerate progress.
- Addresses the specific digital health needs of the community and health system stakeholders.
- Promotes interoperability and standardisation of health system and data exchange.
- Ensures secure and confidential sharing of health data between digital health system to facilitate data-driven decision-making and evidence-based policy development.

National Digital Health Ecosystem

The National Digital Health Ecosystem is comprised of four main components: infrastructure, sources of data, applications and tools, and strategic foundations. Figure 5 provides a visual representation of these four components, all of which have a distinct purpose, but must work seamlessly together to achieve the potential benefits of digital health.

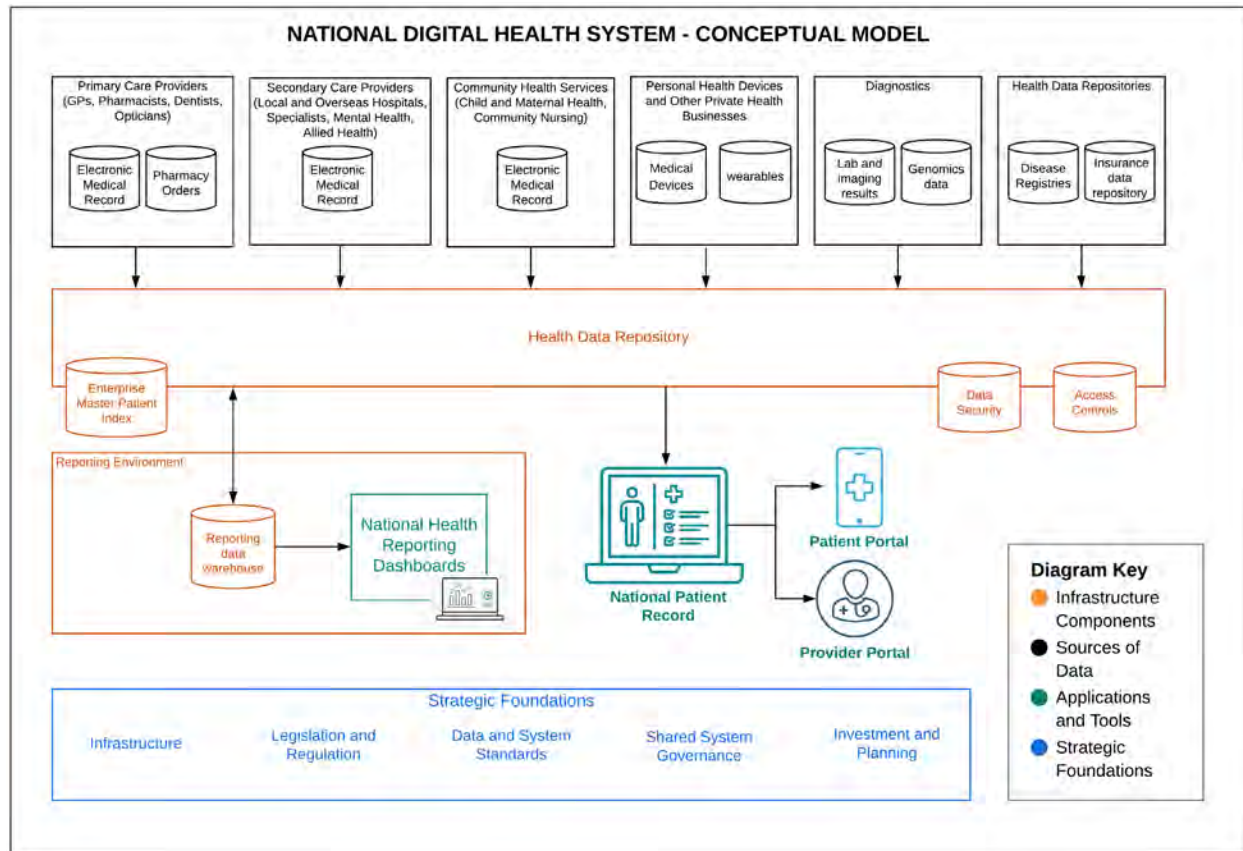


Figure 5. Conceptual Model of a National Digital Health System

Infrastructure Components

The implementation of digital health requires critical infrastructure components that must be in place to receive, store, and manage health data, including:

1. **Health Data Repository** – to receive health data electronically from systems across the health sector. This includes electronic medical record data from the hospitals, primary care physicians, specialists, and overseas providers, along with data from health claims repositories and disease registries.
2. **Enterprise Master Patient Index (EMPI)** – maintains unique identifiers used for patient and provider identification.
3. **Data Security** – This layer implements cybersecurity protocols to protect patients' health information from unauthorised access, use, or disclosure.
4. **Access Controls** – authenticate who connects to the system and allow the patient to manage their privacy settings.
5. **Reporting Environment** – includes a data warehouse to audit the data quality and identify and address data quality issues. The warehouse also formats and organises the data so that it can be used to generate reports.

Sources of Data

There are several sources of data that collect and generate healthcare information as part of the digital health ecosystem. Common data sources include prescription information from pharmacies, lab and imaging results from diagnostic facilities, hospital and primary care records, registration of vital events through medical devices, birth and death registers, disease registers, epidemiological surveillance data, health insurance coverage information, and genomic data. Integrating data from these sources across the health sector through electronic data transfers is one of the critical benefits of digital health.

Applications and Tools

Health data are made available to health system stakeholders through technology applications and tools. Most national digital health systems include a:

- *National Patient Record* that contains all health information about a resident in a simple and understandable format.
- *Patient Portal* that allows residents to access their personal health information and set their privacy preferences.
- *Provider Portal* that allows health and care providers to access their patients' health information to support them in making informed care decisions.
- *National Health Reporting Dashboards* area where health system stakeholders can access aggregated data sets, dashboards, and reports on national health system metrics.

Strategic Foundations

Successful implementation of a national digital health system requires strategic foundations. These include:

- *governance structures* to oversee the management and operation of the system
- *planning and investment*
- *regulation and legislation* to define and allow for enforcement of standards and data integrity
- *standards* to ensure interoperability
- *workforce skills* and training
- *monitoring and evaluation* of the digital health ecosystem

Part 4: Current State of Digital Health in Bermuda

To appropriately assess the current state of digital health in Bermuda, several resources were used, the findings of which are referenced throughout this section. They include, but are not limited to:

- *Community Engagement for the National Digital Health Strategy (April 2023)*
- *Bermuda Omnibus Survey (April 2023)*
- *Digital Health Maturity in Bermuda Current State Assessment (January 2023)*

The assessment included the following areas of focus:

- governance
- legislation and regulation
- planning and investment
- infrastructure
- services and applications
- workforce
- monitoring and evaluation

General Overview

Stakeholder feedback reflected an openness for change and enthusiasm for digitalisation within Bermuda's health system. There are strong local drivers for digital health, including the needs and goals within the broader healthcare system (e.g., to reduce chronic disease prevalence), the Government's broader attention to digitalisation, political will, and the necessity driving the UHC initiative.

