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Harnessing Technologies in an Age of AI to Build A Healthier World

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PMAC 2025 | **Harnessing Technologies** in an Age of AI to Build A Healthier World

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THE COMPANION BOOK FOR FIELD TRIPS

PMAC 2025 | Harnessing Technologies in an Age of AI to Build A Healthier World

The companion book for field trips in PMAC 2025

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EDITORS
Jadej Thammatacharee, MD, PhD
Kamolrat Turner, RN, PhD

AUTHORS
Kamolrat Turner, RN, PhD
Sukjai Charoensuk, RN, PhD
Panarut Wisawatapnimit, RN, PhD
Wilaiporn Khamwong, RN, PhD
Yupawan Thongtanunam, RN, PhD
Matanee Radabutr, RN, PhD
Siriwan Tumchuea, RN, PhD
Tanapa Rittiwong, RN, PhD

REVIEWER
Paul Alexander Turner, PhD

COORDINATORS
Chalarntorn Yothasmutra, MA, BA
Atcharaporn Thammachot, MPH, BA
Thanaporn Ngarmsomsup, BA
Nuttha Siriwattanapisan, BA

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PRINTER
Sahamitr Printing & Publishing Co, Ltd.,
Bang Yai, Nonthaburi 11140, Thailand
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Table of Contents

Preface

Harnessing Technologies in an Age of AI to Build a Healthier World

The National Health Security Office

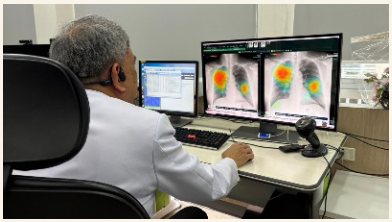
Rapid technological advancements, particularly in Artificial Intelligence (AI), are vital for creating a healthier, more equitable, and peaceful world. Innovative technology applications have demonstrated significant benefits in achieving the Sustainable Development Goals (SDGs) by 2030, especially in promoting environmental sustainability and biodiversity. However, addressing potential risks, including security threats, misinformation, unequal access, and privacy concerns, is essential. The focus of PMAC 2025 is to harness these advancements to ensure equitable and affordable access for all populations, especially in low- and middle-income countries.

Our field trips are designed around three main themes of PMAC 2025 including Technological Innovations to Strengthen Health Systems and Achieve Universal Health Coverage (UHC); Equity, Ethics, and Empowering the Vulnerable; and Governance, Policy, and Stewardship. During these trips, participants will engage in four field visits to observe real-world examples of how Thailand is utilizing advanced

technologies to enhance the country's Universal Health Coverage.

Field trip site 1: Exploring the AI Healthcare Ecosystem in Thailand: A Journey from Invention to Nationwide Implementation

At Bangkok Hospital



As artificial intelligence (AI) rapidly becomes essential in healthcare worldwide, it is transforming medical practices by enhancing diagnoses and creating improved patient treatment plans. In Thailand, both the public and private sectors are actively incorporating AI into the medical field, recognizing its potential to revolutionize healthcare system.

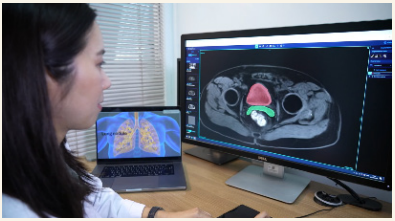
The Faculty of Medicine Siriraj Hospital, Mahidol University, a leading medical school in Thailand, is at the forefront of developing innovative AI applications, particularly in radiology. AI-driven diagnostic imaging solutions assist healthcare professionals in identifying diseases more accurately and at earlier stages, leading to improved diagnostic accuracy and more personalized and effective treatment plans.

Thailand has prepared the network of stakeholders for implementing AI in healthcare system, each playing a crucial role in enhancing the distribution of innovative solutions to improve healthcare for the entire nation. Innovators from Siriraj Hospital and Percepta, a Thai deep tech startup, have been pioneering the development of AI for medical image diagnosis. Their collaborative efforts began with chest X-ray analysis and have since expanded to encompass a range of other imaging solutions. After ensuring the efficacy and safety, the AI chest X-ray has gone through consideration by involved stakeholders ranging from regulatory bodies, endorsement entities, funders, payers and users in order to make it accessible throughout the country. AI chest X-ray is at the forefront of this process and has been endorsed by users in both public and private hospitals nationwide.

A visit to Bangkok Hospital, a leading private healthcare facility, will offer a comprehensive overview of Thailand's robust healthcare ecosystem, illustrating how innovators, private partners, regulatory bodies, and end-users work together to turn AI innovations into real-world solutions. Attendees will gain valuable information from key stakeholders on how advanced technologies being integrated into Thailand's Universal Health Coverage (UHC). Additionally, participants will witness the AI-incorporated service at one of the leading health care facilities in Thailand.

Field trip site 2: Establishing an Open Data Platform for AI Development and Utilizing Metaverse in Medical Training and Patient Care in Thailand

At the Faculty of Medicine Ramathibodi Hospital, Mahidol University



Faculty of Medicine Ramathibodi Hospital, Mahidol University, in collaboration with the Department of Medical Services, the Ministry of Public Health, and the National Science and Technology Development Agency (NSTDA), has pioneered the Open Medical healthcare management and research across Thailand by standardizing and sharing medical data. It supports AI development and fosters a collaborative environment for continuous medical innovation, benefiting the entire Thai health ecosystem.

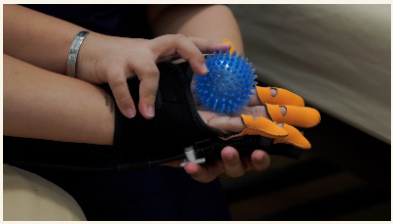
The platform sets a benchmark for secure, ethical, and efficient medical data exchange, establishing a robust infrastructure for developing various AI tools, such as pulmonary, breast, or other several conditions. Additionally, it features a comprehensive cloud-based architecture equipped with data standardization tools and extensive processing networks, significantly enhancing the capability and efficiency of healthcare services.

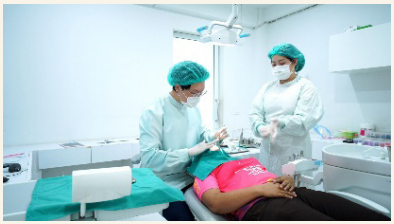
Faculty of Medicine, Ramathibodi Hospital has also embraced Augmented Reality (AR) and Virtual Reality (VR) technologies to enhance medical education and patient care. These tools provide realistic 3D visualizations for anatomy education and provide therapeutic solutions for patients, particularly in palliative care, significantly enhancing patients' quality of life.

Experiencing firsthand the transformative impact of AR, VR, and the metaverse in healthcare while learning about innovation AI applications implemented at Ramathibodi Hospital.

Field trip site 3: Utilizing Social Innovation and Technology to Improve Primary Care Access, Quality, and Financial Protection in UHC: The Case of '30-Baht Treatment Anywhere

Saraburi Province





Thailand is known for its Universal Health Coverage (UHC) but still faces challenges such as hospital overcrowding, long wait times, and limited access to primary care, especially in urban and remote areas. These issues lead to income loss and out-of-pocket expenses for patients and their families.

Lifestyle changes, urbanization, and technological advancements require innovative care models to enhance primary care access and quality. In early 2024, the "30-Baht Treatment Anywhere" policy was introduced to improve the Universal Coverage Scheme (UCS).

This policy aims to improve the accessibility and quality of healthcare services for UC beneficiaries by collaborating with multiple stakeholders, including professional councils, private clinics, pharmacies, and laboratory services. It also features integrating a health information system, allowing patients to access services using only their national ID card.

Currently, over 13,000 private clinics across the country are registered as service providers with the National Health Security Office (NHSO), offering seven groups of services: pharmacies, general medicine, dental care, nursing, medical technology or laboratory tests, physical therapy, and traditional Thai medicine.

The National Health Security Office Region 4 Saraburi, which is responsible for the health security system service units in 8 provinces in the central region and urban provinces, including Saraburi province.

Saraburi Province, which is in the third phase of implementing the "Treatment Anywhere" initiative, serves

as an excellent example of how technological advances and social innovation can create care models that improve access, convenience, and quality in primary care.

These field trip will provide participants with a firsthand experience of how residents access primary healthcare services under the Universal Coverage (UC) Scheme. You will observe how service providers operate and learn how this model improves healthcare access, quality, and financial protection within the Universal Health Coverage (UHC) framework. The trip will focus on three primary care services:

1. Community Physical Therapy Clinic: This clinic provides continuity of care for patients with conditions such as stroke and spinal injuries.

2. Community Dental Clinic: This facility offers essential dental services, which help reduce hospital congestion and allow for better care of complex cases.

3. Community Pharmacy: The pharmacy provides professional medication and symptom management advice, enhancing access for minor health issues.

Field trip site 4: The Role of UHC in Strengthening Public Health and Fueling Local Innovation for Economic Growth: Thailand's Model

At King Chulalongkorn Memorial Hospital and Meticuly Co., Ltd.

Thailand has been in the middle-income trap for decades, relying on basic technologies despite being a net exporter of medical devices. To overcome these challenges, Thailand has focused on leveraging innovation to enhance health equity and economic growth.

Collaborations among health and technology agencies have been instrumental in advancing the "Pay Once, Benefit Three Ways" initiative, which aims to improve public health, foster local innovations, and boost the economy. This approach contributes significantly to the sustainability and success of Thailand's Universal Health Coverage (UHC) system.

This field trip explores how Thailand has successfully integrated advanced technologies and evidence-based innovations into its Universal Coverage Scheme (UCS). By doing so, the country positions UHC as a critical driver of health equity and a catalyst for economic development.

A prominent example of this collaborative effort is the partnership between King Chulalongkorn Memorial Hospital, Chulalongkorn University, the deep-tech startup Meticuly, and the Health Systems Research Institute (HSRI). Together, they developed Personalized 3D-Printed Titanium Skull Implants, now included in the UC health benefits package, demonstrating the potential of local innovations to address complex health challenges.

King Chulalongkorn Memorial Hospital and Chulalongkorn University also lead advancements in other groundbreaking innovations, such as the Albuminuria Test Kit for early kidney dysfunction diagnosis, genomic technology for Precision Public Health, cutting-edge vaccine technologies, and digital health applications designed to improve access and efficiency in healthcare delivery. These initiatives exemplify Thailand's ability to harness innovation for tangible health benefits.

