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The Impact and Benefits of the Digital Health Technology Management System Model on Environmental Public Health Underserved Thai People and Stakeholders

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Abstract

Thailand has been invested in digital health to improve health outcomes and well-being. The Ministry of Public Health has published a Digital Health Strategy (2021-2025), there are the key roles digital technologies can play in strengthening the health system. The Thai population should know the concepts of the digital health management system model (DHMSM) on environmental public health (EPH) with mHealth and eHealth data in the future in medical devices and allied technologies toward digital health. Designing mixed research methodology was administered with the original raw data from Documentary Research reviewed data management in the digital health management system model, digital health environment, and public attitudes toward digital health management system models for the environmental health of strategic direction for digital health risks are impacted and beneficial to 400 Thai patients, people, and stakeholders at the 4-Local Health Centers under the strategies and policies of the Ministry of Public Health of Thailand were assessed of their perceptions on the 36-item Benefits of the Digital Health Management System Model on Environmental Public Health (BDHTs) on six scales and the 35-item Questionnaire on the Impact of the Digital Health Management System Model on Environmental Public Health (IDHTs) on seven scales; each scale of two research instruments are independent variables, and the 24-item Public Attitudes Toward Digital Health Management System Models for Environmental Health (PADHTs) with the grand mean scores are dependent variable. In correlational research, relationships between the variables are associated with simple and multiple correlations and the regression coefficient is correlated and significant. The R2 coefficient values indicate that 71% and 79% of the variance in participants' guidelines of their attitudes on the benefits and impact of the DHMS on Environmental Public Health risks to promote wellness that its' impact and benefits to Thai patients are provided.

Keywords: *Strategy And Policy Digital Health, Digital Health Management System Model (DHMSM), Environmental Public Health (EPH), Patient's Perceptions of Their Benefits and Impact by the DHMSM), And Independent and Dependent Variables Are Associated.*

Introduction

Digital Health

Digital health refers to the using information and communications technologies in medicine and other health professions to manage illnesses and health risks and promote wellness. Digital health has a broad scope and includes wearable devices, mobile health, telehealth, health information technology, and telemedicine. Digital Health has been gaining momentum because it is envisioned to: Improve access to healthcare, reduce inefficiencies in the healthcare system, improve the quality of care, lower the cost of healthcare, and provide more personalized healthcare for patients. There is some evidence to show that digital medicine allows patients to track their health and wellness. For example, the use of digital devices like smartphones not only helps with communication, but these devices now have a huge number of apps that can help monitor blood pressure, record blood sugars, ensure compliance with medications, and track the amount of physical activity (Ronquillo, Meyers, & Korvek, 2023).

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A non-communicable disease (NCD) is a disease that is not transmissible directly from one person to another. NCDs include Parkinson's disease, autoimmune diseases, strokes, heart diseases, cancers, diabetes, chronic kidney disease, osteoarthritis, osteoporosis, Alzheimer's disease, cataracts, and others. NCDs may be chronic or acute. Most are non-infectious, although there are some non-communicable infectious diseases, such as parasitic diseases in which the parasite's life cycle does not include direct host-to-host transmission. Risk factors such as a person's background; lifestyle and environment are known to increase the likelihood of certain non-communicable diseases. They include age, gender, genetics, exposure to air pollution, and behaviors such as smoking, unhealthy diet, and physical inactivity which can lead to hypertension and obesity, in turn leading to increased risk of many NCDs. Most NCD diseases are considered preventable, they are caused by modifiable risk factors. Each year, 17 million people die from an NCD before age 70; 86% of these premature deaths occur in low- and middle-income countries. Of all NCD deaths, 77% are in low- and middle-income countries. Cardiovascular diseases account for most NCD deaths, or 17.9 million people annually, followed by cancers (9.3 million), chronic respiratory diseases (4.1 million), and diabetes (2.0 million including kidney disease deaths caused by diabetes). These four groups of diseases account for over 80% of all premature NCD deaths. Tobacco use, physical inactivity, the harmful use of alcohol, unhealthy diets, and air pollution all increase the risk of dying from an NCD. Detection, screening, and treatment of NCDs, as well as palliative care, are key components of the response to NCDs. (World Health Organization, 2023).

The Ministry of Public Health of Thailand has a policy to reduce crowding in hospitals, resulting in innovations in screening and monitoring blood pressure and blood sugar levels outside hospitals, online health records using applications on people's mobile phones, and connecting data with hospitals. Therefore, the Department of Disease Control and the Ministry of Public Health have developed guidelines for providing digital health stations in communities. This guideline guides public health personnel and those responsible for chronic non-communicable diseases, tailoring their operations to the specific context and network they oversee (Drug and Medical Supply Information Center, 2019). Policy on opening guidelines for providing 'Digital Health Stations in Communities' services using Applications strictly controls the NCDs. Noncommunicable Diseases (NCDs) are the leading cause of death in Thailand. The four most common NCDs are Cancer, Cardiovascular diseases, Diabetes, and Chronic obstructive pulmonary disease (COPD). Today, NCDs, primarily heart disease, stroke, cancers, diabetes, and chronic lung diseases, account for 74% of deaths in Thailand, or 400,000 people each year. NCDs are draining Thailand's health budget for universal health coverage (UHC) and hitting the national economy hard (Ministry of Public Health, 2022).

Moreover, NCDs are a huge economic burden costing the Thai society an estimated THB 280 billion in 2013. Behavioral risk factors for NCDs (tobacco use, insufficient physical activity, harmful use of alcohol, and unhealthy diet) and metabolic risk factors (raised blood pressure, overweight/obesity, raised cholesterol, and raised blood sugar) are highly prevalent in the Thai population to tackle NCDs and risk factors, Thailand has developed a national NCD strategic plan and adopted nine national targets in line with the global targets. NCDs are draining Thailand’s health budget for universal health coverage (UHC) and hitting the national economy hard. In 2022, the economic cost of NCDs was an estimated 198,512 million THB, or 2.2% of GDP, due to premature deaths, and loss of productivity in the workforce draining Thailand’s health budget (World Health Organization, 2022).

The mechanism for driving the action plan for prevention and control of noncommunicable diseases in Thailand (2023 - 2027): Noncommunicable diseases (NCDs) are the cause of death for 2 out of 3 of the Thai population and have been increasing over the past two decades (Ministry of Public Health of Thailand, 2022). Primary health professionals are well-positioned to support the delivery of patient self-management in an evidence-based, structured capacity. A need exists to understand, the active components required for effective self-management support, how these might be delivered within primary care, and the training and system changes that would subsequently be needed. It must be admitted that part of the situation is due to the lack of comprehensive screening services, access to management opportunities, and knowledge of self-management (Dineen-Griffin et al., 2019).

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"Opening of the Village Digital Health Station at Wat Thepsamosorn, Tambon Tha Phlo, Mueang Phetchabun District", which was organized to upgrade and develop the potential of sub-district health-promoting hospitals under the provincial administrative organization to be able to provide better services to people in the area, facilitate people conveniently and quickly by using technology to help manage information, including supporting proactive services in the community, such as providing a set of village health volunteer bags to equip them with equipment/tools to go to the community, visit homes, and set up a community health station so that people who are far from the sub-district hospital, when they are sick or have only minor symptoms, can receive services close to home, do not have to travel and wait in long lines at the sub-district hospital and can be used as a place for health screening, vaccination, and organizing health promotion activities in the community. The staff of Tha Phlo Sub-district Health Promoting Hospital to use the Smart OPD and the Prosthetic Device Center at Tha Phlo Sub-district Health Promoting Hospital, with the executives, members of the Phetchabun Provincial Administrative Organization Council, local leaders, village health volunteers, and the public joining the management (Phetchabun Provincial Administrative Organization Council, 2023).

Currently, there is an innovation in screening and monitoring services for blood pressure and blood sugar outside of hospitals using an application to facilitate and make it easier to access. Most recently, the Division of Noncommunicable Diseases, Department of Disease Control, Ministry of Public Health (MoPH) has developed the "Guidelines for Digital Health Stations in Communities" for public health personnel or those responsible for chronic noncommunicable diseases to use as guidelines for operations, which can be applied according to the context of the area and the network they are responsible for. As for digital health stations, they are places for self-health check-ups for people of all ages. People are serviced and can access at all times when they need to check their health. They are also a channel for communicating health risks via the Digital Platform. The "target area" is set as one village or community per district per province per health zone to provide a prototype digital health station at the village or community. The guidelines are to organize a digital health system to enhance people's self-assessment of their risks, to establish a prototype digital health station in the village or community, and to support the digital health station approach and model (The Coverage Info, 2022).