The current state assessment surfaced concerns from the community that Bermuda's health system is not well run and that there are opportunities for improvement. Feedback suggests that there is limited faith within the health workforce and the community overall in the Government's ability to manage the health system effectively. Stakeholders expressed concern about the fragmented nature of Bermuda's health system and clinical care, and the resulting impact on cost, efficiency, safety, and quality of care. Digitalisation of health is seen as an opportunity to strengthen the health system overall and provide safer interactions within it.

Results from the April 2023 consultation exercise also indicate that while the community understands the general benefits of technology use, it currently needs more understanding of how a national digital health strategy will benefit them and the system.

Perceived reasons for the lack of progress with digital health include a lack of Government direction and drive, limited investment in health information technology and no regulations to support it, outdated legislation, and lack of engagement with (or even opposition to) previous health reform initiatives.

Health equity is a key concern of multiple stakeholders who cite the potential for lack of digital access leading to [digital exclusion](#), concerns about [data poverty](#), and the potential for a poorly devised and implemented digital health strategy to worsen health disparities.

Governance, Regulation, and Legislation

Good governance is the foundation and the means to facilitate high-performing and complex collaborations such as those required to implement digital health solutions in Bermuda successfully. A thoughtfully developed governance model for digital health will reduce risk, enable faster and safer progress, bring stability to the implementation process, and unlock new opportunities.

The current state assessment highlighted opportunities to bolster a digital health strategy through new policies, whilst simultaneously ensuring compliance with existing laws and regulations. The examination of the current regulations, policies, and laws that govern digital health surfaced gaps, barriers to implementation, conflicting policies, and the need for clarity on roles.

There is nothing specific to address digital health within the existing health system governance model. A cohesive digital health governance strategy, leadership, and principles are needed. A list of the current governance mechanisms that will impact digital health follows:



Several Bermuda laws contain health data requirements, including security and privacy, mandated reporting, clinical obligations and standards of practice, public surveillance needs, and how data are transferred. Our health system is also impacted by the requirements and legislation of overseas health systems with which Bermuda residents and visitors interact. All are currently disparate and unconnected, and many need to be updated. [Appendix II](#) provides a (not exhaustive) summary of current legislation that impacts digital health.

Although the development of health-related legal and regulatory frameworks in Bermuda is deemed slow-moving, there is a clear desire for more robust governmental policy and the operationalising of existing legislation. The current state assessment surfaced stakeholder concerns about privacy and security risks specific to health data, with particular concern over the potential for data leaks, breaches and hacks, improper data use, and data mismanagement and fraud.

A perception exists that there is little control over monitoring potential conflicts of interest within the system. Two main governance-related concerns were raised. The first is the challenge of developing national clinical guidelines. The second cited the need for consistency related to coding and the limited mechanisms to incentivise accurate coding.

Planning, Financing, and Investment

Sustainable and effective digital health implementation and maintenance requires a sound financing and investment plan. There is no known system-wide, national digital health financial plan or investment strategy. The Government budget also does not include an allocation for digital health initiatives.

To date, investment in digital health has been made at an organisational level. The largest is BHB's recent investment in PEARL, a digital health application from Cerner. The cost of PEARL will be \$55 million spread over ten years. The other significant healthcare-related technology expenditure identified was the Covid-19 Pandemic Administration System that Government invested \$7.7 million in.

Community clinicians and insurers have made varying levels of disparate investment into digital health; however, there was insufficient data to quantify the degree or amount of investment or to determine initial investment amounts and ongoing maintenance costs.

Over the course of this work, several financing and investment-related challenges and concerns surfaced. This included: misaligned incentives for digitalisation, a lack of incentives for doctors to integrate or interface with BHB's Cerner system, and the express need to ensure future plans address ongoing system maintenance costs in addition to the initial investment costs.

A high-level review of national digital health implementation strategies and costs by country was conducted as part of the current state assessment to inform future budgeting for Bermuda's digital health implementation. The review included Jersey, Queensland, Nova Scotia, and Jamaica. Financial data relating to digital health varied; however, it was difficult to determine the return on investment from national digital health systems. This is a global challenge. See [Appendix III](#) for information that was sourced.

Infrastructure and Data Standards

Mechanisms currently in place to support the implementation of digital health in Bermuda were reviewed and included data standards, interoperability, and overall digital infrastructure and data management.

There is minimal national coordination and no mandates or incentives for digital health adoption exist. This has resulted in limited national digital infrastructure and interoperability.

Connectivity between Government systems is minimal. Despite ongoing discussion regarding the Government's transition to the Cloud, as of the writing of this document, the Working Group is unaware of any comprehensive [cloud strategy](#).

There are no national data standards. Most data exchange is inconsistent and requires manual integration across multiple disparate systems. As a result, the adoption of digital health solutions is low compared to other high-income countries.

Results from the Ministry of Health's April 2023 Community Engagement for the National Digital Health Strategy report indicated a concern over the disjointed information-sharing processes between patients' General Practitioners ("GPs") and specialists.

Bermuda's providers are concerned about the limited ability of health information to follow patients as they move freely between providers. Current data exchange and transfer are inconsistent and inaccurate. Thus, the movement of patients without a matching exchange of data leads to waste, duplication, and an increased risk of harm.

While there is some view-only data exchange with overseas entities such as labs and diagnostic centres, the community raised concerns about medication safety arising from the disjointed sharing of prescription information.¹⁵

¹⁵ Ministry of Health, *Community Engagement for the National Digital Health Strategy Report*, April 2023.

There is an opportunity for the NDHS to leverage existing digital health-related initiatives such as:

- The Health Council's work on integrating insurance claims data (the largest pool of aggregate health data in Bermuda)
- The Health Council's work on developing a nationwide unique patient identifier
- BHB's recently approved Digital Health Strategy

Finally, approximately 75% of the community is supportive of additional uses of their clinical data for benchmarking, public health surveillance, academic research, and trend tracking. However, there are mixed views on the uses of health data for corporate research, with only 48% of respondents willing to consent.