Participants of this field trip will gain invaluable insights into how evidence-based policies and innovations have transformed Thailand's healthcare landscape, reduced health disparities, and underscored the vital roles of artificial intelligence and advanced technologies in achieving health equity and driving economic growth.

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Exploring the AI Healthcare Ecosystem in Thailand: A Journey from Invention to Nationwide Implementation

Exploring the AI Healthcare Ecosystem in Thailand: A Journey from Invention to Nationwide Implementation

Panarut Wisawatapnimit

Tanapa Rittiwong

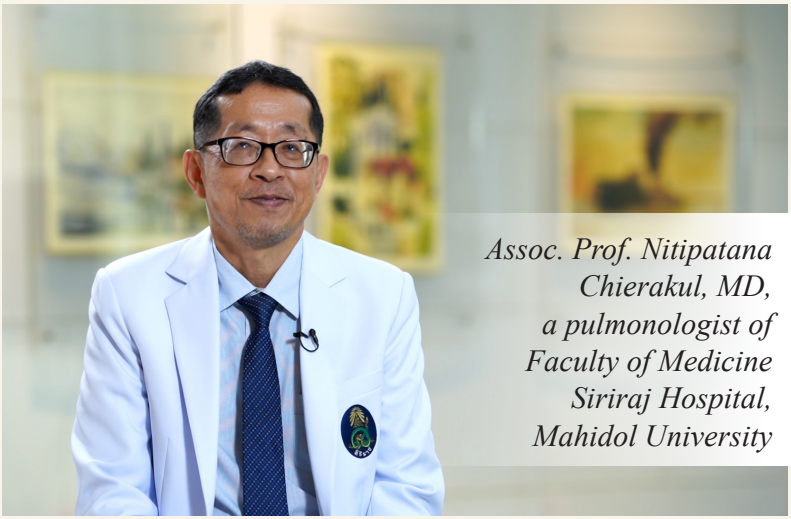
Scale Up AI in Healthcare in Thailand During COVID-19 Outbreak: An Exemplar of AI Chest X-Rays

Chest X-rays' workflow with an original chest X-ray and AI chest X-ray images at Siriraj Hospital

The COVID-19 pandemic marked a significant turning point for AI in the healthcare sector. During the outbreak, limited resources were the main challenge. Health workers had to work under pressure to save patients' lives within limited time. Early diagnosis of COVID-19 pneumonia and other respiratory complications is very important. Chest X-rays and their interpretation by pulmonologists and radiologists are significant to confirm the diagnosis and plan for curing. With a limited

number of experienced physicians and an overwhelming workload, healthcare professionals need effective methods to diagnose and treat respiratory diseases. AI-assisted chest X-ray has become a critical solution as it enables early diagnosis.

Assoc. Prof. Nitipatana Chierakul, MD, a pulmonologist of Faculty of Medicine Siriraj Hospital, Mahidol University and former president of the Thoracic Society of Thailand under Royal Patronage, illustrated that “during the COVID-19 period, when I had the experience of triaging the nearly 20,000 prisoners in a certain area in Bangkok, and we had about 10 days to determine whether they had COVID-19 infection or pneumonia, the tool was the chest X-rays. We had to take nearly 2,000 chest X-rays each day. If we did this manually, we would not be able to triage patients properly and treat them earlier to prevent the spread and mortality of the patients. The AI chest X-rays for initial reading have been very helpful for the doctors with less experience or in situations where we have less time to look at them in detail, such as emergency.” Therefore, the AI chest X-rays developed by the radiology department of Siriraj Hospital and Percepta, an AI company, have been scaled up for use in the Covid-19 situation. Currently, it is being used in the outpatient department of Siriraj Hospital and many private and public hospitals in Thailand.



Assoc. Prof. Nitipatana Chierakul, MD, a pulmonologist of Faculty of Medicine Siriraj Hospital, Mahidol University

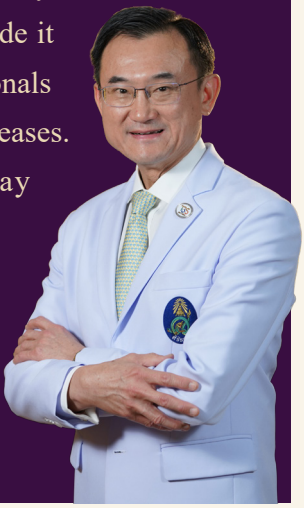
Assoc. Prof. Nitipatana Chierakul, MD, read the AI chest X-ray of a patient at a respiratory clinic

In this article, the AI chest X-rays initial developed by the radiology department of Siriraj Hospital is an exemplar of an innovation to illustrate the journey from inventers to nationwide adoption by leveraging national ecosystems to drive widespread utility and supply commerce.

Starting Point of AI Chest X-Rays Development at Radiology Department, Siriraj Hospital

Siriraj Hospital founded 136 years ago, is a cornerstone of the Thai healthcare system. As the university hospital of the Faculty of Medicine Siriraj Hospital, Mahidol University — Thailand's leading medical school — it has earned a reputation for excellence in patient care, medical education and research.

Prof. Apichat Asavamongkolkul, MD, Dean of Faculty of Medicine Siriraj Hospital, Mahidol University, stated that "Siriraj Hospital was established to serve as a medical center of the land and medical university to produce health personnel and build body of knowledge in healthcare. We have made it our mission to train medical professionals and care for patients with complex diseases. With around 20,000 patients a day and 4.8 million visits a year, we are the largest medical facility in the country."



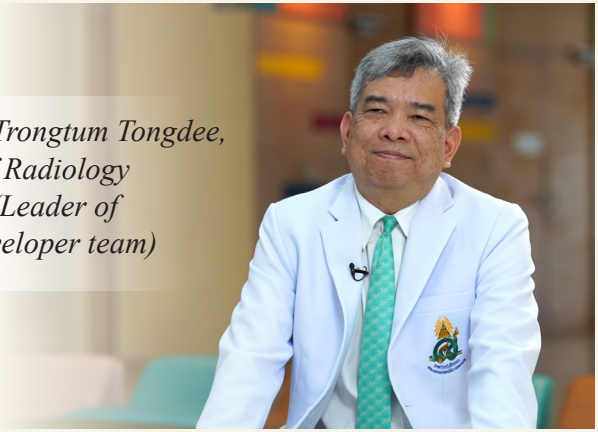
Prof. Apichat Asavamongkolkul, MD, Dean of Faculty of Medicine Siriraj Hospital, Mahidol University

Siriraj Hospital focuses on innovation and integrates state-of-the-art AI and advanced technologies into its services. He praised the development of AI chest X-rays and explained:

“Our team has demonstrated the effectiveness and efficiency of AI X-rays that compensate for human limitations such as fatigue. This innovation underscores the importance of fostering robust innovation ecosystems to drive nationwide implementation and promote global adoption, which ultimately improves quality of life and contributes to economic growth.”

In 2019, Siriraj Hospital started developing AI chest X-rays to overcome the challenges faced by the radiologists. This initiative was led by Assoc. Prof. Trongtum Tongdee, MD, Head of Radiology Department and the leader of the team, Prof. Thanongchai Siriapisith, MD, PhD, a radiologist, and Assoc.Prof. Pairash Saiviroonporn, PhD, a biomedical engineer.

Siriraj AI inventor team including Assoc. Prof. Trongtum Tongdee, MD (Team Leader, at the left side), Prof. Thanongchai Siriapisith, MD, PhD, (in the middle) and Assoc.Prof. Pairash Saiviroonporn, PhD (at the right side)



Assoc. Prof. Trongtum Tongdee, MD, Head of Radiology Department (Leader of Siriraj AI developer team)

Assoc. Prof. Trongtum Tongdee, MD, explained the beginning of the innovation development that "the pain point is the shortage of radiologists and all specialties of physicians in Thailand. AI has benefit in assisting radiologists to diagnose respiratory diseases such as respiratory infection, lung cancer, and tuberculosis. These diseases are also the leading causes of death. If we can detect them early, we can help increase the efficacy of treatment. AI is the answer to the situations where there are no or few radiologists. If hospitals have radiologists, AI can assist them to work more accurately."

Initially, Siriraj Hospital relied on imported AI tools, but their high cost and limited adaptability prompted the team to develop a solution tailored to Thai needs. Assoc. Prof. Trongtum Tongdee, MD, confirmed that "we are confident that we can develop the AI chest X-rays because we have specialists, data, and knowledge about AI development processes. So, we started to develop it."

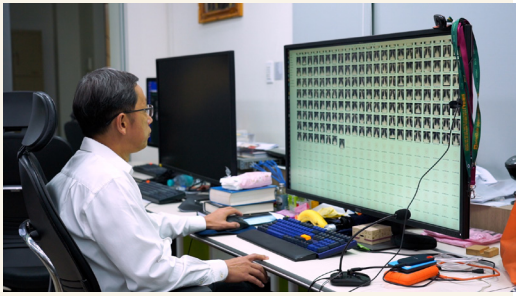
Prof. Thanongchai Siriapisith, MD, PhD, a radiologist (Member of Siriraj AI developer team)

Prof. Thanongchai Siriapisith, MD, PhD, stated that "we have capacity to develop the AI chest X-ray and it should be better than the product from abroad because the images of chest X-rays to develop the AI come from Thai people. We started developing the AI chest X-ray by using more than one million X-ray images of the patients treated at Siriraj Hospital only." The team developed the first version of the AI chest X-rays with funding from the National Science and Technology Development Agency (NSTDA), Thailand, and collaborated with the Percepta company.

The Development Process and Key Features

The partnership with Percepta involved a division of roles to ensure the success of the system. Prof. Thanongchai Siriapisith, MD, PhD, explained that “we divided roles and responsibilities with Percepta. We prepared the data and provided its expertise in interpreting X-ray images, while Percepta wrote an AI program and codes. We started with AI learning about images of the chest X-ray in each finding. However, Siriraj team has also developed the AI chest X-rays to have more ability than the first version. The current version achieves an accuracy of around 95%, with some findings reaching 97-98%. Remarkably, it can detect certain abnormalities better than human eyes, although rare lesions remain challenging. The overall accuracy is around 95 %. The speed is very efficient, as it only takes 50 seconds to process an image.”

A 3-color chest X-ray image



Assoc.Prof. Pairash Saiviroonporn, PhD, has developed the AI chest X-rays.

Radiologists can interpret the chest X-rays by reading the original image and the AI image. For the AI image, there are 3 colors for abnormal findings: yellow, green, and red. The Red color means high probability of abnormal findings, while the probability is lower for the Green and Yellow.