Digital Health Management

Digital information can transform the quality and sustainability of health and care. Used effectively, it can help save lives, improve health and well-being, and support a sustainable health system that delivers safe, high-quality, and effective health services for all Thai populations. 1Digitalization has become an instrumental factor in modernizing health systems and unlocking the value of data that underpins their operation. The potential efficiency of digitalization is key in working towards universal health coverage by providing safe, timely, and affordable access to health services for all. Digital approaches can facilitate training, surveillance, health security, and service delivery to underserved populations. '2Digital technology is key to transforming health and social care services so that care can become more person-centered.' Most importantly, they can empower communities and individuals to improve their health and well-being in new and innovative ways. 3"Technology can appear impersonal, but it has a unique ability to support and bind human beings as families and societies," (Nørby, 2024).

The digital health role-play has come under the spotlight during the COVID-19 pandemic. Using digital tools such as 4mobile chest X-ray and computed tomography (CT) contact tracing apps to monitor outbreaks, and online consultations to help keep health professionals and patients safe while providing continued care are some of the dimensions that the potential of digital health has been harnessed. Strategic uses of digital health have the potential to transform health systems to achieve improved health outcomes and well-being and to realize economic and social benefits. Thailand is investing in digital health, consistently, in the context of developing related national strategies, while trying to accelerate and scale up digital health transformation to address the challenges and realize the opportunities for their healthcare in the 21st Century. Digital health technologies are widely recognized as crucial to well-functioning health systems and empowering individuals as part of a transition to integrated, person-centered care. (Ministry of Public Health of Thailand, 2021).

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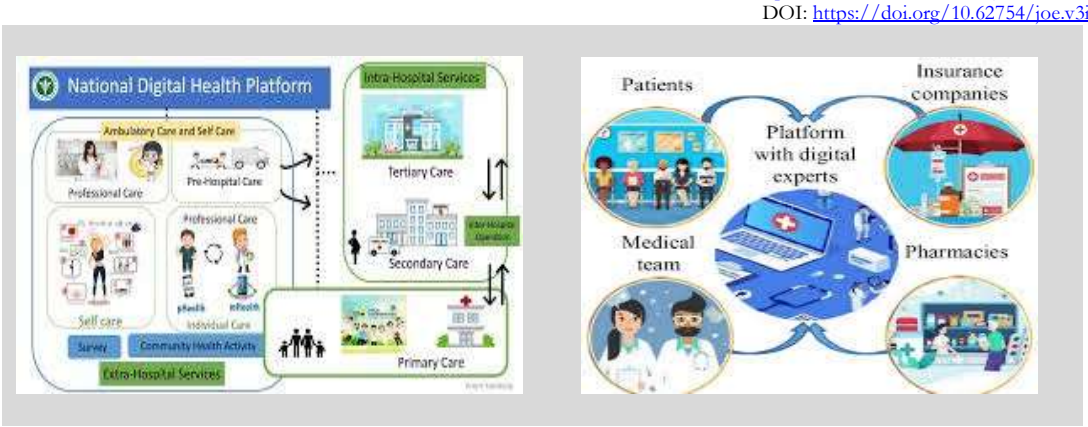

Figure Caption 1. National Digital Health Platform of Thailand

Source: Ministry of Public Health of Thailand (2021)

Strategy on Digital Health Management in Thailand

Strategic uses of digital health have the potential to transform health systems to achieve improved health outcomes and well-being and to realize economic and social benefits. The 2030 Agenda for Sustainable Development highlights that the spread of information and communication technology and global interconnectedness has great potential to accelerate human progress, bridge the digital divide, and develop knowledge in societies (World Health Organization, 2018). WHO's 13th Global Program of Work has committed to meeting the guidelines in the 2030 Agenda for Sustainable Development. This commitment will lead Thailand's action and engagement over the next five years, and it must be supported by an effort towards digitalization at every level of the health system, particularly in primary healthcare settings.

Digital health management also plays a significant role in achieving public health priorities put forth by the health policy framework endorsed by the Digital Government towards Thailand 4.0 in 2017, and in achieving the health-related Sustainable Development Goals (SDGs). In May 2018, during the 71s World Health Assembly, WHO Member States adopted the resolution WHA71.7 (World Health Organization, 2019), which emphasized the role of digital health in strengthening health systems and "as a means of promoting equitable, affordable and universal access to health for all". Thailand requires a more consistent and standardized approach to adopting and scaling up technologies in health. This necessitates both improving the understanding of how these technologies are managed – in terms of both their governance and financial sustainability – and establishing trust among the public and healthcare professionals in their use. Using mobile X-ray equipment could represent a safe approach, enabling imaging of suspected or confirmed COVID-19 patients, performing examinations in their houses or nursing homes, and reducing social contacts (Cozzi et al., 2020).

The Strategic Direction for Digital Health Thailand

Planning for, and aligning investments in, a standard-based digital architecture that facilitates data interoperability and maintains cybersecurity at the health systems level, as well as managing patient safety, and data privacy and protection at the clinical level, remain common challenges among healthcare units in the country. The first edition of the eHealth Strategy, Ministry of Public Health (2017 – 2021) was established in 2015 by the Information and Communication Technology Center, Office of the Permanent Secretary, Ministry of Public Health, to lead the development of the Digital Health Strategy (the Strategy) and its implementation. The Strategic Direction for Digital Health Thailand builds on resolutions adopted by the Digital Health, World Health Organization, and ITU, Global Digital Health Index, Thai Health strategies, Health Informatics on eHealth architecture, the resolution on ICD-11, as well as on information from Thailand's current digital health situation and status, actions, involved strategies, policies and investments, and recommendations of various panels on digital and innovation topics.

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The strategy is designed to be fit for purpose and for use by all healthcare sectors including those with limited access to digital technologies and services. This strategic direction needs to accelerate digital health adoption; the role of digital health in advancing health sector reforms and provide innovative mechanisms to deliver health services, methods for measuring progress in the uptake of digital health, and how to incorporate emerging technologies in strengthening health systems. This initiative aims to provide Thai health organizations, both public and private, with fast-track care services, an integrated approach to accelerate digital health adoption for strengthening health systems and enhancing public health capacity, and to reinforce the role of innovation in achieving national health policy objectives and key public health challenges.

Figure 2. Digitalization of Health Systems of the WHO Regional Office for Thailand

Source: Ministry of Public Health of Thailand (2021).

Digital technologies have transformed our lives from entertainment and communication to travel and banking; digital disruption has delivered efficiency, transparency, and convenience. Now the data-driven revolution is beginning to transform healthcare. By realizing the potential of digital health, we can accelerate the shift towards patient-centered, outcomes-focused access, and sustainable healthcare in Europe. We are focused on delivering access to new treatments and technologies today. To ensure the development of further medical innovation and a sustainable global healthcare system in a globally competitive Thailand, we must all work together now to make this a reality. EFPIA's strategic aim in the digital health space is to support the transformation of European healthcare have been adapted to use in Thailand for the benefit of patients and that digital evolution enables a move towards effective data-driven healthcare systems, ensuring the continued competitiveness (Figure 2).

Environmental Public Health

Environmental public health (EPH) studies how the natural and built environments affect human health. EPH specialists work to protect people from environmental hazards by identifying, evaluating, and controlling exposures to contaminants in the air, water, soil, and food. The environmental public health field advances policies and programs that reduce chemical and other environmental exposures in air, water, soil, and food. A key part of any comprehensive public health system, environmental health ensures everyone has a safe place to live, learn, work, and play (American Public Health Association, 2024). Environmental public health focuses on the positions of the natural and built environments that affect human health. Specialists in this field identify, evaluate, and control exposures to chemical and microbial contaminants in air, water, soil, and food to improve health and health equity (Nekata, 2024).

Climate change is impacting human lives and health in a variety of ways. It threatens the essential ingredients of good health - clean air, safe drinking water, nutritious food supply, and safe shelter - and has the potential to undermine decades of progress in global health. Between 2030 and 2050, climate change is expected to

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cause approximately 250,000 additional deaths per year, from malnutrition, malaria, diarrhoea, and heat stress alone. The direct damage costs to health are estimated to be between USD 2-4 billion yearly by 2030. Areas with weak health infrastructure – mostly in developing countries – will be the least able to cope without assistance to prepare and respond. WHO supports countries in building climate-resilient health systems and tracking national progress in protecting health from climate change (World Health Organization, 2024).