Services and Applications

An assessment of the digital health services and tools currently in use within Bermuda's health system was undertaken to gain insight into usage patterns among different stakeholders and to help identify disparate access or use.

Bermuda's health system is characterised by a fragmented ecosystem of digital health services and applications between and within institutions. BHB's PEARL system creates good potential for digital integration across the health sector. There is a desire to seize the launch of PEARL as an opportunity to digitise healthcare system processes and services more broadly and to integrate systems. However, there is a general lack of system-level knowledge about digital services and applications across the health sector.

Through survey responses and working group research, it has been determined that at least 27 different systems are being used by community health service providers in various settings. A representative (but not exhaustive) map of the health sector's services and applications can be found in [Appendix IV](#).

The use of technology within the healthcare system is currently driven by providers, with some offering a selection of online services, while others offer none. For those survey respondents whose healthcare provider did have online services, the most common was online booking (27%), followed by a patient portal (24%), virtual consultations (18%), online payment (16%), and other (2%).

Interestingly, physician feedback reflects a relatively high uptake of technology; however, patients report a lower level of technology use within their care experience. This may indicate that digital tools are used mainly by clinicians to manage care records rather than their interactions and communications with patients.

Workforce

The assessment of digital health literacy and skill sets among health professionals informs the training and education needs that must be incorporated into the digital health strategy in order to support integrating digital health solutions into clinical workflows.

There is a noteworthy digital skills shortage in Bermuda in various digital health-related areas. This includes data management, coding, health informatics, infrastructure, and application support management.

As became apparent during the Covid-19 Pandemic, the quality and gaps in Bermuda's data hamper accurate analysis. Those who maintain healthcare databases are often not trained to correct errors in records. The limitations in data sets are not recorded anywhere; instead, they are only discovered when a database is analysed.

There are currently limited education and professional development opportunities relating to technology infrastructure, business intelligence, or digital health needs; the importance and relevance of these professions are also not taught in schools. While efforts are underway to address these issues through education reform and collaboration between the private sector and Bermuda College, it will be years before there is a critical mass of Bermudians who have the necessary technology-related skill sets and experience to fulfil the current and future roles.

Monitoring and Evaluation

Monitoring and evaluation mechanisms enable the assessment of digital health initiatives' impacts, identify areas for improvement, and assist in determining the most relevant and effective key performance indicators ("KPIs") to measure the success of digital health implementations.

Currently, no known mechanisms or processes are in place to monitor digital health activity, progress, or efficacy at a national level in Bermuda. There are no centralised reporting mechanisms, established KPIs, or trackable metrics. The quality of Bermuda's data is deemed very poor and inaccessible and presents a significant barrier to formal monitoring and evaluation within the health system generally.

Part 5: Digital Health Needs Assessment

Feedback from the Needs Assessment has been grouped into two main areas of focus – Community Needs and System Stakeholder Needs. While interconnected, they are distinct.

Community Needs:	Health System Stakeholder Needs:
<ul style="list-style-type: none"> • Community engagement • Digital health technology • Privacy and security • Accessibility and equity • Digital and health literacy 	<ul style="list-style-type: none"> • Clinical health and care information • Public health information • System-level information • Insurance/eligibility • Workforce training and development

Community Needs

Stakeholder engagement surfaced a diverse array of concerns and needs from the community, highlighting the importance of addressing the following pressing issues to ensure an inclusive and patient-centric approach to healthcare transformation.

Community Engagement Needs

1. A clear understanding of the national digital health strategy, with demonstrable results “should help with quality control for care and be transparent – say how it will be used, use it that way, and show the public.”
2. A streamlined and [integrated health system](#) that is cost-effective. It is recognised that the current health system is unsustainable, and that ‘waste’ must be removed from the system to improve affordability at the national and individual levels.



“[The Strategy] should help with quality control for care and be transparent – say how it will be used, use it that way, and show the public.”



“...reduce the costs in our healthcare system and reduce the overall cost of government operations, hospital operations, and wastage in the system”

Digital Health Technology Needs

In the Q1 2023 Bermuda Omnibus Survey, respondents were asked to select three choices from a list of eight possible tools or services (with an option for additional input through an open-ended response) that could be used to provide better healthcare service to residents. The top three selected were patient portals, which ranked the highest (56%), followed by electronic medical records (50%), and online appointment booking and reminders (42%). These results will inform the future community engagement strategy to ensure Bermuda residents are aware that remote monitoring and consultations are both feasible and worthwhile.

Tools and Services Which Could Be Used to Provide Better Healthcare Service to Residents

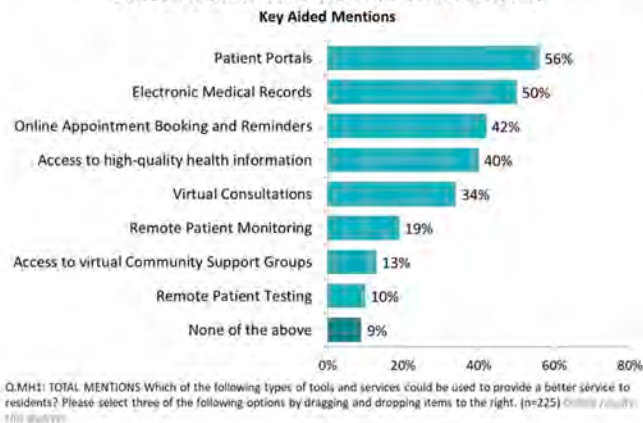


Figure 6: Bermuda Omnibus Survey, (Q1 March 2023).

Privacy and Security Needs

1. Assurances that data will be stored safely, that steps to mitigate security risks such as data leaks, fraud, scams, and cyber-attacks will be employed, and that there will be control over the sharing of personal information
2. The ability to name an advocate who can access their personal information if they feel uncomfortable using digital health tools or need access to the technology themselves



“Set the rules out before we collect and use the data – in the plan up front.”



Accessibility and Equity Needs

1. The ability to access health information from a smartphone or computer, whether overseas or in Bermuda
2. The ability to share medical information with care teams
3. A strategy that accommodates the digital needs of vulnerable groups, so they do not get left behind (e.g., seniors, people experiencing homelessness, people without home Internet access, those with intellectual disabilities, etc.)