Assoc.Prof. Pairash Saiviroonporn, PhD, stated that "the benefit of developing our own AI is that we can continue to improve our products. We have developed and designed the AI chest X-ray and asked the users for their opinions and feedback for further development to make it user-friendly and more accurate. We conduct research and development, and this can save cost of the hospital."

Mahidol University secured the copyrights for the AI chest X-ray developed with the Department of Intellectual Property, Thailand, including

1) the learning program "2D convolution neutral network for estimating numbers that are related to medical images", accepted on 4 December 2023,

2) the learning program "2D convolution neutral network for classification of abnormalities in medical imaging", accepted on 12 December 2023, and

3) Artificial intelligence program for distinguishing 18 types of abnormalities on chest X-ray images, accepted on 25 April 2024.

Subsequently, Mahidol University sold parts of the copyrights to the first version to Percepta for commercial purposes, while maintaining a partnership to further enhance the AI system. This ongoing collaboration ensures continuous development and refinement, driving both innovation and accessibility.

The inventor team of Siriraj Hospital are still writing program codes and further developing the current version of the AI chest X-ray to solve the accuracy issues and increase capacities of the products. As part of Thailand's innovation ecosystem, this product is distributed to many hospitals in Thailand and included in the National Health Security Office (NHSO) benefits package under the universal coverage scheme so that it can be used for free of charge by Thai.

The AI Healthcare Ecosystem in Thailand

The National Research Council of Thailand (NRCT) has set strategics in research and innovation in the period of 2023 - 2027 to strengthen the research and innovation ecosystems with aim to be a leader in creating research and innovation for use in all dimensions to raise country's competitive ability to keep up with the world situation.[1] The innovation ecosystem is a system for launching new, sustainable business models with aimed at accelerating innovation and medical and health services for both commercial and social use and developing health and public

policies promoting sustainable economic and social strength of the country.

It is composed of many stakeholders starting from inventors, product approval, product registration, product endorsement, and product expander, to users. It is also composed of processes and systems that can support an ideation to a scalable business.

The AI chest X-ray developed by Siriraj Hospital's radiology department and Percepta has gone through the innovation ecosystem process in Thailand before being rolled out nationwide. The stakeholders that play vital roles in this ecosystem are shown in Figure 1:

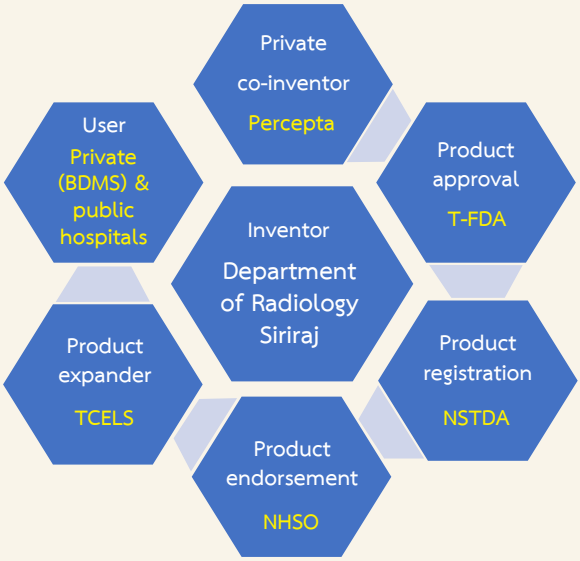


Figure 1 the AI chest X-ray ecosystem

Inventors: The AI diagnostic imaging inventor team, including Assoc. Prof. Trongtum Tongdee, MD (Leader of the team), Prof. Thanongchai Siriapisith, MD, PhD, and Assoc.Prof. Pairash Saiviroonporn, PhD.

Private Sector, the co-inventor partner: Team of Percepta, the private company involved in the early stages of AI development and commercialization.

Regulatory Bodies: Organizations such as the Thai Food and Drug Administration (T-FDA), Ministry of Public Health that ensure the safety and efficacy of AI medical devices.

Product Registrars: Entities such as the National Science and Technology Development Agency (NSTDA) who manage the registration of AI products for healthcare use and develop the national AI Ecosystem to promote the development and application of AI technology in the government and industrial sectors.

Product Endorsement Bodies: Organizations such as the NHSO validate and endorse AI solutions for widespread adoption in patients of government and private hospitals under universal health coverage scheme.

Product Expanders: Initiatives such as the Thailand Center of Excellence for Life Sciences (TCELS) help scale and disseminate AI technologies in the healthcare sector by translating knowledge, research processes and innovations from the research and development process into commercial products.

End Users: Healthcare providers in the government and private hospitals and other health facilities that implement and benefit from AI solutions in clinical practice.

Thailand's innovation ecosystem will promote innovation implementation at the national level for public and commercial purposes to drive the economics of the country and competition with other countries.

The AI Chest X-Ray Implementation: User Perspectives from a Public Hospital

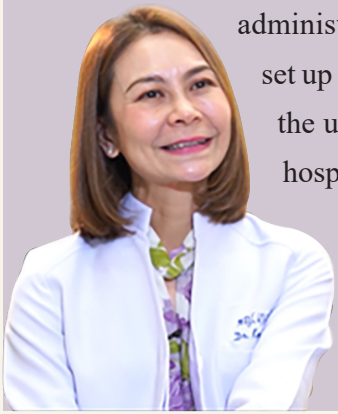
The developed AI chest X-ray has been disseminated to about 100 public and private hospitals across Thailand. Distribution occurs through two channels: directly from Siriraj Hospital, and via Percepta. Most users provide good comments on the product. "The feedback from users is quite good that it is high accuracy, but there are some points that need to be more developed in the future, especially for rare diseases" said Prof. Thanongchai Siriapisith, MD, PhD.

Assoc. Prof. Nitipatana Chierakul, MD, also reflected on the benefits of the product at Siriraj Hospital that its usefulness depends on the skills of the physicians and the difficulty of interpretation. For less experienced physicians, AI can facilitate the diagnosis of diseases, such as lung masses or cavities in the lungs. In some emergency cases or in situations where less time is available, AI can prompt or help the experienced physician to recognize abnormal findings."

The AI Chest X-Ray Implementation: User Perspectives from a Private Hospital

The AI chest X-ray developed by the radiology department of Siriraj Hospital and Percepta is still used widely in the private hospitals in Thailand. One well-known hospital, Bangkok Hospital headquartered in Bangkok, is an example of users of this product. Founded in 1972 as the first private hospital in Thailand, Bangkok hospital now operates 58 affiliated hospitals and is renowned for Thai and international patients.

Kewalin Rungsinaporn, MD, Assistant Hospital Director and Director of Health Design Center, Bangkok Hospital shared the use of AI in the hospital that "Bangkok Hospital has had an idea about AI application for 10 years. We believed that the AI would be useful in all areas, especially in healthcare. We proposed AI to the administrative team. The committee was set up to study the benefits of AI and plan the use of AI at the headquarters of the hospital."



Kewalin Rungsinaporn, MD, Assistant Hospital Director and Director of Health Design Center, Bangkok Hospital

She further pointed out the unique challenges and opportunities arising from the use of AI in a private hospital. "It is different from the government hospital. At Bangkok Hospital, radiologists check all chest X-rays. With AI, this workflow remains the same, but the technology significantly improves accuracy and speed, enabling faster treatment. Prioritization of image interpretation improves so that abnormal findings can be treated immediately. Patients can then be referred to specialists and receive faster treatment. AI also reduces human error, which further improves diagnostic precision."

Bangkok Hospital has decided to use the AI Chest X-ray product of Thailand, which was developed by Percepta in collaboration with Siriraj Hospital. It was found that the product is not different from other companies, but it is better than the global brand because the company can customize the Bangkok hospital's workflow according to user feedback and conduct research together with Percepta and Siriraj Hospital to develop the product.

The hospital also wants to support the innovation ecosystem in Thailand. Kewalin Rungsinaporn, MD, stated that "we look at the overall picture and ecosystem of health system of the country. We would like to support the product from Thai company."

Kewalin Rungsinaporn, MD, suggested how to read the AI chest X-ray that "there are two monitors for radiologists to read the chest X-ray images: one for the original version and another monitor for the AI chest X-ray. For AI application it is needed to set the chest X-ray image of original version first, then the AI chest X-ray image to reduce the bias of the radiologists. If we misuse it, the AI will affect clinical decision of the radiologists. In a few months, we will be an assistant to AI instead. The correct processes for radiologists are reading the image from original and reading from the AI, then the radiologists make final decision and write a report."

The workflow of chest X-rays at Bangkok Hospital

Key Success Factors

Three main key success factors include the determination of inventors, the innovation ecosystem, and perception of users toward AI.

The determination of inventors to develop their own innovation. The development of AI is a lengthy process that takes a lot of time. Inventors must work with great determination, especially inventors working in the healthcare sector because they have a heavy workload. The public-private partnership and the strength of the team are important factors for the AI team because AI programmers usually work in the private sector and healthcare professionals work in the public sector. The trust and mutual benefit of the team must be cultivated.

The innovation ecosystem to support the nationwide implementation of innovation. To develop AI, inventors need support from organizations and other stakeholders. The processes for implementation in other hospitals or sectors also need support in registering the product to disseminate it for public or commercial purposes. Thailand's innovation ecosystem and a policy for the university holding company are key factors to help catalyst the innovation development and implementation. Currently, Siriraj Hospital has established the Siriraj Medical Research Center (SIMR), the Siriraj Excellent Innovation Center (SIEIC), and the university company called Siriraj Vittayavijai Co., Ltd. (SIVITT)

to drive research and innovation for implementation and commercial purposes.

The understanding and perception of users toward AI. To use AI in hospitals, users must accept the benefits of AI and have a positive attitude towards it. Users need to analyze their problems and choose the AI that can help them overcome the challenges, because there are many AIs on the market. It is unnecessary to buy and use all AIs. Testing and preparing staff before using AI is important. If the interpretation of chest X-ray results between the radiologists and the AI is not in the same direction, the radiologists are responsible for the final decision. The chest X-ray films and the results of the AI are treated confidentially in the hospitals."

Challenges

Three main challenges include data of clinical findings, resistance of the users, and cost and investment.

Data of clinical findings. The AI learns from the chest X-ray images and findings from the previous original chest images. Therefore, rare diseases or conditions that are difficult to read for radiologists will also be challenges of AI.

Resistance of the users. Some radiologists may be afraid of using AI or concerned about the accuracy of interpretation. The testing and opportunities to approach it can help radiologists to accept the AI because they will see the benefits of AI.