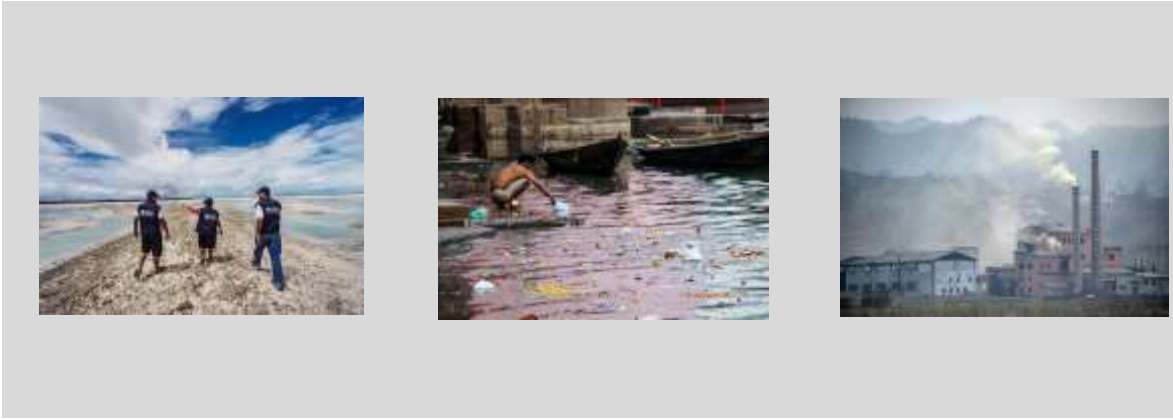

Figure Caption 2. Environmental Public Hearth

Source: World Health Organization, 2024

Benefits of Digital Health Management System Model on Environmental Public Health

Digital health management systems (DHMS) can have several benefits for environmental public health, including:

- Environmental pollution measurement: Digital health technologies can measure environmental pollution and predict how it can negatively impact health.
- Climate-related health impact modeling: DHTs can model how climate change will impact health and provide alerts about potential heat events.
- Healthcare decision support: DHTs can provide decision support tools that help with healthcare performance and quality.
- Reduced waste: Digital transformation can reduce waste and service costs by improving effectiveness while maintaining quality.
- Telehealth: Telehealth can reduce carbon emissions by reducing the daily commute of health professionals.
- One Health: The One Health concept integrates the health of people, animals, and ecosystems, including the potential digital health connections across these systems.
- Environmental health information systems: These systems can monitor health data regarding environmental hazards and human exposure.

However, DHTs can also have a negative environmental impact. They can generate a large amount of e-waste that isn't often managed well. They can also contribute to climate change if their environment's impacts aren't considered (Fragão-Marques & Ozben, 2022).

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Digital health technologies (DHTs) can have a significant environmental impact, and it's important to consider their environmental footprint when assessing their value to healthcare systems. Here are some ways to reduce the environmental impact of digital health:

- Environmental audits: Conduct environmental audits of digital health interventions to account for the environmental impacts of devices, data, computation, and telehealth centers.
- Green technologies: Use green information technologies and ethically source and dispose of devices.
- Sustainable practices: Lobby the digital technology field to make sustainable practices standard.
- Environmental regulations: Ensure environmental regulations are included in national and global health policy.
- Increasing equipment lifespans: The lifespan of equipment by 20% can reduce environmental impacts by 8.1%, increasingly.

In this research study, creative documentary data research methodology was reviewed to monitor and evaluate the impact and benefits of the digital health management system model on environmental public health of the Ministry of Public Health of Thailand has a digital health strategy that aims to improve healthcare delivery and quality of life by integrating digital technology into the national health system including eHealth Strategy, Digital health ecosystem, and Digital health interventions. The Ministry of Public Health also works with other agencies on environmental health issues, including the Third National Environmental Health Strategic Plan, and Environmental Health Standards Project. Creative quantitative research data methodology assessed the local patients' people who used to manage their Digital eHealth, Digital Health Ecosystem, and Digital Health Information Interventions. The research concludes with a discussion of what should be done to satisfaction and their attitudes to the impact and benefits of the digital health management system model on environmental public health.

Research Methodology

Research on documentary methodology, and quantitative research method on the local patients' people who were impacted and benefited from the Digital Health Management System Model on Environmental Public Health that these management's policies and plans by the Ministry of Public Health to the people in the local communities, sub-district healthcare center, the hospital districts, and the general hospitals' using the Digital Health Management System Model on Environmental Public Health were responses of their perceptions to their original raw of this research study, completely. We've made sense a step-by-step guide that we can follow below:

Research Objectives

- To explore stakeholders' perspectives on integrating the environmental impacts of DHTs in the assessment and procurement practices of their simplified benefits.
- To identify the factors enabling or constraining the operationalization of such a change in their daily lives
- To associate stakeholders' perceptions of their integrating the environmental impacts of DHTs to the factors enabling or constraining the operationalization with their attitudes toward a strategic policy for the DHTs of the government of Thailand

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A Documentary Data Research Methodology

The world's response to the pandemic has highlighted the importance of reliable data exchange between parts of the healthcare system and between countries. This has accelerated a greater reliance on telemedicine, a need to analyze large data sets to define research and testing and accelerate healthcare solutions. Focusing on Thailand, Thailand's digital health management system model is a patient-centric ecosystem that uses digital technologies to improve healthcare delivery, coordination, and integration. The model is based on a complex network of interactions between individuals, organizations, technologies, information, and resources. Here are some key aspects of Thailand's digital health management system model followed as each step of the research procedures' subsection:

Research Procedures

Step I: What do the patients use the Digital Health Management Model in Thailand

Thailand's digital health management model is based on a digital healthcare ecosystem, a network of technologies, organizations, and people that aims to improve healthcare delivery. The development goal of this model is to shift healthcare from an organization-centric model to a patient-centric model:

- Promote citizen-centric healthcare services in correspondingly Digital Health development: Citizens can utilize their health systems and applications for managing health and communication. In the healthcare process, Thai citizens can play a more active role, being empowered to participate in decision-making processes regarding their health issues, and their health data. Promote individual health literacy, by offering an online health coaching program to scale up healthy behaviors and proactive healthcare.

- Embrace value-based management by developing a digital health ecosystem: Creating an interoperable digital health ecosystem has been understood as a digital interoperable information technology infrastructure of the healthcare community across all care settings. An interoperable digital health ecosystem should enable the seamless and secure exchange of health data by and between users, healthcare providers, health systems managers, and health data services

- Promote better integration of health information systems (HISs): Health data integration enables a collaborative utilization of data across different systems. All health data activities should lead to better integration including better opportunities for linking data between different registries, integration of relevant data sources in a central database or platform, integration of information on health and social care, and opportunities to integrate data at the personal level.

- Create and implement a digital health platform (DHP) to serve as the underlying infrastructure for an interoperable and integrated national digital health system: Digital health platforms provide a vital central hub, linking together disparate and unconnected systems and applications, enabling faster, more efficient and more reliable information exchange, and promoting increased access to health data across a range of devices, such as Internet of Thing (IoTs) that can be linked with Telemedicine. A DHP will improve how health applications and systems work together and accelerate innovation and growth in public health service delivery, ultimately leading to improved health outcomes.

Digital health is a broad term that encompasses a variety of terms including e-health, m-health, and telehealth, and captures everything from electronic patient records, remote monitoring, connected devices, digital therapeutics, and more. It means embracing information technology, big data, AI and machine learning to collect, share, analyze, and use data on patient outcomes to help healthcare professionals make informed decisions and improve care. The patient-centered disruption has rapidly changed how environmental public health operates and how services are developed and delivered, rebuilding

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relationships between key factors such as research-based patients, healthcare professionals, health institutions, and regulators.

This is not science fiction. The tools and technologies that will reshape healthcare are rapidly becoming available in hospitals and homes across Europe. The digital transformation is already here.

- Optimized Diagnosis: Radiology departments use artificial intelligence (AI) to optimize diagnosis.
- Enhanced Monitoring: 'Smart inhalers are monitoring asthma patients' using medication.
- Remote Engagement: Medical specialists offered advice to patients and trained colleagues remotely.
- Connected Data: Clinics securely share vital patient information to enhance individuals' care.
- Ongoing Feedback: Outcome data is being pooled to extract real-world insights on how interventions add value.
- Tech-enabled Delivery: Drone technology is being used to deliver medicine in remote areas in times of crisis.
- Improved Efficiency: Blockchain technologies are being considered to increase efficiencies across global supply chains and speed up the time of manufacturing and delivering medicinal products to patients.
- Breakthrough Research: Clinical trial data from around the world is shared across borders to more quickly develop new medicines that are safe and effective

There is more to come. Researchers are exploring how blockchain technology could enhance information security, how remote monitoring can improve patients' experience and make services more efficient, and how citizens can enjoy real control over their health data.

Step II: What is the Concept of the Digital Health Management System Model

The digital health management system model, also known as the connected health management model, is a conceptual model that uses technology to improve healthcare delivery by putting the patient's needs first. The model aims to create a proactive, efficient, and patient-centric healthcare system by:

- Sharing data: Sharing patient information promptly and accurately across all stakeholders.
- Designing around the patient: Designing devices, services, and interventions around the patient's needs.
- Using technology: Using technology to improve healthcare delivery, coordination, and integration

The Ministry of Public Health of Thailand has a digital health strategy that aims to improve healthcare delivery and quality of life by integrating digital technology into the national health system to the local patients' people at their local Healthcare Centers and Others using:

- Digital health ecosystem: A complex network of interactions between people, organizations, technologies, information, and resources that support the health sector. The goal is to encourage collaborative healthcare delivery.