Digital and Health Literacy Needs

1. Educational opportunities to improve [digital literacy](#)
2. Access to medical information in a simple and easy-to-understand format, so they can be more involved in their care and make more informed decisions with their care providers
3. Reports with healthcare insights to better understand how their conditions compare to others in Bermuda

Health System Stakeholder Needs

Bermuda's healthcare workforce is vast. It includes health and care providers across the community and at the hospitals, health insurance providers, Bermuda's health regulation team, our rest home caretakers, social care professionals, and many others. Their primary digital health need is to access health information through reliable systems to support the health and care needs of the community. Following are the requirements as indicated by key stakeholder groups in Bermuda's health system. It should be noted that this list is not exhaustive.

Clinical Health and Care Information Needs

1. Access the whole patient health record at the point of care as needed, to make more informed care recommendations and increase patient confidence in care recommendations
2. Training on how to enter information safely and accurately into medical information systems and defined processes for monitoring data quality

Hospital Information Needs

1. Access to results done at other lab and radiology centres. For radiology, access to the images
2. Access to a complete medication list – ideally including dispensing information from pharmacies
3. Patient summary information to have more information on patient care in the community
4. Electronic referrals to allow for better tracking and waitlist management
5. Ability to link to other data sets, like social determinants of health

Public Health Information Needs

1. Public health surveillance information flows that are secure and anonymised from point-of-care systems to centralised reporting systems
2. The ability to issue complete and accurate reports on the well-being of the population

System-level Information Needs

1. Electronic Master Patient Index (EMPI) to support a national patient and provider identifier to enable interoperability and sharing of data
2. The ability to access, aggregate, and analyse data on all residents to identify system-level trends and to share this information with policymakers so that Government officials can develop evidence-based healthcare policy
3. The ability to measure the impact of healthcare interventions over time

Insurance/Eligibility Information Needs

1. Access to clean and accurate claims data to understand the actual cost of healthcare services and improve the relevance of health insurance services.

Workforce Training & Development Needs

1. A specialised workforce of infrastructure specialists to build the integrated system
2. Business intelligence and health informatics specialists to manage the aggregated data and turn it into information that is useable for each stakeholder group
3. A plan to address the immediate and short-term needs to increase Bermuda's capacity of technology, business intelligence, and health informatics specialists to begin implementation of the digital health strategy
4. A plan to improve the accuracy of clinical coding in the short- to medium-term.
5. A plan to build long-term sustainability of the local workforce's capacity and capability in the fields required to maintain and enhance a digital health ecosystem
6. A plan to reskill and upskill today's healthcare workforce as the health sector becomes digitised
7. A plan to partner with local businesses to build career pathways so that Bermuda's next generation chooses to train in these fields (e.g., ABIC education awards model that created scholarships and sponsorship programmes for students to learn the reinsurance industry and led to the growth of the local workforce in that field).

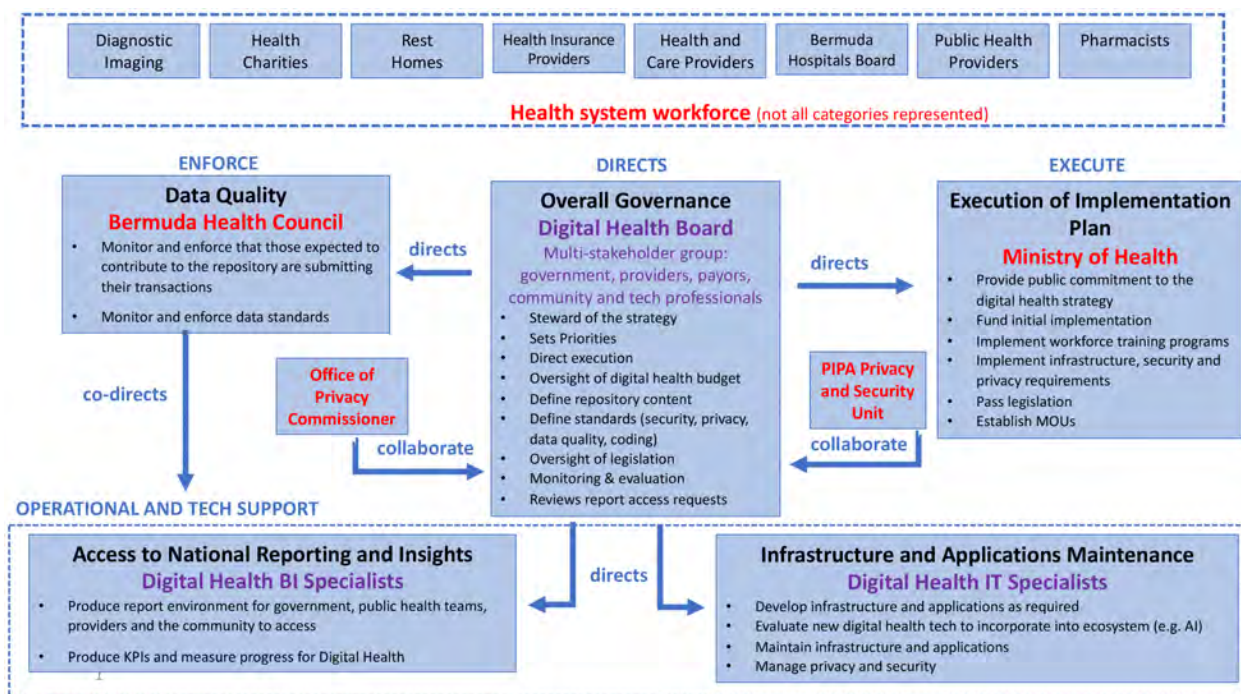
Part 6: Strategic Recommendations

The following strategic recommendations will enable the successful implementation of a national digital health system in Bermuda and support the implementation of equitable access to needed, informative, preventative, curative, rehabilitative, and palliative essential health services of sufficient quality to be effective, while also ensuring that people do not suffer financial hardship when paying for these services and critical medicines.

Select primary recommendations will include supporting recommendations. Primary recommendations can be found in [Appendix V](#).

Governance

1. Develop a collaborative yet independent governance model (example below) to orchestrate the National Digital Health Strategy in dynamic coordination with system stakeholders, with clearly defined mechanisms, responsibilities, and accountabilities.



2. Stand up an interdisciplinary, independent body with the responsibility and authority to oversee the NDHS, budget, execution, implementation, digital health policy, and ongoing monitoring and evaluation.
 - a) Include representatives from key stakeholder groups across the health system including clinicians, payers (public and private), community, technology (public and private), community-based businesses, BHB, non-profits, regulator(s), social services, senior care, public health, and Government.
 - b) Ensure the independent body has no single authority/role able to appoint or dismiss representatives. Each stakeholder group should nominate their representative. Where there is no organising body, the collective group should propose members.
 - c) Set a membership appointment structure with term limits and minimum-term period, with clear dispute resolution policies and procedures.