Cost and investment. AI chest X-ray and other AI development in healthcare is high cost because it needs specialists in the area to develop, such as radiologists, biomedical engineers, AI developers, high performance computers, servers, and high speed and stable internet. For users, it increases the cost of hospitals, but it is worth investment because it can facilitate the radiologists and physicians to diagnose accurate diseases and health problems.

The Way Forwards

Thailand has recognized the importance of AI and medical technology in the healthcare sector. The national innovation ecosystem, policies and supporting systems have been established to support the development and implementation of innovation for national and commercial purposes. Public and private hospitals in Thailand are planning to use AI in many areas, such as mammography, stroke, diabetic retinopathy and pathology reports. Siriraj Hospital, the country's medical center, is leading the way in healthcare innovation, following the philosophy of His Royal Highness Prince Mahidol of Songkla "for the benefit of mankind." With the support of the innovation ecosystem and private hospitals in Thailand, such as Bangkok Hospital, innovation in healthcare will be sustained and benefit patients as a whole.

Further development of Siriraj AI inventor team

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7. Sakditat Ittiphisit, MD, Faculty of Medicine Siriraj Hospital, Mahidol University

8. Kewalin Rungsinaporn, MD, Assistant Hospital Director and Director of Health Design Center, Bangkok Hospital.

Reference:

1. National Research Council of Thailand [Internet]; n.d. Organizational strategy in 2023 – 2027. [cited 2024 Dec 27]. Available from https://nrct.go.th/file/Strategis/Strategis-NRCT66-70.pdf

2

Developing an Open Data Platform for AI Innovation and Leveraging the Metaverse in Medical Training and Patient Care at Ramathibodi Hospital, Thailand

Developing an Open Data Platform for AI Innovation and Leveraging the Metaverse in Medical Training and Patient Care at Ramathibodi Hospital, Thailand

Kamolrat Turner
Matanee Radabutr

When we think about "innovation", images of novel inventions, cutting-edge developments, and technological breakthroughs driving national industrial progress often come in mind. How revolutionary it would be to harness such innovations for medical advancement. Innovation is paramount in today's world as it drives the development of novel solutions for the diagnosis and treatment of patients at all stages of disease. Innovation is a cornerstone of human capital development and national progress.

The healthcare sector is undergoing a significant transformation through the integration of digital technologies, data-driven platforms, and immersive learning tools. Medical institutions, including Ramathibodi Hospital, are leading the way in integrating new technologies to improve patient care, medical education, and healthcare services, as the statement by Clinical Prof. Artit Ungkanont, Dean of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University that:

Clinical Prof.
Artit Ungkanont
Dean of the Faculty
of Medicine,
Ramathibodi Hospital,
Mahidol University

"Innovation is deeply embedded in our mission, and we actively strive to foster it within our institution. AI and technological advancements are among the most promising areas currently shaping our outlook. As an academic medical center, we have three primary missions: education, academic service, and patient care. A key strategic objective for our administrative team is to drive innovation in all of these areas," said by Clinical Prof. Artit Ungkanont Dean of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

MIND Center at a Glance

Under the auspices of Ramathibodi Hospital, the MIND Center functions as a dynamic hub that not only supports but also drives innovation across the healthcare sector. The center plays a pivotal role in fostering and accelerating medical innovations by collaborating with a diverse range of partners, including academic institutions, industry leaders, and healthcare providers. These collaborations facilitate the development of innovative technologies such as advanced medical devices, robotics, AI applications, and digital health solutions.

Through its comprehensive support system, the MIND Center offers essential resources for innovators and researchers, from concept development and prototyping to testing and implementation. The center ensures that innovations can be seamlessly integrated into clinical practices to improve patient outcomes and drive the digital transformation of Thailand's healthcare system.

By working together with local and international partners, the MIND Center strengthens the capacity for groundbreaking solutions in medical technology by advancing research, education, and the introduction of new innovations that will shape the future of healthcare.

"The MIND Center serves as a unified hub for driving medical innovation and support the development of transformative technologies. With a strong commitment to healthcare innovation, we integrate cutting-edge technologies such as AI for diagnostic imaging, AI-driven health records, and advanced systems solutions for education and palliative care. Our Open Medical Data Platform fosters the development of big data and AI, enhancing diagnostics and personalized medicine. We also use AR/VR technologies to revolutionize medical training and patient care, by enabling immersive learning experiences and improving palliative care outcomes. Through strong collaborations with industry and academia, we are at the forefront of advancing Thailand's digital transformation in healthcare and strengthening our leadership in healthcare innovation".

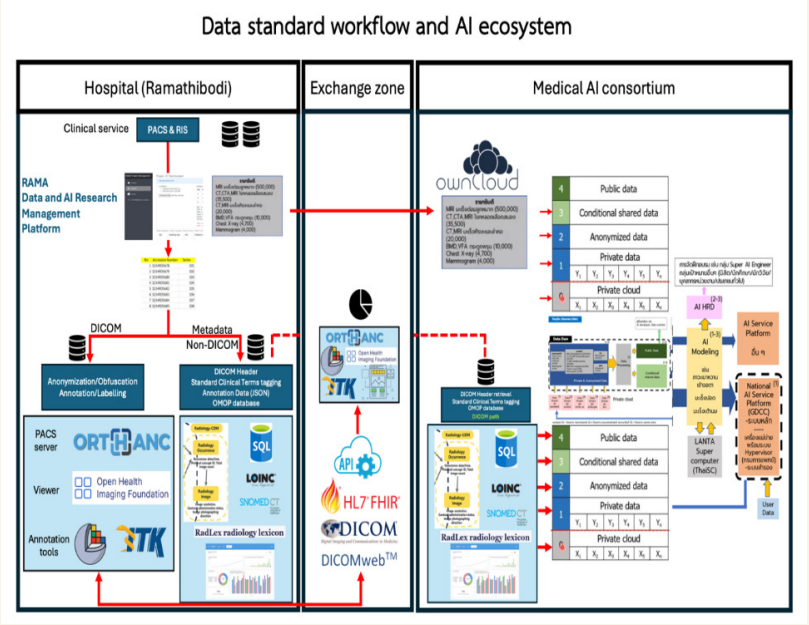
Prof. Chagriya Kitiyakara
Deputy Dean for Innovation and Cooperation, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

Under the theme of PMAC 2025, the MIND Center and Ramathibodi Hospital have selected cutting-edge healthcare technologies to present to participants in a field trip titled 'Establishing an Open Data Platform for AI Development and Utilizing the Metaverse in Medical Training and Patient Care in Thailand.' The presentation will focus on the advanced application of technologies such as Artificial Intelligence (AI) and the Metaverse, utilizing AR/VR tools to drive innovation in healthcare and medical training. Central to this innovation is the Open Medical Data Platform, a vital resource that facilitates the development of AI-driven solutions. The aim is to highlight these innovations from the perspective of a leading medical school and position them as pioneers in technology to enhance and develop the country's healthcare system.

Open Medical Data Platform: A Catalyst for AI Development

Ramathibodi Hospital is one of Thailand's leading medical institutions that has pioneered the development of an **Open Medical Data Platform** in collaboration with the Department of Medical Services, the Ministry of Public Health, and the National Science and Technology Development Agency (NSTDA). This significant infrastructure supports efficient healthcare delivery, research, AI, and medical innovations through the standardization and sharing of medical data. The platform enables the continuous integration of big data and high-quality datasets essential for training AI algorithms.

The platform enables the continuous integration of big data and high-quality datasets essential for training AI algorithms. It provides access to diverse and standardized patient data and enables the development of advanced machine-learning models that drive diagnostic accuracy, predictive analytics, and personalized medicine. It also fosters innovation and enables AI researchers to collaborate across institutions, accelerating the development of new tools and solutions to improve patient outcomes.



Ramathibodi's Open Medical Data Platform Infrastructure, 2024

Assist. Prof. Mungkorn Apirakkan, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

"This platform can lead to innovations and new medical advancements while patient information is still protected," said by Assist. Prof. Mungkorn Apirakkan, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

AI-Powered Medical Imaging: Revolutionizing Diagnostic Precision

The development of an open medical data platform has become a crucial resource for advancing AI technologies. Ramathibodi Hospital has pioneered several in-house AI solutions in radiology, enhancing patient diagnosis and streamlining radiology workflows.

The integration of AI in the Diagnostic and Therapeutic Radiology Division at Ramathibodi Hospital marks a significant leap forward in diagnostic medicine. By combining sophisticated AI algorithms with traditional radiology expertise, medical

professionals can now analyze complex scans with unprecedented precision and efficiency. The image illustrates radiologists using a dual-display system that simultaneously presents AI-enhanced visualizations of lung nodules alongside detailed cross-sectional images. AI assists in highlighting and segmenting various anatomical structures in different colors, allowing for better interpretation.

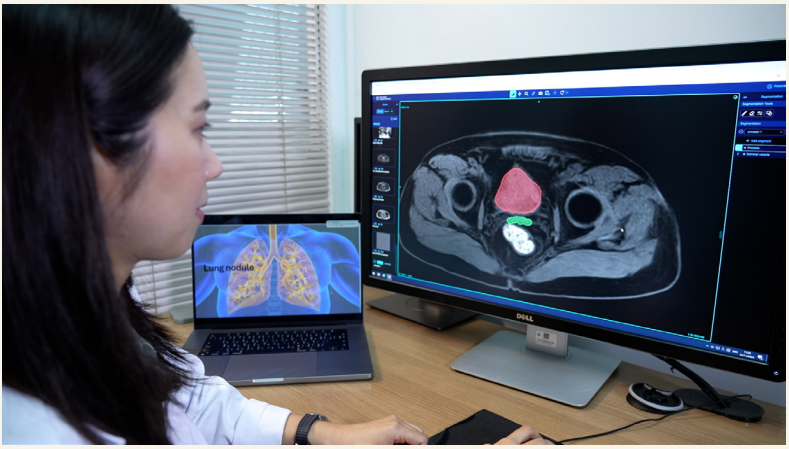
Chayanin Nitiwarangkul, Assistant for Dean of Innovation and Cooperation, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

"Artificial intelligence has revolutionized our approach to radiology, allowing us to detect and diagnose with a level of accuracy and speed that was previously unattainable," said Chayanin Nitiwarangkul, Assistant for Dean of Innovation and Cooperation.