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- Connected health management model: A model where devices, services, and interventions are designed around the patient's needs. The goal is to share health-related data so that patients can receive care efficiently and proactively.

- Digital health: The use of information and communications technologies in healthcare to manage health risks and illnesses, promote wellness, and improve healthcare delivery. Digital health includes telehealth, mobile health, wearable devices, and health information technology.

Digital health can improve healthcare by improving access to healthcare, reducing inefficiencies in the healthcare system, improving the quality of care, lowering the cost of healthcare, and providing more personalized healthcare for patients.

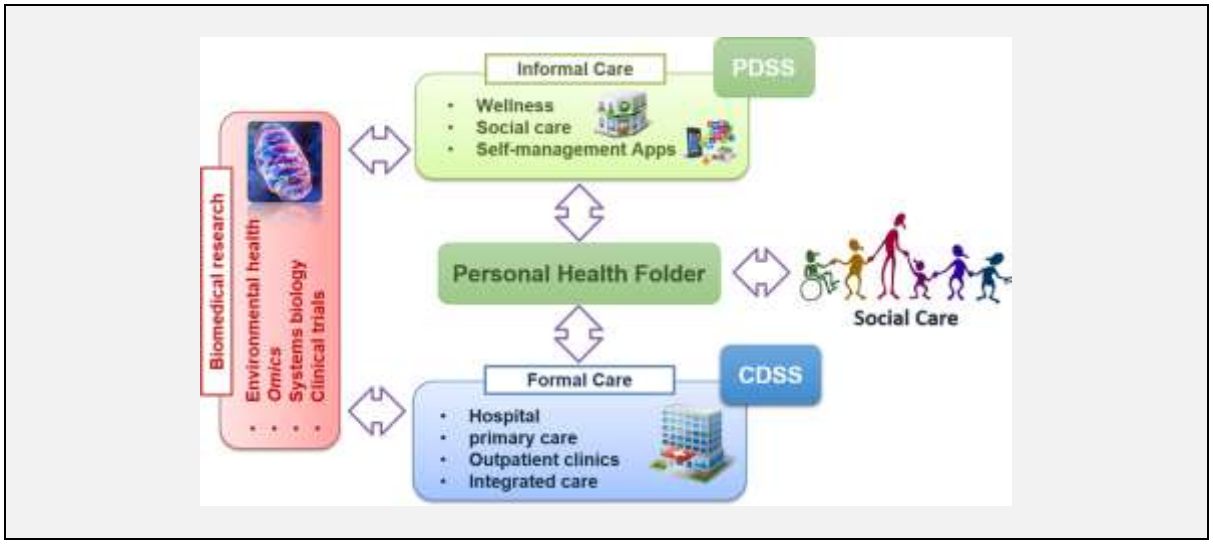

Figure 3. The Concept of The Digital Health Framework Covers the Different Areas Wherein the Information

Source: The Ministry of Public Health of Thailand Strategy 2022-2025 (2021)

Step III: How can local patients use the Digital Health Management Model

Digital health technologies can help patients manage their health in many ways, including:

- Communication: Patients can ask questions, provide feedback, and receive guidance from healthcare providers outside of face-to-face visits.

- Monitoring: Patients can monitor their health at home with wearables and remote monitoring systems. This allows healthcare providers to detect and address health issues more proactively.

- Personalized care: Healthcare providers can use digital health technologies to create tailored treatment plans for individual patients.

- Self-management: Patients can use digital health tools, that independently manage their health, such as medication reminders, exercise trackers, and nutrition apps.

- Prevention: Digital health tools can help promote prevention and good health behaviors.

- Improved diagnosis: Digital health technologies can improve diagnostic capability.

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Some examples of digital health technologies include fitness trackers, assisted living sensors, personal health records, prescription management apps, maternity and family apps, and health management apps, which fully utilize the potential of the DHTs and are important to ensure that healthcare professionals are trained in their use and involved in the implementation process. These advancements are leading to the convergence of people, data, technology, and connectivity to improve healthcare and improve health outcomes of patients. Under the role of digital health are mobile health (mHealth) apps, electronic health records (EHRs), electronic medical records (EMRs), wearable devices, telehealth and telemedicine, and personalized medicine (Awati & Bernstein, 2021).

Figure 4: Patients Can Use Digital Health Tools, That Independently Manage Their Health, Such as Medication Reminders, Exercise Trackers, And Nutrition Apps.

Source: Awati and Bernstein (2021)

Step IV: Digital Health Management System Model on Environmental Public Health data in the future

The inventions and technologies that will reshape environmental and social healthcare are rapidly becoming available in hospitals and homes across Europe. The digital transformation is already here:

- Optimized Diagnosis: Radiology departments use artificial intelligence (AI) to optimize diagnosis.
- Enhanced Monitoring: 'Smart' inhalers monitor asthma patients' medication of use.
- Remote Engagement: Medical specialists are offering advice to patients and training colleagues remotely.
- Connected Data: Clinics securely share vital patient information to enhance individuals' care.
- Ongoing Feedback: Outcome data is being pooled to extract real-world insights on how interventions add value.
- Tech-enabled Delivery: Drone technology is being used to deliver medicine in remote areas in times of crisis.

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- Improved Efficiency: Blockchain technologies are being considered to increase efficiencies across global supply chains and speed up the time of manufacturing and delivering medicinal products to patients.

- Breakthrough Research: Clinical trial data from around the world is shared across borders to develop new medicines that are safe and effective.

There is more to come. We are exploring how blockchain technology could enhance information security, how remote monitoring can improve patients' experience and make services more efficient, and how citizens can enjoy real control over their health data (Figure 4).

Step V: How can use the Internet of Medical Things and Blockchain-Enabled Patient-Centric agent through Software-defined networking (SDN) for remote patient monitoring in a 5G Network

In the three last decades, there has been a significant increase in the use of Internet resources for accessing medical care, resulting in the development and advancement of the Internet of Medical Things (IoMT). Nevertheless, the preservation of privacy and security in the realm of online communication continues to provide a significant and pressing obstacle. Blockchain technology has shown the potential to mitigate security apprehensions across several sectors, such as the healthcare industry. Recent advancements in research have included intelligent agents in patient monitoring systems by integrating blockchain technology. However, the conventional network configuration of the agent and blockchain introduces a complexity. The architectural design contains a patient-centric agent (PCA) including the SDN control plane to manage user data on behalf of the patients, the appropriate handling of patient data is ensured by the PCA via the provision of essential instructions to the forwarding devices, the suggested model is assessed using Hyperledger fabric on Docker Engine, and its performance is compared to that of current models in fifth-generation (5G) networks. The performance of our suggested model surpasses current methodologies, as shown by our extensive study, including factors such as throughput, dependability, communication overhead, and packet error rate (Figure 5).

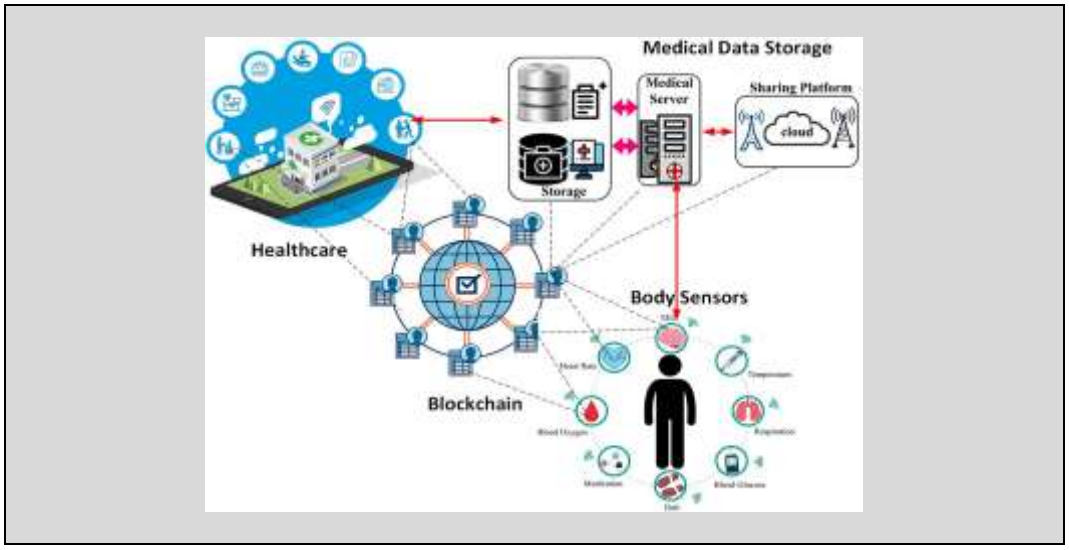

Figure 5. Internet of Medical Things and Blockchain-Enabled Patient-Centric Agent Through SDN For Remote Patient Monitoring In 5G Network Rahman et al., (2024).

Step VI: Why is health data access important to Digital Health Model Research Methodology on Environmental Public Health?