3. Obtain bipartisan commitment to the NDHS and its implementation.
 - a) Establish a specialist board that is “above the fray” to maintain public trust in who is holding and accessing their information.
 - b) Ensure the board is not used for partisan purposes.

National Data Standards

To lay the foundation for system-wide interoperability and improved data quality and coding in Bermuda, the following recommendations are proposed:

4. Establish and implement national health data standards (i.e., methods, protocols, terminologies, and specifications) supported by international bodies and account for different types of health data, including [genomic data](#).
5. Develop mechanisms to mandate the adoption of national data standards that include clear stakeholder accountability.
 - a) Leverage existing entities to pass legislation (e.g., Ministry of Health) and enforce standards (Bermuda Health Council), utilising Memorandums of Understanding to ensure collaboration and data quality.
 - b) Perform legislative review of current applicable health data-related legislation (including PIPA) with a view towards pro-harmonisation measures and ensuring protections from data misuse and abuse.
6. Develop privacy and security protocols that balance requirements to protect personal and sensitive health data without stifling digital innovation.
 - a) Develop consent mechanisms for residents to monitor and manage who can view their record and consent to any secondary uses of their health data.

Infrastructure

7. Build a national digital health platform to collect data from all health system stakeholders that allows for specified and secure access levels according to need and role.
 - a) Providers, payers, the Regulator, and Government should be mandated to submit information and can use their existing systems to submit their health data, provided they meet interoperability standards for flowing data to the integrated system.
 - b) Build a flexible reporting environment that includes a data lake to store unstructured and structured data that business intelligence specialists can use to generate reports to meet various stakeholder information needs.
 - c) Hire a business intelligence team to help regulators monitor and enforce adherence to national data standards and ensure appropriate access and data quality.
 - d) To ensure flexibility and sustainability, the national digital health platform should be cloud-based and built using internationally recognised open interfacing/API capabilities and flexible open-source software to support future tech innovation.
 - e) Purchase an Enterprise Master Patient Index (EMPI) system to manage the identification of patients and the workforce in the integrated system, leveraging existing identification systems to define universal identifiers.

- i) Leverage the significant progress of the Health Council in developing universal health identifiers for patients (the unique patient identifier) and providers and facilities (national patient identifiers).

Applications and Tools

- 8. Develop a national patient record that integrates all health information related to a person and allows individuals to access and add personal health content and manage privacy and access rights of their record via a 'patient portal'.
 - a) The portal should be accessible to an individual's care team to assist health and care providers make informed and safe care decisions.
 - b) Consider pilot projects within high-needs or high-opportunity/value areas to test the data environment (e.g., ePrescribing or clinical care pathway management for chronic disease (kidney disease, cancers, etc.)).

Workforce Development

- 9. Develop a phased workforce strengthening and sustainability strategy to address essential capacity and capability needs, focusing on immediate NDHS deliverables.
 - a) Build sustainability of local workforce capacity and capability by developing local education opportunities of digital health training and awareness, certifications, and partnerships with local industries and academic institutions.
 - b) Given the immediate need to increase Bermuda's technology capacity with technology and business intelligence/data analysts, priority should be given to addressing this workforce capacity deficit.

Community Literacy and Awareness

- 10. Develop a community awareness and education plan to assist with health literacy, digital literacy, and health system literacy, focusing on vulnerable populations and issues related to data poverty, digital disparities, and health inequities.
 - a) Develop a strategy to focus on granting access to the Internet to those without it before offering digital skills training.
 - b) Create Internet access points in the community to promote digital literacy. Select locations that are trusted and safe for vulnerable populations. Consider partnerships with trusted community groups or physician offices to assist these populations with setting up email addresses, booking appointments online, and accessing services and results online.
 - c) When building digital tools that require community accounts for access, consider creating accounts based on mobile phone authentication, not just email addresses.
 - d) Use patient portals to provide access to relevant information and in the process, grow awareness of health status, treatment options, and appropriate services.

Monitoring and Evaluation

- 11. Develop ongoing monitoring and evaluation mechanisms for digital health to track short-, medium-, and long-term goals.

- a)** Adapt international models to develop a ‘whole Bermuda system’ digital health maturity model to help identify milestone targets and assess progress over time. The digital health maturity model should define specific milestones that each health system stakeholder group must meet to progress digital maturity. See [Appendix VI](#) for a sample framework.
- b)** Develop key performance indicators (KPIs) to monitor the impact of digital health initiatives on the healthcare system and report these to the public. Use lag (indicators of past performance) and lead (indicators of performance that might predict future success) KPIs as crucial measures for progress.
- c)** Conduct regular workforce digital literacy assessments and stakeholder surveys to assess community and workforce engagement and satisfaction with the rollout of the strategy.

Planning and Investment

- 12.** Define the budget for the lifetime of the NDHS according to determined priorities and timing.
 - a)** Include implementation and ongoing maintenance costs, and identify critical project budgets.
 - b)** Determine the return-on-investment model appropriate for the Bermuda context and the varying stakeholder groups to aid with strategic prioritisation and goal setting.
- 13.** Establish multi-track financing options to avoid dependence on one financing source.
 - a)** Explore financing options, including public-private partnerships, innovation funds, partnerships with academic institutions, international bodies with digital health support initiatives, partnerships with local industries, direct government transfers, a regular contribution from the MRF fund, and self-financing options (e.g., membership fees).
- 14.** Develop a change management-based implementation plan to aid with execution and multi-stakeholder engagement and communication.
 - a)** Include a community engagement strategy that is aligned with the communications strategy for other national health priorities.
 - b)** Develop an action plan with detailed timelines and project management coordination that aligns with national strategy. The plan should define project priorities and dependencies and account for short-term opportunities, value creation, and risk assessment.
- 15.** Promote digital health innovation and research in Bermuda by developing a well-regulated, interoperable national system, creating the opportunity for Bermuda to serve as a regional innovation sandbox for digital health in the future.
 - a)** Research ways to leverage artificial intelligence and machine learning to facilitate the development of data insights and make healthcare processes more efficient.

A high-level Gantt chart of suggested milestones and timelines can be found in [Appendix VII](#).