This technical innovation indicates an enhancement in imaging capabilities and a fundamental transformation in medical diagnosis. The AI-assisted system is characterized by its ability to quickly detect underestimated anomalies, precisely measure lesions, and visualize complex anatomical structures that are difficult to detect with conventional methods. Ramathibodi Hospital has created a robust diagnostic ecosystem that accelerates the analysis process and significantly enhances the accuracy of medical diagnoses, making treatment plans more appropriate and effective for patients. This continuous integration of technology and medical expertise exemplifies Ramathibodi Hospital's commitment to pushing the boundaries of modern healthcare.

Nuttamon Chaithanapat, Diagnostic radiology resident, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

"AI is another assistive tool for learning that helps me to be confident and hones my skills when I am looking at a case," said Nuttamon Chaithanapat, Diagnostic radiology resident, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.



AI algorithms X-Ray

Augmented and Virtual Reality in Healthcare: Transforming Medical Training and Patient Care

Digital Anatomy: Revolutionizing Medical Training through 3D

Ramathibodi Chakri Naruebodindra Hospital, under the Faculty of Medicine Ramathibodi Hospital, has transformed education in human anatomy to inspire medical students beyond the limitations of conservative textbooks and cadaver dissections.

Medical students engage with realistic simulations of skeletal structures, muscular systems, and delicate tissues through 3D visualizations of human anatomy. This immersive approach provides exceptional detail and interactivity, allowing learners to explore and modify virtual body systems in unimaginable ways.

Realistic simulations of skeletal structures, muscular systems, and delicate tissues

AR and VR have significantly enhanced the depth and effectiveness of anatomical studies by providing an interactive, experiential learning environment. This represents a fundamental shift in gaining critical knowledge about the human body for healthcare learners. Understanding anatomy and fostering an experiential learning environment significantly improves the efficiency of medical training. The 3D visualizations of human anatomy using Wi-Fi technology are supported by the National

Broadcasting and Telecommunications Commission (NBTC), faculty members from Ramathibodi Hospital, and industry leaders in digital technology focusing on the required digital infrastructure.

3D visualizations of human anatomy

The use of AR/VR can also be applied in surgical planning. The use of a virtual world where surgical trainees can practice procedures in highly realistic VR-based simulations of surgical training environments goes beyond traditional surgical simulations. It offers a more comprehensive and immersive experience, unlocking new paths for surgical training. Medical students can practice complex surgical procedures through virtual environments for patients' safety. VR-based simulations enable them to repeat procedures to develop proficiency in surgical skills, increase their confidence before working in actual situations, and reduce risk in learning experiences.

VR-based simulations can recreate various surgical scenarios, including rare cases that medical students might not encounter during regular training. The immersive technology can respond to individual student needs, focusing on areas where they need the most practice.

The transformation of medical education through AR and VR represents a paradigm shift in how future medical students are trained by engaging, interacting, and providing comprehensive learning experiences to improve patient outcomes. This innovative approach aligns with integrating AR and VR technologies. This innovative approach also reforms traditional training methods with interactive learning experiences that enhance medical students' understanding and application of medical concepts. Transforming medical education through innovation, AR, and VR enhances the learning experience and prepares medical students to meet the challenges of modern medical practice. This integration is a significant innovation for improving healthcare education to achieve the ultimate outcomes for patients. The future of medical training is evolving through AR and VR to develop the potential skills and knowledge necessary for success in medical fields.

Dr. Benrita Jitaree, Lecturer of Chakri Naruebodindra Medical Institute, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

"MR, AR, and VR can be called "Extended Reality or XR" and serve as interactive textbooks, enabling students to learn anytime and anywhere while optimizing their time efficiency. These technologies can develop autonomous and self-directed learners," said by Dr.Benrita Jitaree, Lecturer of Chakri Naruebodindra Medical Institute, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

VR simulation

Realizing Final Aspirations Through Virtual Reality

Virtual reality (VR) is a transformative tool in palliative care, specifically addressing Buddhist patients' spiritual and emotional needs in several significant ways. Patients who are bedridden can use it to virtually visit temples that they can see at 360 degrees. Patients feel as if they are physically present at holy sites and can participate in meaningful rituals that they would otherwise be unable to perform due to their health conditions. In addition, the technology enables interactive meditation experiences where patients can virtually participate in meditation sessions led by monks, learn about dharma, and take part in chanting rituals. This is particularly advantageous for people who get comfort from religious rituals but do not have access to temples or meditation centers. The immersive nature of VR cultivates a deep sense of presence, allows patients to connect with these spiritual experiences despite their physical limitations.

For Buddhist patients in Thailand, attaining spiritual tranquility via conventional religious activities is profoundly significant throughout the virtual final journey. Many people express a wish to participate in substantial Buddhist practices, such as temple visits, blessings from monks, hearing dharma discourses, and engaging in meditation. Moreover, VR can help young patients follow their dreams, such as going to the sea or theme park. These spiritual activities are one essential to their existence. It become more important but maybe unattainable during end-of-life care. Virtual reality technology addresses these spiritual needs by providing immersive experiences that enable patients to engage in religious activities from their hospital beds.

Monk chanting in VR

The case of 76-year-old Buddhist patient who was confined to bed for months due to advanced-stage cancer is an example of the use of VR to support the patient's last wish. Her last wish was to visit her favorite monastery and meditate with the monks. The palliative care team used VR technology to create a virtual environment that allowed her to experience a tranquil temple setting, with the calming presence of chanting monks and the recognizable elements of traditional Buddhist architecture. This immersive experience offered her spiritual solace while effectively alleviating her anxiety and pain symptoms through a mindfulness-based virtual reality treatment.

A woman patient using AR to pray

The effectiveness of this approach illustrates how technology can reconcile physical constraints with spiritual needs in end-of-life care. In addition to religious experiences, the VR

program at Ramathibodi Hospital enables patients to digitally revisit meaningful places from their past, rekindle memories, and realize ultimate aspirations that are not possible in reality. This new approach to palliative care demonstrates the use of modern technology to provide comprehensive treatment that encompasses not only physical symptoms but also patients' emotional and spiritual well-being in their final days.

Siriporn Semsarn, Ramathibodi Palliative Care Excellent Center, Faculty of Medicine, Ramathibodi Hospital, Mahidol University

"How we help them smile even during the final stage of their life, so we can help to make the final days of terminal patients fulfilling. VR fulfills patients' end-of-life wishes," said Siriporn Semsarn, a palliative care nurse.

Challenges and Way Forward

The journey toward developing an open data platform for AI innovation and harnessing the potential of the metaverse for medical training and patient care at Ramathibodi Hospital, Thailand, is a ground-breaking endeavor. However, it faces several critical challenges that need to be addressed to ensure meaningful progress and sustainable implementation.

1. Data Management and Security

Ensuring patient confidentiality remains a key concern in the adoption of open data platforms. Enhanced security measures need to be developed to protect sensitive medical information while maintaining compliance with strict data protection regulations. Developing a solid framework for the responsible handling and sharing of medical data is essential for building trust and fostering innovation in healthcare.

2. Integration and Educational Revision

The seamless integration of new technologies into existing healthcare systems requires well-defined protocols. This includes not only the adoption of the technologies but also the revision of training programs for healthcare professionals. Comprehensive educational strategies should include the creation of evaluation frameworks to assess the impact and effectiveness of virtual training environments, ensure compliance with accreditation standards, and enhance the overall quality of medical education.

3. Scaling and Accessibility

Extending the reach and affordability of these technologies is a key priority. Cloud-based platforms and mobile applications could facilitate greater accessibility, especially in underserved or remote areas. This would enable healthcare services to overcome geographical barriers. Continuous validation and feedback mechanisms are essential to measure the effectiveness of these innovations in improving patient outcomes and ensuring equitable access.

4. Research and Validation

Ongoing research is critical to demonstrate the reliability and effectiveness of AI-driven technologies and metaverse-based solutions. Robust clinical frameworks need to be developed to demonstrate their value in real-world applications. This includes long-term studies on the impact of augmented and virtual reality (AR/VR) training on medical student performances and evaluating the accuracy of AI-assisted diagnostics in clinical practice.

The Vision of the Future

Ramathibodi Hospital is at the forefront of technological innovation in healthcare, setting the standard for medical education and patient care in Thailand. By addressing these challenges, the hospital can pave the way for a future where advanced technologies are seamlessly integrated into the

healthcare ecosystem. The success of these initiatives will represent a sustained commitment to technological advancement for practical implementation, measurable outcomes, and a vision that prioritizes both innovation and accessibility.

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3

Utilizing Social Innovation and Technology to Improve Primary Care Access, Quality, and Financial Protection in UHC: The Case of "30-Baht Treatment Anywhere"

Utilizing Social Innovation and Technology to Improve Primary Care Access, Quality, and Financial Protection in UHC: The Case of "30-Baht Treatment Anywhere"

Sukjai Charoensuk
Yupawan Thongtanunam

Background of the Transition from "30-Baht Treating All Diseases" to "30-Baht Treatment Anywhere"

Thailand's journey to Universal Health Coverage (UHC) was initiated in 2002 establishing a pioneering model in promoting equitable access to healthcare. The UHC policy aimed to ensure that all Thai citizens could access to a wide range of medical services for just 30 baht in order to reduce the financial burden and improve population health. This scheme is therefore commonly referred to as "30-Baht Treating All Diseases program".[1]

Thailand's UHC is an example of how strategic health policy can contribute to significant advances in public health and promotion of social equity. It also serves as a model for low- and middle-income countries, demonstrating how strong political will, strategic planning, and investment in health infrastructure can transform healthcare accessibility and equity. Its success

is reflected in reduced out-of-pocket expenditure, improved population health outcomes, and greater trust in the healthcare system.

However, despite its groundbreaking success in reducing the financial burden and improving the health of the population, the system was not without its challenges. Patients in rural areas faced long journeys and overcrowded urban hospitals, highlighting gaps in equitable access.

“I lived in a rural area. I sometimes had to leave as early as 5 a.m. to queue for my turn, which was quite time-consuming,” said Ms. Supaporn Yamnam, a patient.

Ms. Supaporn Yamnam, a patient at I-Care community dental clinic in Saraburi province

Imagine starting your day at 5a.m., driving along country roads to reach a hospital and then having to wait hours for treatment. That was the reality for Supaporn Yamnam and countless others like her. These phenomena have led to calls for a more accessible healthcare system.

In January 2024, Thailand introduced the “30-Baht Treatment Anywhere” program, which offers patients the

opportunity to receive treatment at any facility in the UHC network. This new program was initially piloted in 12 provinces across Thailand and will be extended to the entire country by the end of 2024, so that patients will be no longer tied to a single healthcare provider. Every Thai citizen with just an identity card now has seamless access to healthcare.