Health data is the mechanism driving the research and innovation engine of healthcare. There is significant scope for the EHDS to improve data sharing in the Royal Kingdom of Thailand which was an adapted

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version of the original of the EU. Thailand could strengthen public health, deliver better health outcomes for citizens, and promote Thai environmental and social health well-being:

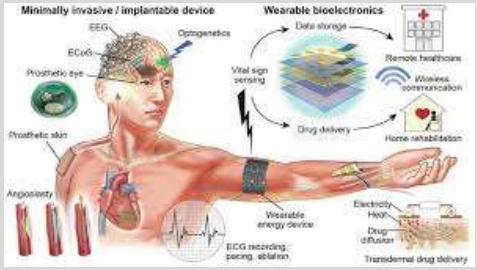
- Health data research: Health data research can help identify people at risk of illness, diagnose diseases, and improve care. It can also help health services run more efficiently.

- Data ethics and governance: Ethical and legal constraints on data access vary across different types of health data. For example, environmental health data may have looser restrictions than human health data.

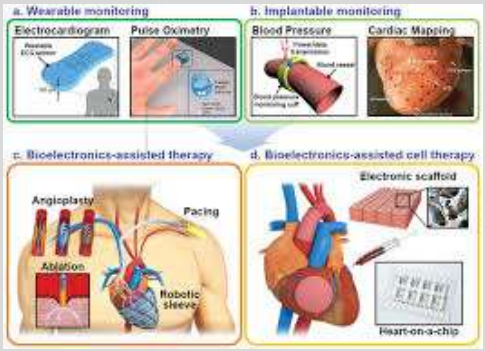
- Health data: Health data includes clinical metrics, as well as environmental, socioeconomic, and behavioral information. It can be collected from a variety of sources, including healthcare providers, wearable devices, and other relevant sources.

- Digital transformation: Digital transformation in healthcare is the integration of digital technologies, data analytics, and innovative processes to improve healthcare services. (Figure 6).

a) A schematic showing various avenues of digital health technology-enabled telemedicine modalities.



b) Digital health-focused medical devices



c) Cardiovascular Health

Figure Caption 6. Health Data Access Important to Digital Health Model Research Methodology on Environmental Public Health

Source: Health Data Governance Center (HDGC) (2024).

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Figure Caption 6(a) enables remote patient monitoring and teleconsultations, such as remote patient monitoring systems, webcams, and handheld devices with cameras and communication capabilities. Following the Health Data Governance Center are some of the latest trends and developments in the area. Health Data Governance Center (HDGC) is a working group conducting regular meetings with stakeholder participation and consultations. It monitors the implementation of digital health, based on a working plan, and provides digital health information exchange services while monitoring the health information exchange processes.

Step VII: Developments in medical devices and allied technologies toward digital health

Digital health-focused medical devices are to utilize digital technologies to improve health and healthcare. These devices play an increasingly important role in improving healthcare delivery by enabling remote patient monitoring, increasing access to medical services, and reducing healthcare costs. They also offer the potential for improved patient outcomes by enabling early detection and intervention in medical conditions. However, there are challenges associated with these devices, such as the need for appropriate regulatory oversight, privacy concerns, and attention to cybersecurity risks (Figure 6(b)). Band-Aid style patch for continuous detection of ions in sweat, with RFID antenna for wireless signal transmission. One-time, colorimetric detection of sweat analytes is realized using colorimetric assay reagents encased in microfluidic wells. d Layer components of flexible drug delivery microdevice (f-DDM) comprise a PET substrate, an epoxy micro reservoir, a metal membrane, and a passivation layer (left). Schematic of the f-DDM inserted beneath the skull in a live mouse through a small cranial slit (Figure 6(c)).

Step VIII: Mobile health (mHealth) application Thailand

Mobile health (mHealth) apps have gained widespread popularity, enabling individuals to seamlessly track fitness, monitor health conditions, and access healthcare information. Meanwhile, electronic health records (EHR) are becoming more prevalent, with hospitals and clinics adopting digital systems for efficient storage and sharing of patient data. Telemedicine, though in its early stages, is making headway, especially in rural areas with limited healthcare access. Online sales channels for pharmacies are on the rise, particularly after patients' mobile health (m-health) applications. Currently, mHealth is widely used for health education, medication, prevention of illness, etcetera. However, women are extremely sensitive to their design. While the number of m-health applications for women is increasing, many are of poor quality and have development issues (Figure Caption 7).

a) Mobile health apps, as a form of automated healthcare solutions

Source: Riken Shah (2021)

b) Exploring the Rise of Mobile Health Apps in 2024

Source: Empowering Global Businesses (2024)

Figure Caption 7. Mobile health apps' form to be developed for Exploring the Rise of Mobile Health Apps in 2024

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Figure Caption 7(a) details mHealth or mobile health which is rapidly turning into the new normal of healthcare. Agile technological adoptions of mobile health have created a plethora of opportunities for remote caregiving and speedier service. A cheaper and faster diagnosis is the biggest advantage of mobile health, but there are several others. mHealth apps have significantly improved the quality and approach toward healthcare services. The proliferation of mobile health apps has revolutionized the guide individuals engage with their wellness and healthcare needs. In 2024, these apps have become indispensable tools, and offer functionalities that empower users to monitor their health, access medical services remotely, and make informed decisions about their well-being (Figure Caption 7(b)).

Sep X: The Thai Government supports the Digital Health Certification Program

The strategic design of Thailand's digital health innovation aims to address persistent challenges in healthcare, including inefficient systems, limited resources, and escalating costs. By streamlining processes and enhancing overall accessibility and quality of healthcare services, the nation is actively shaping the future of its healthcare landscape. Health analytics, powered by advanced software and algorithms, is gaining traction for its ability to analyze vast healthcare datasets, improving disease surveillance and personalized medicine. Online channel pharmacies are rising, particularly after the COVID-19 pandemic, reflecting a growing trend in digital health adoption. This digital health transformation is not confined to healthcare facilities alone; it extends to life insurance companies and specialized telemedicine firms, indicating a comprehensive integration across various sectors.

Step XI: Digital Health Outlook in Thailand

Look ahead, future trends in Thailand's digital health transformation point towards heightened collaboration between public and private entities. Government agencies are increasingly seeking partnerships with healthcare and digital platform providers, fostering the development of digital technologies. Moreover, a surge in investment activities is anticipated as the demand for more efficient healthcare services continues to grow. This influx of funds. Local and international, is expected to lead to the development of more sophisticated technologies, broadening the scope and effectiveness of healthcare offerings. Integrating new digital technologies is a key focus for the future, with room for growth in technologies still in their infancy. Blockchain, in particular, is anticipated to play a crucial role in ensuring the security and swift transfer of patient medical records.

Step XII: Digital health stations launched in Thailand

New digital health stations are rolled out across malls, shops, and markets nationwide in Thailand to ensure that every Thai citizen has easy access to free or affordable health screenings and consultations, promoting accessible healthcare for all. These stations are connected to online telemedicine services staffed by doctors, offering convenient medical consultations without long travel or extended waiting times. Digital health platform: In January 2024, a digital health platform was expanded to include four provinces in the first phase and eight more provinces in the second phase. The digital health stations platform includes features like patient information confidentiality and safety, and identification with national ID cards (Health Tech Asia, 2024).

Step XIII: Quantitative Data Research Method

Creative research instruments assessed the patients who used to be supported and well-known by the Health Official Centers under the Ministry of Public Health of Thailand of their perceptions to their satisfaction and to be able to contact and use their digital health application, successfully. The process collects and analyzes numerical data and can be used to find patterns and averages, make predictions, test causal relationships, and generalize results to wider populations.

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Participants

This study focused on being well-known for digital health technology operations, health innovation, and a paradigm shift including the civil service welfare system for civil servants and their families; and social security for general patients. A further issue is that care is restricted to specific hospitals that patients are assigned to have been developed by the Ministry of Public Health in Thailand including an eHealth Strategy to use digital technology to drive the national health system. The participants consisted of 400 patients, people, and stakeholders who are eligible to use the services of the Ministry of Public Health's digital health management system model.

Research Instruments

Digital health technologies (DHTs) are promoted as a means to reduce the environmental impact of healthcare systems. However, a growing literature is shedding light on the highly polluting nature of the digital industry and how it exacerbates health inequalities. Thus, the environmental footprint of DHTs should be considered when assessing their overall value to healthcare systems. The objectives of this article are to: (1) explore stakeholders' perspectives on integrating the environmental impacts of DHTs in assessment and procurement practices; (2) identify the factors enabling or constraining the operationalization of such a change; and (3) encourage an attitude constructive dialogue on how environmental issues fit within healthcare systems' push for more DHTs; (4) associate the impact and benefits of the digital health technology management system model on environmental public health for Thai's stakeholders

The Benefits of the Digital Health Management System Model on Environmental Public Health (BDHTs)

The Ministry of Public Health of Thailand has a digital health strategy that aims to improve healthcare delivery and quality of life by integrating digital technology into the national health system for the local patients' people and stakeholders at their local Healthcare Centers and Others. Creative the 36-item Benefits of the Digital Health Management System Model on Environmental Public Health (BDHTs) on six scales, namely Communication, Monitoring, Personalized Care, Self-management, Prevention, and Improved Diagnosis scales; each scale consists of six items on five options' level: Strongly Agree (5), Agree (4), Neither Agree nor Disagree (3), Disagree (2), and Strongly Disagree (1). The BDHTs instrument assessed the 400 participants' perceptions of the benefits of the Digital Health Management System Model.