Part 7: Conclusion

The transformative vision of the National Digital Health Strategy is to establish a sustainable and digitally integrated healthcare ecosystem designed to meet the diverse and sometimes divergent needs of the community, health professionals, and the Government. This comprehensive strategy focuses on improving quality and safety, and better health outcomes for all.

Through extensive stakeholder engagement and research, the NDHS identifies key focus areas, including governance, health data standards, interoperability, workforce development, community engagement, and financing. By prioritising these areas, Bermuda can build a strong foundation for a sustainable and digitally integrated healthcare ecosystem.

The initial key findings and strategic recommendations included within this document outline a best practice approach to ensure digital health can become a reality for the citizens of Bermuda. Recognising the complexity of digital health and Bermuda's health system, and the sheer number of diverse stakeholders involved, the need for good governance cannot be understated. A holistic approach, where each component of the health ecosystem is addressed individually yet connected as a whole, is essential for successful implementation.

Implementing digital health in Bermuda will be a collaborative effort spanning multiple years and phases. Achieving the ultimate vision of digital health for Bermuda will require the commitment, collaboration, and openness of all stakeholders in the health system. A comprehensive governance structure and practice must support this effort to ensure that the diverse worldviews of all stakeholders are utilised effectively. A holistic approach to its implementation will be required; one where the critical components of the health ecosystem are assessed and implemented individually as parts of an overall and completely interconnected whole. Implementing the NDHS will require commitment, collaboration, and ongoing adaptation to emerging technologies. By embracing digital health solutions, Bermuda could position itself as a regional leader in digital health innovation and research.

Digital health represents a transformative approach to healthcare that extends beyond mere technology. Digital health recognises that, at its core, healthcare is a human-centred endeavour and technology serves to improve the well-being of individuals and communities. It revolves around people utilising technology as a powerful tool to enhance outcomes. By seamlessly integrating innovative digital solutions, it empowers individuals to actively participate in their own healthcare journey, making informed decisions and accessing the necessary resources with ease. Ultimately, digital health underscores the importance of putting people first, leveraging technology to foster a more inclusive, accessible, and patient-centric healthcare ecosystem.

Digital health seeks to integrate efficiencies and cost-effectiveness into the healthcare system, addressing the current burden of health expenditures and the fragmented healthcare delivery in Bermuda. It aims to benefit healthcare providers by streamlining operations and enabling them to offer patients a seamless and effective experience across different care pathways. By leveraging digital solutions, healthcare providers can optimise their processes, reduce administrative complexities, and enhance overall efficiency. This relieves the financial strain on the healthcare system and improves the continuity and quality of care for patients throughout their healthcare journey. Digital Health strives to create a more cohesive, patient-centric healthcare environment in Bermuda.

The openness for change and enthusiasm for digitalisation within Bermuda's health system expressed by stakeholders are encouraging. They will be positive drivers for the adoption of new technologies and new approaches within the delivery of healthcare by both providers and members of the community.

Digital health plays a critical role in driving health reform and facilitating the adoption of a new sustainable healthcare model for Bermuda. By adopting digital health, we will not only realise our vision for a technologically advanced healthcare system but also contribute to the realisation of universal health coverage. Through digital health initiatives, we can ensure that every individual in Bermuda has access to affordable and high-quality healthcare services, ultimately leading to improved health outcomes for the entire population. By committing to Bermuda's digital health journey, we pave the way for a future where technology empowers individuals, enhances healthcare accessibility, and drives positive health outcomes for all.

Glossary

Please refer to the definitions below to better understand the terms and technical language used throughout this report.

allied health health professions that are not doctors, nurses, or dentists, but are specially trained and licensed (or certified) to provide a range of health services to prevent or treat acute and chronic diseases.

cloud solution hosting services via the internet; also known as cloud computing.

cloud strategy a plan that outlines best practices, tools, and services to use when implementing a cloud-based solution.

data poverty the inability to afford internet access (mobile or broadband) to meet essential needs, lack of data on certain segments of the population.

digital exclusion the difference between those who have adequate access and ability to use digital technology (i.e., internet and computers) and those who do not.

digital health is the use of technology within the healthcare system. The concept of digital health embraces a new way of working within healthcare – one that utilises technology, people, and systems to organise and deliver healthcare services and data efficiently. Ultimately, digital health is implemented to enhance access to affordable, quality care and to bring efficiency to the delivery of healthcare.

digital literacy being able to use different technologies (e.g., information and communication) to access, assess, create, manage, and communicate information; combines technical and cognitive abilities.

digitalisation transitioning existing everyday processes into digital technologies.

digitisation transitioning manual/analogue information into a digital format.

electronic health record an electronic/digital form of a patient's medical history that can be shared with other healthcare providers (e.g., specialists, laboratories, etc.).

genomic data information that comes from the analyses of DNA, genes, and the human genome

health literacy being able to find, understand, and use information and services to inform health-related decisions and actions.

integrated health system brings the organisation, management, and delivery of care to people in a way that addresses the kind of care they need (e.g., primary care, mental healthcare, etc.), when it is needed, in a way that will achieve the desired health outcomes more affordably and easily for the people needing care; a highly coordinated approach to healthcare that requires the ability to share information efficiently and effectively to everyone involved.

interoperability the ability of technology systems, applications/software, and devices to seamlessly communicate and share data.

synthetic data artificially created data (as opposed to data generated by real-world events). May be generated through computer simulation or algorithms when real-world data are not readily available.

universal health coverage (“UHC”) Bermuda's vision for UHC is for all people to have equitable access to needed, informative, preventative, curative, rehabilitative, and palliative essential health services of sufficient quality to be effective, while also ensuring that people do not suffer financial hardship when paying for these services and critical medicines.