The transition from "30-Baht Treating All Diseases" to "30-Baht Treatment Anywhere" has marked a significant evolution in Thailand's Universal Health Coverage, aiming at enhancing accessibility and convenience for patients, by encouraging private clinics to participate in the scheme as an Innovative Primary Healthcare Units.

These measures allow patients to access healthcare services at any hospital or primary care facility within the UHC network, supported by a unified digital health information system for seamless exchange of medical records. The scheme has expanded the scope of services to cover advanced diagnostics, specialized treatments, and rehabilitation, while enhancing the capacity of participated healthcare facilities to serve as the initial point of contact for health concerns. The reforms aimed to improve service quality, reduce waiting times, and provide personalized treatment, with a focus on patient-centered care. A more efficient referral system ensured that patients in need of specialized care received timely treatment, and community engagement was strengthened by empowering health care providers in the local area and volunteers to prioritize prevention and health education.[2]

The success of the initiative lies in its innovative reforms. The reform introduced seven key initiatives, referred to as the "7 Angels to improve Thailand's Universal Health Coverage (UHC) system. The "7 Angels" – healthcare units that extend primary care beyond the traditional hospital setting. These units include community pharmacies, nursing clinics, medical technology centers, dental clinics, physiotherapy facilities, traditional Thai medicine and mobile dental treatment units.[3] These services demonstrate a "New Way" of public health services to serve all Thais, especially in vulnerable groups and people living in remote areas.

"Currently, over 10,000 private clinics nationwide have been registered as units with the NHSO. There are seven services include pharmaceuticals, general medicine, dental care, nursing, medical technology and lab testing, physical therapy, and traditional Thai medicine established in Thailand as well as in Saraburi Province," said Somchart Sutjaritrungsee, MD, Director of the Driving, Monitoring, and Evaluation Department, NHSO District 4.

Somchart Sutjaritrungsee, MD, Director of the Driving, Monitoring, and Evaluation Department, NHSO District 4

Saraburi Province: An Example of the 30-bath of Treatment Anywhere Scheme Implementation

Saraburi Province is home to 632,795 people, 69.39% (439,138) of whom have UC rights. In 2023 the Life Expectancy at birth (LE) is 72.01 years for Male, and 79.68 years for Female. From 2021 to 2023, the leading causes of death are sepsis, cancer, pneumonia, stroke, and ischemic heart disease. In 2024, The most common ambulatory diseases in hospitals in Saraburi Province are followed by diabetes, abnormal tissue, upper respiratory tract infections, and dental and gum disorders (432.7, 233, 183, 182, and 117 cases per thousand population, respectively).

Health facilities in Saraburi Province include 12 hospitals under the Ministry of Public Health, 1 hospital under the Department of Health, 4 private hospitals, 2 hospitals under the Ministry of Defense, 96 sub-district health promotion hospitals under the Ministry of Public Health, 30 sub-district health promotion hospitals under the Provincial Administrative Organization, 3 public health service centers under the municipality, and 4 public health service centers under the Ministry of Public Health. There are also 304 clinics, 7 laboratories, and 243 pharmacies. The Health Information Systems (HIS) used include HOSxP V3, V4, HOSxP PCU XE, and SSB, Hospital OS.[4]

Healthcare in Saraburi province faces several challenges that have led to the introduction of the “30-Baht Treatment Anywhere” scheme. These include geographical barriers, healthcare infrastructure, workforce shortages, the burdens of Non-Communicable Diseases (NCDs), financial barriers, and limited access to emergency care.

Crowded of Patients at Saraburi Hospital

Health Promoting Hospital in Saraburi Province

Saraburi population and prevalent health problems exemplify the demand and capacity to pioneer the 30-Baht Treatment Anywhere Scheme.

The extensive healthcare network, supported by advanced health information systems such as HOSxP and Hospital OS, ensures seamless data sharing and continuity of care. With a robust infrastructure and high UC coverage, Saraburi is an example of equitable and efficient healthcare delivery.

The system addresses challenges such as geographical barriers by providing access to any UHC hospital, improving

referrals and data integration, and alleviating labor shortages through the expansion of primary care and community volunteers. It also addresses the burden of NCDs, reduces financial barriers through affordable services, ensures access to emergency care, strengthening equitable healthcare across the province.

The Seven Health Care Services in Saraburi: A Social Innovation

The "30-Baht Treatment Anywhere" scheme in Saraburi Province offers a comprehensive range of healthcare services to ensure that residents receive quality care across various medical fields. Here are the key services provided:

1. Physiotherapy: Rehabilitation services, including physiotherapy, occupational therapy, and post-injury or post-surgical rehabilitation, are provided to help patients recover and regain functionality. These services are essential for improving patients' quality of life.

Previously, rehabilitation services at Saraburi Center Hospital were limited and patients had to travel long distances, making access difficult. To address this, Saraburi Hospital established Saraburi-2 Hospital as a primary care facility. However, with only one physiotherapist, and only 2 physiotherapists available for home visits, the capacity remained insufficient — limited to one visit per month.

To increase access, the hospital partnered with the Sub-District Health Promoting Hospitals and increased the number of services. “However, many patients do not receive their full entitlement because they are unable to take care of themselves, making it difficult for family members to transport them to the hospital. The “30 Baht Treatment Anywhere” program significantly improved the situation. Home visits by clinics under this program increasingly covered 80-90% of patients, which these clinics received 650-baht compensation per home visit. This ensures that patients unable to visit clinics or hospitals can receive comprehensive care,” said Suppasil Jampanak, MD, PMR, Saraburi Hospital.

Suppasil Jampanak, MD, PMR, Saraburi Hospital

Physical therapy at Supaporn Physical Therapy Clinic in Saraburi Province

2. Dental Care: The scheme aims to improve oral health by making dental services more accessible and affordable. Regular dental check-ups and cleanings are provided to maintain oral health. Services include fillings, extractions, root canals, and other dental procedures. Preventive measures such as fluoride treatments and dental sealants are offered to prevent tooth decay and gum disease. The clinic can provide free services 3 times a year.

"Our dental clinic participates in this scheme because we serve as the frontline for screening when patients come in. It's like the first step—if patients see us earlier, they can receive treatment more quickly. Early detection and intervention can help avoid major procedures, which would otherwise incur higher costs for the Universal Healthcare system. Besides, detecting diseases early, treatment becomes simpler and less likely to require referrals to secondary and tertiary care hospitals.," said Thanabodee Yuthayuenyong, a dentist at Community Dental Clinic in Saraburi Province.

Thanabodee Yuthayuenyong, a dentist at Community Dental Clinic in Saraburi Province

Dental service at Community Dental Clinic in Saraburi Province

3. Pharmaceuticals: The expanded role of pharmacists in primary care is the result of a partnership between the NHSO, the Pharmacy Council of Thailand, and drugstores. Patients can access a wide range of medicines from any participating pharmacy within the UHC network. This includes both prescription and over-the-counter medicines. The scheme ensures that medicines are affordable, reducing the financial burden on patients. Pharmacies are the most prevalent type of the "30-baht Treatment Anywhere", with over 5,000 registered pharmacies nationwide.

Service at Community Dental Clinic in Saraburi Province

"My son has been unwell with a fever since last night. I came to get fever-reducing medicine. I've used similar services at other pharmacies before, but this is my first time using this pharmacy. It's very convenient—close to home, with no long waiting times. I can get the medicine and return to work without taking time off. The pharmacist gave me clear and helpful advice that was easy to understand." said the mother of a 10-year-old boy with the flu.

A sick child with his parents at Community Pharmacy in Saraburi Province

4. General Medicine: General practitioners (GPs) provide primary care services, including diagnosis and treatment of common illnesses, routine check-ups, and preventive measures. This ensures that patients receive timely and appropriate medical care. Patients can be referred to a specialist for more complex conditions. The referral system is streamlined to reduce delays and ensure timely treatment. GPs also provide health education and counseling to promote healthy lifestyles and prevent illness.

5. Nursing and Midwifery Care: The collaboration between NHSO and the Nursing Council facilitated the "30-Baht Healthcare for All with One ID Card" initiative, which allows patients to use their ID card to access the services of registered "Warm Community Nurse Clinic." These clinics offer seven health promotion and disease prevention services, including birth control, pregnancy testing, prenatal care, anemia prevention and mental health screening. They also provide medication, basic care, home health care and treatment for common illnesses. This initiative ensures that Thai citizens across the country receive easily accessible and convenient healthcare.

6. Medical Technology and Lab Testing: To enable accurate diagnosis and treatment, advanced diagnostic services such as blood tests, imaging (X-rays, ultrasounds), and other laboratory tests, are available.

7. Traditional Thai Medicine: The scheme also incorporates traditional Thai medicine, offering treatments to treat various ailments and promote overall health. Therapeutic Thai massage is also offered to relieve pain, reduce stress, and improve circulation. Traditional Thai medicine provides a holistic approach to health, addressing physical, mental, and emotional well-being.

At first glance, the "30-Baht Treatment Anywhere" scheme aims to make healthcare services more accessible, affordable, and comprehensive for all residents of Saraburi Province, ensuring that they receive the care they need, regardless of their location or financial situation.

The Role of AI in Building a Healthier World

Saraburi Province has developed an innovative data system to support the "30-Baht Treatment Anywhere" scheme, ensuring comprehensive, equitable, and efficient access to healthcare. The system connects hospitals to Saraburi's data center via APIs and displays patients' medical history via a web application. QR codes and the Line app "Mor Prom", while staff access is verified by the Department of Provincial Administration. Authentication is done using national ID cards, QR Codes, and the Line app "Mor Prom".

The Health Information Exchange (HIE) system enables seamless data sharing across Health District 4 and beyond,

allowing quick access to medical records and lab results for timely diagnosis and treatment. The data is displayed on a web application, and access to the system is authenticated using Thai ID from the Department of Provincial Administration.

The implementation Plan for the Policy "30 Baht Treatment Anywhere" with a Single ID Card was divided into 4 phrases, starting with four pilot provinces in January 2024 and nationwide by October 2024, allowing clinics to efficiently track patient visits, work results and reimbursement processes and process payments every 7 days.

This system allows clinic staff like Ms. Supaporn Teppanich, the community physiotherapist clinic owner to monitor patient activities and reimbursement claims in real-time. "It makes the entire process transparent and efficient," she said.