The Impact of the Digital Health Management System Model on Environmental Public Health (IDHTs)

Designing the 35-item Questionnaire on the Impact of the Digital Health Management System Model on Environmental Public Health (IDHTs) on seven scales; namely: Optimized Diagnosis, Enhanced Monitoring, Remote Engagement, Connected Data, Ongoing Feedback, Tech-enabled Delivery, and Improved Efficiency scales; each scale consists of five items on five options: Always, Often, Sometimes, Seldom, and Never perceptions' levels.

Public Attitudes Toward Digital Health Management System Models for Environmental Health of Strategic Direction for Digital Health Thailand (PADHTs)

Digital health technologies have the potential to: Improve access to healthcare, reduce inefficiencies in the healthcare system, Improve the quality of care, Lower the cost of healthcare, and provide more personalized healthcare for patients. Public Attitudes towards Digital health technologies frequency of use of digital health technology and consideration of use present potential barriers to accessing future healthcare in Thailand. Creative the questionnaire on the 24-item *Public Attitudes Toward Digital Health Management System*

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Models for Environmental Health of Strategic Direction for Digital Health Thailand (PADHTs) in four scales, namely: Digital Health Ecosystem (DHE), Connected Health Management Model, Communication Digital Health (CDH), and Self-Management/Personalized Care attitudes. The participants responded to five options: Always, Often, Sometimes, Seldom, and Never perceptions levels

Data Analysis

The Documentary Data Methodology was reviewed and reported via description, the three research instruments were analyzed with internal consistency (Cronbach Alpha Reliability) coefficient, and associations between the independent and dependent variables' scales were assessed using simple and multiple correlations, standardized regression weight coefficient, and determination predictive value coefficient analysis.

Results

Current trends in Thailand's digital healthcare technology highlight a significant increase in overall efficiency. Six key technologies underpin Thailand's digital health transformation. They are mobile health (mHealth) apps, electronic health records (EHR), telemedicine, wearable technologies, health analytics, and online pharmacies.

A Documentary Data Methodology

Investigating the IT information and communications technologies in medicine and other health professions to manage illnesses and health risks and promote wellness with a digital health management system model on environmental public health risks are impacted and beneficial to Thai patients at the Local Health Centers and Communities, Sub-District Publics Health Hospitals, District Hospitals, etc., in Thailand whereas the patients who used to register and apply the applications of the Digital Health Management System Model under the Ministry of Publish Health's plans and policies are supported and divided. The results in this section will be reported in Table 1.

A Documentary Data Methodology	**Resulting in the Digital Health Management System Model under the Ministry of Publish Health's plans and policies**
The Concepts of the Digital Health Management System Model (DHMSM)	The National Plan for Preventions and Control of Non-Communicable Diseases (2025-2027), Thailand has planned the project and policy to risk factors such as a person's background; lifestyle, and environment are known to increase the likelihood of certain non-communicable diseases. The model is based on the idea of a digital health ecosystem and is a complex network of interactions between people, organizations, technologies, and resources
Digital health stations launched in Thailand	Thailand is home to 38,512 facilities that offer some form of healthcare services. About 35 percent of these are state-funded such as public health centers, district public health offices, community, and general hospitals. The remaining 65 percent are private ventures such as private clinics and hospitals. Each station is equipped to measure basic health vitals such as body weight, temperature, blood pressure, heart health, glucose levels, blood oxygen levels, and eye health, among other medical indicators.
The DHMSM on Environmental Public Health (EPH) data in the future	Digital health systems can improve the quality of care and reduce disparities in access and care. Digital health systems can be used to improve environmental public health: capture environmental determinants of health; improve resource use; promote circular economy strategies; improve data quality; and improve data security and privacy.
The Thai Government supports the digital	Government support plays a crucial role in this transformation. Initiatives such as the Ministry of Public Health's e-Health Strategy and the Digital Health Certification Program by the Ministry of Digital Economy and Society underscore the commitment to quality, safety, and standardized digital health

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health certification program	innovations, which has experienced a remarkable 27% growth in market size from 2020 to 2022, and from 2022 to 2027.
Developments in medical devices and allied technologies toward digital health	Digital transformation in the medical device industry is pivotal for enhancing quality management. The invention of an electronic Quality Management System (eQMS) automates and streamlines processes, reducing errors and ensuring consistent quality management activities.
Health data access is important to the DHMSM on the EPH	Digital health interventions including wearable technologies, electronic health records, and online health searches, generate large amounts of health data. This data can be used to improve health care and research. Environmental impacts the disposal of electronic technologies creates e-waste, which can release toxic chemicals into the environment.
Using the Internet of Medical Things and Blockchain-Enabled Patient-Centric agents	Digital technology utilizes a range of medical equipment, and testing software to broadcast patient results over the Internet, enabling the provision of remote healthcare services with this disparity, an architectural framework to combine software-defined networking (SDN) with blockchain technology for facilitating remote patient monitoring systems in the 5G environmental context.
Mobile health (mHealth) application Thailand	Digital health has become increasingly popular, especially among young people, and is well-known for addressing health system shortcomings and achieving health objectives. Health analytics, powered by advanced software and algorithms, is gaining traction for its ability to analyze vast healthcare datasets, improving disease surveillance and personalized medicine, such as M-Health: An app that allows users to access their health information from their smartphone or tablet.
The Local and Community patients can use, and understand to be well-known the DHMSM	The Thai government has recognized the situation and launched the Thailand 4.0 project and the Digital Thailand plan in 2016 to accelerate integration to use digital technology to strengthen the health system, increase public health capabilities, and strengthen the role of health innovation. The role of community nurses in using health care technology is created to allow various data to be linked and communicated via the Internet: LINE, Facebook, Twitter, YouTube, etc.

Quantitative Data Research Method

Validity And Reliability of The Bdhts, Idhts, and Padhts Research Instruments

Validity and reliability of the BDHTs

The 36-item *Benefits of the Digital Health Management System Model on Environmental Public Health* (BDHTs) on six scales, namely Communication (COM), Monitoring (MON), Personalized Care (PSC), Self-management (SMM), Prevention (PRE), and Improved Diagnosis (IMD) scales. Each scale consists of six items on five option levels: Strongly Agree (5), Agree (4), Neither Agree nor Disagree (3), Disagree (2), and Strongly Disagree (1). The validity and reliability of the BDHTs are reported in Table 2.

Table 2. Scale Means, Scale Standard Deviation, Variance, Cronbach Alpha Reliability, Grand Means, F-Test, And P-Value for The Bdhts

Scale	α-reliability	Scale means	S.D.	Variance	Grand means	F-test	*p*-Value
COM	0.834	20.137	3.166	10.024	3.356	15.381***	.000
MON	0.831	19.921	3.213	10.324	3.320	17.853***	.000
PSC	0.835	20.104	3.142	9.875	3.350	13.323***	.000
SMM	0.776	21.523	3.630	13.177	3.585	4.618***	.000
PRE	0.815	21.562	3.796	14.417	3.594	2.760*	.017
IMD	0.692	20.175	3.218	10.361	3.703	58.477***	.000
Total	0.898	125.460	13.495	181.602	3.485	30.957***	.000

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*N=400, *p<.05, **p<.01, ***p<.001*

Validity and reliability of the IDHTs

The 35-item Questionnaire on the Impact of the Digital Health Management System Model on Environmental Public Health (IDHTs) on seven scales; namely: Optimized Diagnosis (OPD), Enhanced Monitoring (ENM), Remote Engagement (REE), Connected Data (COD), Ongoing Feedback (ONK), Tech-enabled Delivery (TED), and Improved Efficiency (IME) scales; each scale consists of five items on five options: Always, Often, Sometimes, Seldom, and Never perceptions' levels. The validity and reliability of the IDHTs are reported in Table 3.