Appendix I: National Digital Health Strategy Working Group Members

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Deann Trott	Nurse, Department of Health, Ministry of Health
Keechia Tuckett	Director, Health Insurance Department, Ministry of Health
Martin Walsh	Senior Manager Digital Services, Department of Information and Digital Technologies, The Cabinet Office

Appendix II: Current Legislation that Impacts Digital Health

CLINICAL REGULATIONS	
Allied Health Professions Act (1973)	Pharmacy and Poisons Act (1979)
Code and Standards of Conduct for Optometrists and Opticians (2015)	Public Health Act (1949)
Dental Practitioners Act (195)	Standards of Practice for Allied Health (2016)
Medical Practitioners Act (1950)	Standard of Practice for Dentists (2014)
Medical Practitioners Amendment Act (2016)	Standards of Practice for Medical Practitioners (2013)
Nursing Act (1997)	Standards of Practice for Nurses (2014)
Optometrists and Opticians Act (2008)	Standards of Practice for Pharmacists (2013)
OVERARCHING LEGISLATION	
Bermuda Constitution Order (1968)	
Human Rights Act (1981)	
Limitation Act (1984)	
DATA TRANSMISSION	
Electronic Communications Act (2011)	Health Insurance Regulations (2012)
Electronic Transactions Act (1999)	Personal Information Protection Act (2016)
Health Insurance Act (1970)	Telecommunications Act (1986)
STATUTORY REPORTING REQUIREMENTS	
Children Act (1998)	Occupational Safety & Health Act (1982)
International Health Regulations (2005)	Registration (Births and Deaths) Acts (1949)
Misuse of Drugs Act (1972)	Senior Abuse Register Act (2008)
EXTERNAL/INTERNATIONAL LEGISLATION	
American Recovery and Reinvestment Act (ARRA)/Health Information Technology for Economic and Clinical Health Act	Federal Trade Commission Act
Bill of Rights 14th Amendment	GDPR
European Convention on Human Rights	Health Insurance Portability and Accountability Act of 1996 (HIPAA)

Appendix III: Comparative Information on Countries' Spend on Digital Health

COUNTRY/ REGION	JERSEY	QUEENSLAND	NOVA SCOTIA	JAMAICA
Population Size	103,267	5,319,000	1,019,725	2,995,000
GDP (USD)		USD 243 billion	USD 37.7 billion	USD 14.66 billion
Country/Region Healthcare Spend (USD)	\$276M	\$15.6B	\$10.5B	\$894M
Public Healthcare Spend Per Capita (USD)	\$2,679.99	\$2,947.78	\$10,296.89	\$298.58
Who is Financing Digital Health	Government	Government	Government	\$50M loan from IDF, 10M grant from EU-Caribbean Investment Fund
Overall Digital Health Budget (USD)		\$481M for a 10-year plan	\$4.1 B	\$1.3B estimated for digital transformation with no timeline, \$20M initial plan over 5 years
Annual Cost of Digital Health	\$966,128		USD 145.3 million	\$4 million
Digital Health Initiatives	integrated national health record, patient portal, care pathways, workforce and community digital literacy, analytics, leveraging AI	provincial EHR for 16 hospitals (Cerner-iEMR), clinical and business intelligence, patient portal (MyHealth), telemedicine, AI, workforce planning	provincial EHR (Results, transcribed reports), radiology imaging and drug info system, provincial EMPI	\$8.5 million for integrated system, \$5 million for EHR (unclear if part of integrated system cost)

Appendix IV: Health Systems Currently in Use in Bermuda

BERMUDA HOSPITALS BOARD	
Cerner Millenium (PEARL)	Primary electronic medical record system for clinical and diagnostic services. Some services are provided through other applications that interface with Cerner.
COMMUNITY-BASED PROVIDERS	
Range of EDI Claim and Data capture programmes – most administered by off-island, third-party vendors	EDI Claim and Data transmission system for Health (physician), Dental, Pharmacy, Allied Health, and unregulated providers (associations only)
Innovative Medical Solutions OSCAR Clinical Suites Dragon Medical Dictation Bamboo TriMed	Electronic Medical Record systems
ENVIRONMENTAL HEALTH	
Vector Control Unit: BEDS	Documentation system for environmental health, port health, vector control, and occupational health & safety
GOVERNMENT DEPARTMENT OF HEALTH	
eTherapy Doc	Community Rehabilitation Services
Healthshare database	Licensing of daycare centres and providers
Electronic Immunisation Record	National pediatric and travel vaccine record system
10t8	Community Health appointment system
Penelope	Case management system for social services and community nursing
Schylab	Laboratory information management system
Power School	School disease surveillance system
MINISTRY OF HEALTH	
EpiInfo	Case management system for surveillance, monitoring, investigation, and control of communicable disease
Online reporting database developed by PAHO and UKHSA	System used for international reporting to WHO, CDC, and IHR
OFFICE OF THE CHIEF MEDICAL OFFICER	
Medical Registrations System	
OFFICE OF THE CHIEF MEDICAL OFFICE – EPIDEMIOLOGY & SURVEILLANCE UNIT (ESU)	
Online Outbreak Report	Online form for schools and childcare facilities to report disease outbreaks
Quantros	Online database for reporting adverse events following immunisations
PRIVATE INSURERS	
Plexis	Claims processing and benefit administration software
Javelina	Professional liability management system
Custom health (web-based) portals	Reinsurance (Stop Loss) system
Online claims filing (i.e., ANSI 837 5010, 4010 standards)	Claims processing systems
Eligibility Listing via SFTP (.txt. files)	

Appendix V: Primary Recommendations

1. Develop a collaborative, yet independent governance model to orchestrate the National Digital Health Strategy in dynamic coordination with system stakeholders, with clearly defined mechanisms, responsibilities, and accountabilities.
2. Stand up an interdisciplinary, independent body with the responsibility and authority to oversee the National Digital Health Strategy, budget, execution, implementation, digital health policy, and ongoing monitoring and evaluation.
3. Obtain bipartisan commitment to the National Digital Health Strategy and its implementation.
4. Establish and implement national health data standards (i.e., methods, protocols, terminologies, and specifications) that are supported by international bodies and account for different types of health data, including genomic data.
5. Develop mechanisms to mandate the adoption of national data standards that include clear stakeholder accountability.
6. Develop privacy and security protocols that balance requirements to protect personal and sensitive health data without stifling digital innovation.
7. Build a national digital health platform to collect data from all health system stakeholders that allows for specified and secure access levels according to need and role.
8. Develop a national patient record that integrates all health information related to a person and allows individuals to access and add personal health content and manage privacy and access rights of their record via a 'patient portal'.
9. Develop a phased workforce strengthening and sustainability strategy to address key capacity and capability needs with a focus on immediate National Digital Health Strategy deliverables.
10. Develop a community awareness and education plan to assist with health literacy, digital literacy, and health system literacy, with a particular focus on vulnerable populations and issues related to data poverty, digital disparities, and health inequities.
11. Develop ongoing monitoring and evaluation mechanisms for digital health to track short-, medium-, and long-term goals.
12. Define the budget for the lifetime of the National Digital Health Strategy according to determined priorities and timing.
13. Establish multi-track financing options to avoid dependence on one financing source.
14. Develop a change management-based implementation plan to aid with execution and multi-stakeholder engagement and communication.
15. Promote digital health innovation and research in Bermuda through the development of a well-regulated, interoperable national system, creating the opportunity for Bermuda to serve as a regional innovation sandbox for digital health in the future.