Ms. Supaporn Teppanich, the community physiotherapist clinic owner

Meanwhile, pharmacists like Ms. Chuenjai Sratongfaeng leverage AI tools to track prescriptions, preventing duplication and ensuring patient adherence. “Database systems and AI have significantly improved service delivery. They allow us to check whether a patient has already received medication from another provider and what medication they have been prescribed, which helps to avoid duplicate prescriptions and track patients better. Sometimes patients switch to another pharmacy without stopping their previous medication. At our pharmacy, we use the hotline to ask patients who have already received medication how they are feeling and give them additional advice if their symptoms have not improved,” she said,” said Chuenjai Sratongfaeng, a Pharmacist at Community Pharmacy.

Ms. Chuenjai Sratongfaeng, Pharmacist at Medico Drugstore, in Saraburi Province

Each clinic used the applications to improve their services under the “30-Baht Treatment Anywhere” scheme in Saraburi Province. For example, HealthPortalWeb, DentClound, and Disability Portal applications are used to verify patient identities, check their medical history, and track the number of services they are eligible to receive under their benefits.

Applications are used to verify patient identities, check their medical history, and track the number of services

Currently, healthcare facilities can use different programs to process claims. However, the NHSO mandates a standardized data set that will simplify claims verification, ensure faster payments and reduce processing times. Clinics now receive payments within just seven days, improving operational efficiency.

In addition, communication and education tools such as Line Official, Medisave and Telehealth have been introduced to support preventive care and health promotion. These applications enhance healthcare delivery by simplifying patient management, facilitating communication with providers and improving access to care, making the system more efficient and patient centered.

Remained Challenges

Due to the growing proportion of older people, the demand for healthcare services is increasing. The budget required for the care of the elderly and people with disabilities also tends to increase. The NHSO has realized these challenges and has already prepared by expanding both treatment benefits and health promotion and disease prevention initiatives. This ensures that patients receive effective treatment when they fall ill, while promoting the health of the elderly to keep them in good health condition and reduce their susceptibility to illness.

"While there have been many positive outcomes, challenges remain, all the challenges highlight the need for a more flexible and accessible healthcare system, which the 30-Baht Treatment Anywhere scheme aims to provide." said Dr. Athaporn Limpanyalers, Deputy Secretary-General of NHSO.

Dr. Athaporn Limpanyalers, Deputy Secretary-General of NHSO

To ensure a sufficient workforce engaging private clinics are critical next steps. Deputy Secretary-General of NHSO, Dr. Athaporn Limpanyalers, underscores the need for innovation. “Telemedicine, health kiosks, and expanded community clinics are also in need to bridge the remaining gaps. Hence, we not only need AI to provide care to patients, but also to support all registered community clinics to provide their services more conveniently and claim medical expenses quickly and efficiently. However, at present, each clinic uses its own applications developed by themself. If there were standard applications for all clinics, it would greatly improve the efficiency of data connectivity in the provision of healthcare services.

Recommendations

Policymakers should promote guidelines for AI implementation and training programs to enhance AI use and digital literacy of both clients and healthcare providers. Furthermore, the NHSO should encourage stakeholders to collaborate in leveraging AI to deliver efficient and valuable healthcare services to all Thais.

In addition, financial security must address concerns about the budget allocated to this scheme, as it may increase with the rise in accessibility to sustainable healthcare services without becoming a prohibitive financial burden.

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References

1. National Health Security Office (NHSO). NHSO Annual Report 2022 [Internet]. Bangkok, Thailand: National Health Security Office; 2022 [cited 2024 Dec 29]. Available from: https://eng.nhso.go.th/assets/portals/1/files/Nhso%20annual%20report%202022(1).pdf
2. National Health Security Office (NHSO). From Treats All Diseases to Treatment Anywhere: The Transformation of Thailand's Universal Coverage Scheme [Internet]. 2024 [cited 2024 Dec 29]. Available from: https://eng.nhso.go.th/view/1/DescriptionNews/From-Treats-All-Diseases-to-Treatment-Anywhere-The-Transformation-of-Thailands-Universal-Coverage-Scheme/610/EN-US

3. National Health Security Office (NHSO). News update [Internet]. 2024 [cited 2024 Dec 29]. Available from: https://www.nhso.go.th/news/4543

4. National Health Security Office (NHSO). NHSO Saraburi Information System [Internet]. 2024 [cited 2024 Dec 29]. Available from: https://nhso4.nhso.go.th/mis_saraburi/

4

The Role of UHC in Strengthening Public Health and Fueling Local Innovation for Economic Growth: Thailand's Model

The Role of UHC in Strengthening Public Health and Fueling Local Innovation for Economic Growth: Thailand's Model

Wilaiporn Khamwong
Siriwan Tumchuea

KCMH and MDCU at a Glance

King Chulalongkorn Memorial Hospital (KCMH)

King Chulalongkorn Memorial Hospital (KCMH), located in the heart of Bangkok, Thailand, is a major healthcare facility easily accessible from all regions of the country. Established

in 1914 and named in honor of King Chulalongkorn (Rama V), who played a pivotal role in the modernization of Thailand in the late 19th and early 20th centuries. KCMH has become one of the nation's leading academic medical centers. With a capacity of 5,000 to 7,500 outpatient visits daily and 1,500 inpatient beds, the hospital is renowned for its advanced healthcare services, medical research and innovation, and education.

Buildings of Chulalongkorn University

As part of the Thai Red Cross Society and affiliated with the Faculty of Medicine, Chulalongkorn University (MDCU), King Chulalongkorn Memorial Hospital (KCMH) stands as a premier hub for advanced medical education, training, and research. The hospital collaborates with global partners to foster innovation and knowledge exchange while providing world-class care for advanced and complex medical cases. Committed to

inclusivity, KCMH serves all segments of the population, including marginalized communities. It plays a pivotal role in Thailand's healthcare system, driving advancements in medical care, education, and local innovation for the benefit of Thai society and the global medical community.

Pioneering Research and Innovation: MDCU and KCMH's Role in Advancing Healthcare Technologies

As Thailand's medical landscape continues to evolve, MDCU and KCMH have consistently upheld their reputation for excellence in patient care and medical education. At the same time, they are at the forefront of introducing and developing cutting-edge healthcare technologies and innovations. *"We have faced many challenges, and we aim to elevate our standards to new heights. Innovation is crucial—it provides solutions to the problems we encounter every day. That is why, at Chulalongkorn University, we are committed to being an innovative institution. Our goal is to deliver impactful solutions that benefit society,"* said Assoc. Prof. Chanchai Sittipunt, MD, Dean of the Faculty of Medicine at Chulalongkorn University and Director of KCMH.

Assoc. Prof. Chanchai Sittipunt, MD, Dean of Faculty of Medicine, Chulalongkorn University, and Director of KCMH

With its commitment to both research and patient-centered care, MDCU and KCMH are actively shaping the future of medicine in Thailand and Southeast Asia, fostering a health-care ecosystem that emphasizes locally-developed innovations, accessibility, and improved patients' outcomes. *"I'm so excited to share what we've been working on to revolutionize healthcare. What we are doing is not just about technology—it's about people. It's about making healthcare more accessible, efficient, and, ultimately, better for everyone,"* said Assoc. Prof. Solaphat Hemrungrojn, MD, Associate Dean for Integrated Innovation and Digital Technologies Affairs, Faculty of Medicine, Chulalongkorn University.

Assoc. Prof. Solaphat Hemrungrojn, MD, Associate Dean for Integrated Innovation and Digital Technologies Affairs, Faculty of Medicine, Chulalongkorn University

MDCU and KCMH integrate clinical expertise with cutting-edge technologies to tackle both local and global health challenges. Assoc. Prof. Solaphat Hemrungrojn highlights the Chulalongkorn Medical Innovation Center (CMICE) as a dynamic hub where innovative ideas are transformed into practical solutions. CMICE fosters collaboration among doctors, researchers, and entrepreneurs to develop accessible and equitable healthcare

solutions. Focusing on research, development, commercialization, and social impact, it aims to improve health outcomes, especially for underserved communities by delivering innovative, locally tailored solutions.

Working in Labs and Facilities of Chulalongkorn Medical Innovation Center (CMICE)

Here are examples of local innovations developed by Chulalongkorn University to enhance healthcare services.

1) DMIND (Detection and Monitoring Intelligence Network for Depression) is an application developed to address the global issue of depression, particularly in Thailand, where there is a shortage of mental health professionals. DMIND analyzes subtle signs of depression, such as facial expressions, tone of voice, and conversation patterns, to identify individuals who may need early support and help.

2) BrainDi is an AI-powered device designed to predict dementia by analyzing patterns from computer-based cognitive tests. It detects subtle signs of dementia early, enabling faster diagnosis and identifying potential risks before symptoms worsen.

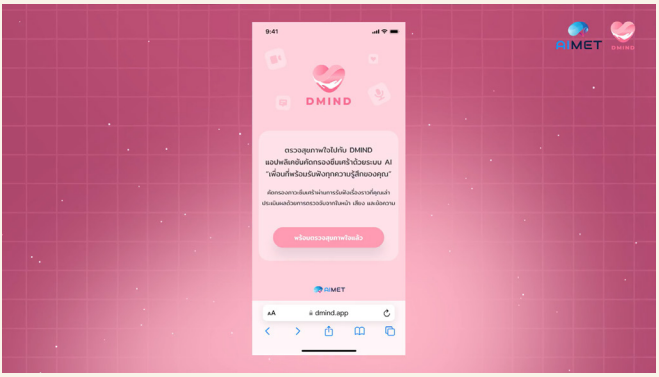
This innovation helps healthcare teams to provide timely care and improve patient outcomes.

3) AI Ultrasound is an AI tool developed to detect liver cancer by generating ultrasound images. It addresses the challenge of late-stage diagnosis caused limited screening and radiologist shortages, especially in remote areas. By enabling real-time detection of tumor during ultrasound, it facilitates early detection and timely treatment, even in underserved regions.

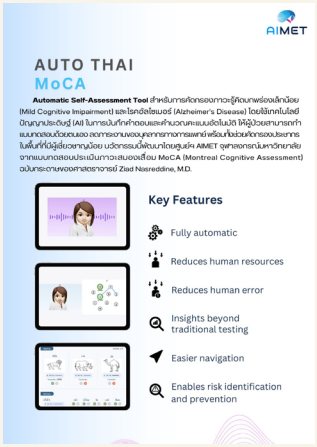
4) Albuminuria Test Kits are groundbreaking tools designed for the early detection of chronic kidney disease (CKD), addressing a critical global health challenge. Developed through a collaboration between Chulalongkorn University's Department of Internal Medicine and the Health Systems Research Institute, these kits enhance CKD screening by offering point-of-care testing suitable for home use and are integrated with automated data systems. These innovative kits are designed to improve early diagnosis and facilitate timely interventions, ultimately contributing to better patient outcomes.