Table 3. Scale Means, Scale Standard Deviation, Variance, Cronbach Alpha Reliability, Grand Means, F-Test, And *P*-Value for The Idhts

Scale	α-reliability	Scale means	S.D.	Variance	Grand means	F-test	*p*-Value
OPD	0.809	16.640	2.699	7.289	3.328	10.568***	.000
ENM	0.717	17.030	2.457	6.039	3.406	5.676***	.000
REE	0.781	16.605	2.653	7.042	3.321	24.719***	.000
COD	0.682	16.925	2.481	5.207	3.385	15.633***	.000
ONK	0.777	18.030	3.232	10.445	3.606	4.213***	.000
TED	0.793	18.016	3.247	10.544	3.603	2.994*	.018
IME	0.794	17.967	3.212	10.317	3.594	6.926***	.000
Total	0.903	121.210	13.504	182.372	3.463	18.343***	.000

*N=400, *p<.05, **p<.01, ***p<.001*

Validity and Reliability of The Padhts

The 24-item *Public Attitudes Toward Digital Health Management System Models for Environmental Health of Strategic Direction for Digital Health Thailand (PADHTs)* in four scales, namely: Digital Health Ecosystem (DHE), Connected Health Management Model (CHMM), Communication Digital Health (CDH), and Self-Management/Personalized Care (SMPC) attitudes. The participants responded to five options: Always, Often, Sometimes, Seldom, and Never perceptions levels. The validity and reliability of the PADHTs are reported in Table 4.

Table 4. Scale Means, Scale Standard Deviation, Variance, Cronbach Alpha Reliability, Grand Means, F-Test, And *P*-Value for The Padhts

Scale	α-reliability	Scale means	S.D.	Variance	Grand means	F-test	*p*-Value
DHE	0.898	20.152	4.438	19.698	3.359	12.506***	.000
CHMM	0.907	20.925	4.659	21.706	3.497	16.700***	.000
CDH	0.917	20.445	4.402	19.385	3.408	14.090***	.000
SMPC	0.916	20.447	4.540	20.614	3.408	14.835***	.000
Total	0.974	82.207	17.148	294.027	3.418	15.221***	.000

*N=400, *p<.05, **p<.01, ***p<.001*

The results given in Table 2 show the scale item means (scoring minimum is 6.00 and the maximum is 30) ranged from 19.921 to 22.175, scale item standard deviation ranged from 3.142 to 3.796, variance values indicated from 9.875 to 14.417, and grand means ranged from 3.320 to 3.707, and an F-test statistic is significant at .05 ($p<.05$) in the six scales of the BDHTs research instrument that the F-test of overall significance tests whether all of the predictor independent variables are jointly significant.

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Similarly in Table 2, Table 3 shows the scale item means (scoring minimum is 5.00 and the maximum is 25) ranged from 16.640 to 18.030, scale item standard deviation ranged from 2.457 to 3.247, variance values indicated from 5.207 to 10.547, and grand means ranged from 3.328 to 3.606, and an F-test statistic is significant at .05 ($p<.05$) in the seven scales of the IDHTs research instrument that the F-test of overall significance tests whether all of the predictor independent variables are jointly significant. Table 4 shows the scale item means (scoring minimum is 6.00 and the maximum is 30) ranged from 20.152 to 20.985, scale item standard deviation ranged from 4.438 to 4.659, variance values indicated from 19.385 to 21.706, and grand means ranged from 3.359 to 3.497, and an F-test statistic is significant at .05 ($p<.05$) in the four scales of the PADHTs research instrument that the F-test of overall significance tests whether all of the predictor dependent variables are jointly significant with totalized grand mean scores.

The internal consistency (Cronbach alpha reliability) coefficients are criteria by which researchers assess the measurement quality of research instruments' reliability and validity. that is, how closely related a set of 5-6 items are suitability. It is considered to be a measure of scale reliability (Taber, 2018). The accepted value of Cronbach's alpha; however, values of 0.6-0.7 (acceptable), and 0.7-0.8 values are also accepted (good, and acceptance), 0.8 and above is better, and 0.9 and above is best (Frost, 2022). The results are reported in Tables 2-4, the values of Cronbach alpha reliability ranged from 0.682 to 0.917 to a model of the Cronbach model responses. On the whole, these results are acceptable for the BDHTs, IDHTs, and PADHTs questionnaires' producing guidelines, respectively. These are the three research instruments, which are valid and reliable.

In statistics, the simple correlation coefficient, r, tells us about the strength and direction of the linear relationship between the independent and dependent variables which describes the strength and direction of the relationship between two variables. A multiple correlation coefficient (R) yields the maximum degree of linear relationship obtained between independent variables and a single dependent variable. Standardized regression coefficients (β) allow researchers to compare the relative magnitude of the effects of different explanatory variables in the path model by adjusting the standard deviations such that all the variables, have equal standard deviations. R-squared is used in various fields such as risk analysis in finance, marketing campaigns, scientific research, or economics. the standards for a good R-squared reading can be much higher, such as 0.7-0.9 or above.

Associations between participants' perceptions are benefits of the DHMSM on the EPH (the 6-BDHTs scales) with public attitudes toward the DHMSM for EPH of Strategic Direction for Digital Health Thailand (PADHTs)

Associations with the 36-item Benefits of the DHMSM on Environmental Public Health (BDHTs) on six scales: Communication, Monitoring, Personalized Care, Self-management, Prevention, and Improved Diagnosis scales. These grand mean scores of six scales are the independent variables. The value of the dependent variable (the totalized grand mean scores of the PADHTs) depends on changes in the independent variables. The results are reported in Table 5.

Table 5. Simple Correlation (R), Standardized Regression Weight (B), Multiple Correlations (R), Determination Predictive (R^2) Value Coefficient for The Padhts with The Six Scales for The Bdhts

Scale	Simple correlation (r)	Standardized regression weight (β)
Communication (COM)	0.674***	0.312***
Monitoring (MON)	0.268***	0.269***
Personalized Care (PSC)	0.264***	0.308***
Self-management (SMM)	0.395***	0.236***
Prevention (PRE)	0.352***	0.301***
Improved Diagnosis (IMD)	0.367***	0.272***
Multiple correlations (R) coefficient	0.861***	
Determination predictive (R^2) value coefficient	0.744***	

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*N=400, *p<.05, **p<.01, ***p<.001*

Associations between participants' perceptions are impacts of the DHMSM on the EPH (the 7-IDHTs scales) with public attitudes toward the DHMSM for EPH of Strategic Direction for Digital Health Thailand (PADHTs)

The relationship between independent variables (The grand mean scores of seven scales of the IDHTs: Optimized Diagnosis (OPD), Enhanced Monitoring (ENM), Remote Engagement (REE), Connected Data (COD), Ongoing Feedback (ONK), Tech-enabled Delivery (TED), and Improved Efficiency (IME) scales) and dependent variable ((the totalized grand mean scores of the PADHTs) is often conceptualized as cause and effect, where the independent variable is the cause and the dependent variable is the effect with associations were assessed. The results are reported in Table 6.

Table 6. Simple Correlation (R), Standardized Regression Weight (B), Multiple Correlations (R), Determination Predictive (R^2) Value Coefficient for The Padhts with The Seven Scales for The Idhts

Scale	Simple correlation (r)	Standardized regression weight (β)
Optimized Diagnosis (OPD)	0.684***	0.424***
Enhanced Monitoring (ENM)	0.490***	0.285***
Remote Engagement (REE)	0.536***	0.311***
Connected Data (COD)	0.424***	0.228***
Ongoing Feedback (ONK)	0.351***	0.221**
Tech-enabled Delivery (TED)	0.363***	0.236***
Improved Efficiency (IME)	0.488***	0.280***
Multiple correlations (R) coefficient	0.886***	
Determination predictive (R^2) value coefficient	0.786***	

*N=400, *p<.05, **p<.01, ***p<.001*

In correlational research, the direction of the relationship is not considered, so independent and dependent variables are not identified. In Tables 5 and 6, the simple correlation values (r) show statistically significant correlations (p<.001) on all scales. The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between participants' perceptions on each scale of the BDHTs and IDHTs toward the Attitude scale of the PBDHTs when the effect of relationships between the scales is scales controlled for significance (p<.05) all on scales. The multiple correlations, R_B and R_I correlations are significant for the BDHTs and IDHTs, and show that when the scales are considered together (R_B = 0.861 and R_I = 0.886) these are significant (p<.001) association with the PADHTs scales. The determination predictive (R^2) values indicate that 71% and 79% of the variance in participants' guidelines of their attitudes on the benefits and impact of the Digital Health Management System Model on Environmental Public Health risks to promote wellness with a digital health management system model on environmental public health risks are impacted and beneficial to Thai patients at the Local Health Centers and Communities, Sub-District Publics Health Hospitals, District Hospitals, etc., in Thailand whereas the patients who used to register and apply the applications of the Digital Health Management System Model under the Ministry of Publish Health's plans and policies are supported and divided.