Appendix VI: Sample Digital Health Maturity Framework

Level 1: Initial	Level 2: Developing	Level 3: Maturing	Level 4: Advanced	Level 5: Innovating
<p>Limited or no digital health technologies in use.</p> <p>Manual, paper-based processes for most tasks.</p> <p>Minimal or no use of electronic health records (EHRs).</p> <p>Limited or no health information exchange (HIE) capabilities.</p> <p>No telehealth or remote patient monitoring programmes.</p> <p>Minimal patient engagement tools or capabilities.</p> <p>Limited or no data analytics or decision support tools.</p> <p>Basic cybersecurity measures in place.</p> <p>Minimal interoperability with other healthcare providers.</p> <p>Limited training and support for digital health technologies.</p>	<p>Some digital health technologies in use, but not fully integrated.</p> <p>Partially electronic processes with some paper-based tasks.</p> <p>Partial adoption of EHRs, but not fully utilised.</p> <p>Limited health information exchange capabilities with select partners.</p> <p>Limited telehealth or remote patient monitoring programmes.</p> <p>Basic patient engagement tools, such as patient portals or online appointment scheduling.</p> <p>Limited use of data analytics or decision support tools.</p> <p>Enhanced cybersecurity measures in place.</p> <p>Improved interoperability with some healthcare providers.</p> <p>Partial training and support for digital health technologies.</p>	<p>More comprehensive digital health technologies in use.</p> <p>Majority of processes are electronic with minimal paper-based tasks.</p> <p>Fully integrated and optimised EHR system.</p> <p>Established health information exchange capabilities with multiple partners.</p> <p>Robust telehealth or remote patient monitoring programs.</p> <p>Advanced patient engagement tools, such as secure messaging and access to health records.</p> <p>Advanced data analytics and decision support tools.</p> <p>Robust cybersecurity measures in place with regular audits and updates.</p> <p>High interoperability with other healthcare providers.</p> <p>Comprehensive training and support for digital health technologies.</p>	<p>Advanced and cutting-edge digital health technologies in use.</p> <p>Fully automated, paperless processes.</p> <p>Highly optimised EHR system with advanced functionalities.</p> <p>Seamless health information exchange capabilities with diverse partners.</p> <p>Matured telehealth or remote patient monitoring programmes with advanced features.</p> <p>Advanced patient engagement tools, such as personalised health plans or mobile apps.</p> <p>Advanced data analytics and population health management capabilities.</p> <p>Robust cybersecurity measures with advanced threat detection and response.</p> <p>Seamless interoperability with various healthcare providers, systems, and devices.</p> <p>Ongoing training, education, and support for digital health technologies.</p>	<p>Industry-leading digital health technologies in use.</p> <p>Continuous innovation and optimisation of processes.</p> <p>Cutting-edge EHR system with advanced analytics and AI capabilities.</p> <p>Advanced health information exchange capabilities, including nationwide interoperability.</p> <p>Innovations in telehealth, remote patient monitoring, and virtual care delivery.</p> <p>Advanced patient engagement tools, including personalised health coaching and AI-powered chatbots.</p> <p>Advanced data analytics and predictive analytics for proactive care management.</p> <p>State-of-the-art cybersecurity measures with real-time threat intelligence and response.</p> <p>Leadership in interoperability standards and data exchange.</p> <p>Continuous improvement of training, education, and support for digital health technologies.</p>

Appendix VII: Strategy Implementation Milestones

AREAS	DIGITAL HEALTH IMPLEMENTATION – MILESTONES	PHASE 1	PHASE 2	PHASE 3
Governance	Set up Digital Health Board			
Governance	Appoint members			
Governance	Define shared governance model responsible for each function			
Governance	Define entity terms and conditions (use RACI model)			
Governance	Define service model			
Governance	Develop constitution and by laws			
Governance	Define national standards for data quality and coding			
Governance	Agree access protocols			
Governance	Agree security protocols			
Governance	Identify consent mechanisms appropriate for Bermuda			
Governance	Harmonise our legislative needs with existing legislation			
Governance	Define cyber security strategy			
Governance	Set up mechanism to monitor cyber security			
Governance	Governance MOUs signed			
Governance	Develop legislation to mandate contributions to the integrated system			
Governance	Pass section 13 and other Digital health legislation identified			
Planning and Investment	Action plan completed			
Planning and Investment	Develop budget			
Planning and Investment	ROI model defined			
Planning and Investment	Secure funding			
Planning and Investment	Agree change management model			
Planning and Investment	Develop the change management plan			
Planning and Investment	Develop stakeholder engagement plan, for each stakeholder group			
Planning and Investment	Identify champions for each stakeholder group			
Planning and Investment	Community engagement strategy			
Planning and Investment	Develop innovation sandbox			
Planning and Investment	Establish research partnerships			
Infrastructure	Procure an Enterprise Master Patient Index			
Infrastructure	Implement EMPI			
Infrastructure	Procurement for infrastructure build complete			
Infrastructure	Integrated record system is built			
Infrastructure	Eligible providers are connected to registry			
Infrastructure	Integrated care record launch			
Infrastructure	Analytics environment build			
Infrastructure	Analytics environment launch			
Infrastructure	Community portal build			
Infrastructure	Community portal launch			
Workforce Development	Hire infrastructure specialists to manage infrastructure and applications			
Workforce Development	Hire business intelligence experts to run analytics environment			
Workforce Development	Explore academic partnerships			
Workforce Development	Develop communication plan using personas			

AREAS	DIGITAL HEALTH IMPLEMENTATION – MILESTONES	PHASE 1				PHASE 2				PHASE 3			
Community Literacy	Coordinate communication plan												
Community Literacy	Identify community champions												
Community Literacy	Set up digital access points in trusted places in community												
Community Literacy	Develop a Bermuda health tech maturity model												
Monitoring and Eval	Develop a Bermuda health tech maturity model												
Monitoring and Eval	Develop lead KPIs												
Monitoring and Eval	Set short-, medium- and long-term goals												
Monitoring and Eval	Conduct regular workforce digital literacy assessments												
Monitoring and Eval	Conduct stakeholder surveys to assess community and workforce engagement and satisfaction with NDHS rollout												

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