5) 3D-Printed Titanium Skull Implants, developed through collaboration between Meticuly Co., Ltd., the Health Systems Research Institute, and Mahidol University, offer a safer and more effective alternative to conventional Polymethyl-methacrylate (PMMA) implants for stroke patients requiring skull reconstruction. These implants meet international standards

for quality and affordability. The use of 3D printing also enables personalized prostheses and anatomical models that enhance surgical precision and patient comfort. This innovation improves the healthcare accessibility by reducing the costs and manufacturing time for customized medical devices.



DMIND



BrainDi

Medical Devices and Titanium Skull Implants

KCMH's Local Innovations and Meticuly's Medical Devices and Titanium Skull Implants

Meticuly is a Deep Tech startup that combines metallurgical technology, 3D printing and medical science to produce customized titanium bone implants. *"The company was founded 8 years ago when I was visiting my mother who was seriously ill in an ICU. I met a friend who was a doctor. He asked me if I could produce these medical devices. Because importing these devices is very expensive,"* said Assoc. Prof. Boonrat Lohwongwatana, PhD, Co-founder of Meticuly, and Laturer at Faculty of Engineering, Chulalongkorn University. Initially, Meticuly focused on overcoming the challenges of product safety and global standards to gain doctors' trust.

Assoc. Prof. Boonrat Lohwongwatana, PhD, Co-founder of Meticuly, and Lecturer at Faculty of Engineering, Chulalongkorn University

Despite early doubts, the team proved the demand for locally made implants after an investor experienced the high cost of imported implants. *"After we completed our first 4-5 cases, we felt great that we could actually help the patients. It made us so happy. Because engineers usually don't have much contact with people. When we were able to help people, we felt really good and continued to do it ... until now. Because it makes our career more meaningful,"* said Assoc. Prof. Boonrat Lohwongwatana,PhD.

Meticuly creates customized bone implants with great empathy, such as the one for a 10-year-old cancer patient who needed an arm amputation. Despite the costly and labor-intensive process, the team is dedicated to restoring lives. In collaboration with Chulalongkorn University and donations from alumni, Meticuly has launched the "100 Bone Implants and Titanium Devices for Thais" project, offering free implants and advancing research. Their goal is to provide patient-specific, affordable, and high-quality implants. Meticuly aims to build a sustainable Deep Tech ecosystem in Thailand, supporting local doctors with advanced technology and inspiring future innovation in the MedTech sector.

The MDCU and KCMH are advancing Thai healthcare through groundbreaking local innovation and research in vaccine development, precision health, and genomics. Despite high costs, research for better healthcare outcomes is a priority. Prof. Kiat Ruxrungtham highlights the challenges low- and middle-income countries face in accessing vaccines and expensive therapeutic options. The Chula Vaccine Research Center plays a key role in mRNA vaccine research, collaborating with global networks like the WHO and the UK Vaccine Hub.

Prof. Kiat Ruxrungtham, MD, Director of School of Global Health, Faculty of Medicine, Chulalongkorn University, and Scientific Chair of the Chula Vaccine Research Center

MDCU and KCMH are also leaders in genomics for population health, focusing on rare diseases with advanced DNA sequencing technologies. Their work enables precise diagnoses and treatments that save lives. The Center of Excellence in Genomics is expanding research and clinical services, including newborn sequencing to detect genetic disorders early, and supporting WHO's global health genomics program for equitable health solutions and advancing precision medicine for all.

MDCU and KCMH's Local Innovations Promoting the Role of UHC in Strengthening Healthcare Sustainability and Equity for Economic Growth

World leaders have pledged to achieve Universal Health Coverage (UHC) by 2030, but progress has been slow and uneven. Some countries are struggling to maintain their UHC achievement, while others are faced with challenges in sustaining them due to conflicts, the ongoing impact of COVID-19, and limited healthcare funding. Although UHC was previously seen as a financial burden, it is increasingly recognized as a strategic investment that improves public health, boosts productivity, and contributes to long-term economic stability.

Thailand has also launched a policy to promote innovations under its UHC, focusing on advanced technologies for treatment, health promotion, and disease prevention technologies. Despite the challenges, the Thai healthcare industry has significant

potential to compete globally. Innovations in the health system could help Thailand escape the middle-income trap. The National Health Security Office (NHSO) and four partners; the Center of Excellence in Life Sciences, the Office of the Science Promotion Board Research and Innovation, the Health Systems Research Institute, and the National Research Council of Thailand; are integrating these innovations into the UHC (Gold Card), aiming to maximize health funds to drive both economic growth and advancements in science and technology.

Last year, KCMH provided treatment to 21,336 patients under the Universal Health Coverage (UHC) program, accounting for approximately 40% of all inpatient cases, and recorded 533,856 outpatient visits. *"UHC is a remarkable initiative and one of the best examples of how Thailand can provide equitable healthcare to its people,"* said Assoc. Prof. Chanchai Sittipunt, MD, Dean of the Faculty of Medicine, Chulalongkorn University, and Director of KCMH. *"We need to prioritize sustainability and equity, ensuring that people can access to the care they need while maintaining available system. That's why we're exploring innovative approaches, such as developing medical instruments and devices. Innovation doesn't always mean completely new ideas—sometimes, it's about making existing solutions more affordable. By producing these locally, we can reduce costs compared to importing them, which increases accessibility. Our collaboration with UHC aims to ensure that healthcare is both affordable and sustainable for all."*

Local innovations produced by CMICE and Meticuly are transforming healthcare through advanced technology, equity, and sustainability. UHC patients are now benefiting from these advancements, with DMIND serving nearly 500,000 users in two years, cutting waiting times to just 6 minutes. Tools like Braindi enable early detection of dementia 10 years in advance, while AI-assisted ultrasound enhance the diagnosis of liver cancer. 3D-printed titanium skull implants are designed in minutes and shipped worldwide within seven days. Over 2,000 Thai patients have already received these implants, including 168 under UHC. These efforts highlight CMICE and Meticuly's commitment to providing accessible, high-quality care and a more equitable future for healthcare.

Ongoing Projects and Future Plan

Looking to the future, MDCU and KCMH are committed to nurturing and advancing local innovations and research development, with a particular focus on studies in human genetics and precision medicine. Over 10 vaccines are currently being developed, including one against dengue fever. Although numerous research projects and innovative initiatives are already underway, both the leaders and the team have a shared vision to expand the impact of these local innovations across Southeast Asia and the world. This commitment seeks to ensure sustainable healthcare while exploring commercialization opportunities to boost economic growth.

The hospital is advancing AI-powered predictive models to forecast and prevent disease outbreaks, using data analytics to address public health threats proactively. It is also exploring VR and AR technologies to enhance medical education and surgical training through safe, immersive simulations. By integrating these cutting-edge advancements, MDCU and KCMH reaffirm their leading position in medical research, education, and patient care in Thailand, aspiring to deliver world-class healthcare and inspire excellence across Southeast Asia and beyond.

Medical Students and Advancements in Teaching and Learning Education

Key Success Factors

1. *Clear Vision and Strong Leadership:* Assoc. Prof. Chanchai Sittipunt, MD, Dean of the Faculty of Medicine at Chulalongkorn University and Director of KCMH, together with his team, envisions integrating healthcare technologies and fostering local innovations. They promote a culture of innovation and continuous improvement to ensure effective adoption of advances.

2. *Teamwork and Collaboration with interdisciplinary professionals and Research Institutions:* MDCU and KCMH collaborate with universities, research institutes, and inter disciplinary teams to drive impactful research, clinical trials, and therapy development. By securing funding from diverse sources, the institutions advance innovative healthcare solutions and build strong partnerships within and outside Thailand.

3. *Skilled Workforce and Continuous Training:* Both MDCU and KCMH employ a highly skilled workforce, including experts in medical technology, data science, and healthcare management, provide continuous training for staff, and foster a supportive environment to attract and retain top talent.

4. *Focus on Patient-Centered Innovation:* MDCU and KCMH place patients at the heart of their innovations, leveraging genomics, precision medicine, and wearable technologies to provide personalized care. Digital tools such as

patient portals, telemedicine, and AI-powered chatbots enhance communication, improve patient experiences, and optimize healthcare delivery.

5. *Innovation Culture and Support for Local Solutions:* Both institutions empower local providers and researchers to create community-focused solutions, support health tech startups, and develop culturally sensitive innovations to tackle local and global health challenges.

6. *Sustainability and Scalability:* MDCU and KCMH prioritize sustainable practices, such as energy-efficient devices and waste reduction, while ensuring that innovations are scalable and cost-effective to maintain high-quality healthcare services.

7. *Regulatory Compliance and Quality Assurance:* The institutions ensure that all technologies meet local and international standards, such as FDA approvals, conduct clinical trials to validate new treatments, and regularly assess the impact of innovations on patient outcomes and efficiency.

By emphasizing these success factors, MDCU and KCMH together set a benchmark for excellence in healthcare, improving patient outcomes, enhancing quality of care, and advancing the global healthcare sector.

Executive Leadership Team of MDCU and KCMH

Challenges and Ways Forward

MDCU, KCMH and Meticuly lead healthcare innovation in Thailand, driving progress with cutting-edge technologies and a focus on research, collaboration, and patient care. However, local innovation faces challenges, including the rapid development of AI, the need for skilled professionals, and high costs of resources like advanced computing and cloud systems. Assoc. Prof. Chanchai Sittipunt emphasized the importance of creating a sustainable and equitable healthcare system in Thailand. "Self-care should be the answer in the next decade," he remarked, highlighting the critical role of prevention and accessibility in achieving these goals. He advocated for broader access to preventive measures, including vaccines, and encouraged

people to take an active role in managing their own health. He also stressed the need for accurate information, especially in digital media, to empower the public and use innovations effectively to benefit the public and foster a healthier society. By addressing these challenges, the institutions aim to continue driving healthcare transformation while promoting inclusivity, sustainability, and innovation for the benefit of all.

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"True Success is not in the learning, but in its application to the benefit of mankind."

HRH PRINCE MAHIDOL OF SONGKLA

National Health Security Office

Government Complex, Building B , No. 120 ,
Moo 3 , Chaengwattana Road , Tungsonghong Subdistrict,
Laksi District, Bangkok 10210
Tel 662 1414000 Fax 662 143 9730-31
e-mail : interNHSO@nhso.go.th
website: http://www.nhso.go.th