Discussions

Thailand is investing in digital health to improve health outcomes and well-being. The Ministry of Public Health (MoPH) has published a Digital Health Strategy (2021-2025), there are the key roles digital technologies can play in strengthening the health system. Digital health has become increasingly popular, especially among young people, and is well-known for addressing health system shortcomings and achieving health objectives. Some health platforms offer interactive features like chatbots, counseling chatrooms, and referral mechanisms. Wearable technologies, including smartwatches and fitness trackers, are increasingly utilized to monitor health and fitness goals. Health analytics, powered by advanced software and algorithms,

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is gaining traction for its ability to analyze vast healthcare datasets, improving disease surveillance and personalized medicine, such as M-Health: An app that allows users to access their health information from their smartphone or tablet. The plan focuses on creating participation from the population, communities, local administrations, and various sectors; improving operating efficiency with data use; and enhancing people's potential to enable self-care of their health (Ministry of Public Health of Thailand. 2021).

Although the Thai people or Thai stakeholders know the concepts of the *Digital Health Management System Model* (DHMSM). They include age, gender, genetics, exposure to air pollution, and behaviors such as smoking, unhealthy diet, and physical inactivity which can lead to hypertension and obesity, in turn leading to increased risk of many *Noncommunicable Diseases* (NCDs) the leading cause of death in Thailand, accounting for 74% of all deaths in the country. The four most common NCDs are Cancer, Cardiovascular diseases, Diabetes, and Chronic obstructive pulmonary disease (COPD). Today, NCDs, primarily heart disease, stroke, cancers, diabetes, and chronic lung diseases, account for 74% of deaths in Thailand, or 400,000 people each year. NCDs are draining Thailand's health budget for universal health coverage (UHC) and hitting the national economy hard (World Health Organization, 2022). A digital health management system model is a patient-centric system that uses information and communications technologies (ICT) to improve healthcare delivery. Digital information can transform the quality and sustainability of health and care. Used effectively, it can help save lives, improve health and well-being, and support a sustainable health system that delivers safe, high-quality, and effective health services for all Thai populations (Australia's National Digital Health Strategy, 2020).

Since Thailand started its universal health coverage program in 2002, it has become widely recognized for its accessibility and comprehensive coverage. The government largely funds the local healthcare system via taxes, giving most of the population access to affordable healthcare services (Jacobs, 2023). A digital health platform relies on cutting-edge technologies and health services to improve patient care and engagement. By adopting these platforms, healthcare organizations can improve the patient experience and the quality of a patient's care. Additionally, a platform, a digital health platform consolidates several healthcare services and technologies in an online space with virtual care, patients can speak with their doctor on demand, employ medical devices and the Internet of Things (IoT) for disease monitoring and detection, and communicate with their providers on a mobile app. These data-driven technologies and services empower patients to invest in their physical and mental health, continuously (Virtusa Engineering First, 2023).

The benefits of the DHMSM technologies: Digital health technologies can help improve Thailand's healthcare system in many ways, including patient safety (Digital health can reduce the number of medical and clinical adverse events); faster diagnosis (Treatments can be recorded and test results returned more quickly, leading to better diagnosis and care); better communication (Patients and caregivers can communicate more effectively); access to care (Patients can receive care remotely, even when they're away); improved efficiency (Digital health technologies can improve the operational efficiency of healthcare facilities); reduced costs (Digital health technologies can help reduce healthcare costs by reducing the reliance on in-person visits); access to underserved populations (Digital approaches can facilitate service delivery to underserved populations; surveillance (Digitalization can facilitate surveillance); and health security (Digitalization can facilitate health security) (YPC Precision (Thailand), 2023). Digital Health Services for Young People in Thailand include improving access to care, quality of care, cost of healthcare, patient engagement, and health outcomes. Advances in digital technologies such as smartphones, social media, high-speed internet networks, AI, and machine learning are changing and supporting people's communications, providing new positions to monitor and improve human health and well-being. Thailand has progressively managed to transition from facility-based health services to digital health services (UNICEF for Every Child, 2023).

Digital health management systems in Thailand can have many positive impacts, including improved access to healthcare (Digital health technologies, such as telemedicine, can help patients in rural and remote areas access healthcare); increased access to health information (Digital health tools, such as mobile apps and SMS-based health education, can provide health information to individuals, regardless of their location or socioeconomic status); better follow-up care (Electronic health records (EHRs) can improve care coordination and follow-up care by making patients' medical histories easily accessible to healthcare

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providers); faster access to specialized care (Telehealth consultations can connect patients with specialists and primary healthcare providers, which can improve access to specialized care); reduced healthcare costs (Digital health technologies can help reduce healthcare costs by improving operational efficiency and reducing the need for in-person visits); improved patient safety (Digital health can reduce medical and clinical adverse events); better communication between patients and careers (Digital health can improve communication between patients and careers); improved diagnosis (Digital health can help improve diagnosis by enabling quicker recording of treatments and return of test results); and improved health outcomes (Digital health can help improve health and well-being) (Ministry of Public Health of Thailand, 2017).

Digital Health Management System Model on Environmental Public Health, DHTs are promoted as a means to reduce the environmental impact of healthcare systems. However, a growing literature is shedding light on the highly polluting nature of the digital industry and how it exacerbates health inequalities. Thus, the environmental footprint of DHTs should be considered when assessing their overall value to healthcare systems. Innovation factors include stakeholders' recognition of the environmental issue and the extent to which it is feasible for them to address the environmental impact of DHTs depending on micro-meso-macrosystemic factors involving a variety of stakeholders and levels of governance, sometimes with divergent or even antagonistic objectives and expectations. It highlights the importance of better understanding the complexity inherent in the environmental shift in healthcare for integrating environmental considerations in digital health technology assessment and procurement: Stakeholders' perspectives (Alami et al., 2023). A sociodemographic information form, a scale developed by the researcher, Norman and Skinner's e-Health Literacy Scale, and the Mobile Health and Personal Health Record Management Scale were used as data collection tools. The main criteria used to include mobile personal health record (mPHR) applications for the three leading cellular phone platforms (iOS, BlackBerry, and Android) were operating standalone on a mobile platform; not requiring external connectivity; and covering a wide range of health topics (Kharrazi et al., 2022).

The research instruments' content validity and reliability of the quantitative data research method are significant. Associations are conducted and created to analyze the relationships between the benefits and impact of the Digital Health Management System Model on Environmental Public Health underserved Thai populations and stakeholders are the main topics of the research study. Creative the three research instruments assessed and the determination of the predictive values between the independent and dependent variables that have never been studied in this field before.

Conclusions

Designing mixed research methodology was administered with the original raw data from Documentary Research reviewed the Data Management in the Digital Health Management System Model, Digital Health Environment Scales, and Public Attitudes Toward Digital Health Management System Models for Environmental Health of Strategic Direction for Digital Health Thailand under the strategies and policies of the Ministry of Publish Health of Thailand risks are impacted and beneficial to Thai patients at the Local Health Centers and Communities, Sub-District Publics Health Hospitals, District Hospitals, etc., in Thailand where the patients who used to register and apply the applications of the Digital Health Management System Model under the Ministry of Publish Health's plans and policies are supported and divided. The digital health stations are linked to health databases and individual health records, using AI tools to identify potential health issues. The DHMSM systems can notify nearby doctors and recommend appropriate for patients.

Creative data management in the 36-item Benefit on Digital Health Management System Model (BDHTs) questionnaire on six scales, the 35-item Impact on Digital Health Environment (IDHTs) on seven scales, each scale of the two research instruments are the independent variables and the 24-item Public Attitudes Toward Digital Health Management System Models for Environmental Health of Strategic Direction for Digital Health Thailand (PADHTs) in four scales, and the totalized mean scores are the dependent variable. These three research instruments are valid and reliable measurement tools that measure individuals'

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perceptions of 400 patients, people, and stakeholders who used to be serviced by the officials and involvers under the Ministry of Public Health of Thailand whose they have recorded on privacy, security, use, sharing, benefit, and satisfaction in the digital health environment. In research, the relationship between independent and dependent variables is often conceptualized as cause and effect, where the independent variable is the cause and the dependent variable is the effect.

In correlational research, the simple correlation values (r) show statistically significant correlations ($p<.001$) on all scales. The second type of analysis consisted of the more conservative standardized regression coefficient (β) which measures the association between participants' perceptions on each scale of the BDHTs and IDHTs toward the Attitude scale of the PBDHTs when the effect of relationships between the scales is scales controlled for significance ($p<.05$) all on scales. The multiple correlations, R_B and R_I correlations are significant for the BDHTs and IDHTs, and show that when the scales are considered together ($R_B = 0.861$ and $R_I = 0.886$) these are significant ($p<.001$) association with the PADHTs scales. The determination predictive (R^2) values indicate that 71% and 79% of the variance in participants' guidelines of their attitudes on the benefits and impact of the Digital Health Management System Model on Environmental Public Health risks to promote wellness with a digital health management system model on environmental public health risks are impacted and beneficial to Thai patients at the Local Health Centers and Communities, Sub-District Publics Health Hospitals, District Hospitals, etc., in Thailand whereas the patients who used to register and apply the applications of the Digital Health Management System Model under the Ministry of Publish Health's plans and policies are supported and provided.

Conflict of Interest Statement

The authors declare no competing interests.

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