Development of Information and Communications Technology-enabled Smart Hospitals

APEC Policy Partnership on Science, Technology and Innovation

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1. Introduction and the current status of smart hospital systems

Today, the world is facing the trends of declining birthrate, urbanization and aging population. In the future, there will be unprecedented demand for elderly care and medical services. However, with limited financial resources in various economies, it is increasingly difficult to continue existing medical insurance. How to further cope with the huge demand for medical care in the future. Life expectancy is getting longer, and diseases are becoming more complicated. There is a shortage of healthcare workers around the region. For example, the number of doctors per 10,000 people in Indonesia is 6.89 [1]. World Health Organization (WHO) has promulgated desirable doctor–population ratio as 1:1,000. Yet, over 44% of WHO Member States reported less than one physician per 1,000 population [2]. Coupled with the continuous spread of the COVID-19 epidemic in the world in recent years, medical systems around the world have collapsed. In the past two years since the outbreak of the epidemic, 500,000 medical staff have been lost (about 1 out of 5 medical staff have left their jobs), which has seriously overloaded the medical system. Therefore, "aging of the population structure", "chronic disease patterns", "obstacles in health problems", "complex care content" and "long-term care time" will become the key factors for medical care, health and social care in an aging society. The main characteristics of services, and the demand for long-term care of medical care and life care will also increase rapidly. This medical demand is also a common problem faced by APEC economies.

According to the definition of WHO [3], smart healthcare generally refers to the application of information and communication technology (ICT) in the medical and health field, including medical care, public health monitoring, etc. Smart Healthcare refers to the use of advanced technologies such as artificial intelligence (AI), Internet of Things (IoT), big data analysis, and cloud computing to improve the efficiency and quality of medical services. The purpose of smart healthcare is to improve patient experience, optimize the allocation of medical resources, and improve the accuracy of diagnosis and treatment through technological innovation. At present, most of the applications of smart healthcare focus on communication technology and information integration. Through the establishment of a systematic database, it is convenient for data access, and it is also conducive to the integration of data for medical research and analysis. In addition, highly repetitive tasks or diagnoses (such as image interpretation) will gradually be performed by AI. In addition, by combining AI with information and communication technology (ICT), patients can take medical equipment home, or still receive medical services remotely. For example: remote health monitoring, AI warning

notification system, etc. And we are aware that this should be conduct according to the guiding principle of “promote the appropriate use of digital technologies for health” proposed by WHO. Here are some of the main applications of smart healthcare [4]:

1. Telemedicine
   The use of video calling and remote monitoring technology allows doctors to provide medical advice to patients who are far away, especially in remote areas and areas with limited medical resources.

2. AI-assisted diagnosis
   Artificial intelligence can quickly analyze large amounts of medical data, such as images, laboratory results and medical history, to assist doctors in diagnosis. For example, AI can be used to identify abnormalities in X-rays, CT scans and other images to help detect diseases early.

3. Medical robots
   Medical robots can be used in surgical assistance, automatic medicine dispensing, nursing services and other fields. Surgical robots can improve surgical accuracy and reduce surgical risks and recovery time.

4. Health monitoring equipment
   Wearable devices such as smart watches, heart rate monitors, etc. can continuously monitor personal health data and promptly alert users or medical personnel when abnormalities are detected. This helps in the management of chronic diseases such as diabetes, hypertension, etc.

5. Electronic Health Record (EHR)
   Digital health records make it easier to save, share and review patients' medical records, and quickly provide them to relevant medical personnel when needed, helping to improve the efficiency of diagnosis and treatment.

6. Big data analysis
   By collecting and analyzing large amounts of medical data, we can better understand disease trends, predict the development of epidemics, and help develop new drugs and treatments.

7. Personalized medicine
   Using gene sequencing and data analysis technology, medical staff can develop personalized treatment plans based on patients' genetic characteristics and health

data to improve treatment effects.

Smart Healthcare is changing the traditional medical model, making medical services more intelligent and efficient, and providing high-quality medical services to more patients.

Benefits of Smart Healthcare:

Smart Healthcare brings many benefits. We can understand that through the above-mentioned Smart Healthcare application solutions, it can effectively improve the efficiency of diagnosis and treatment, optimize resource allocation, improve patient experience, etc. We further sort out the main advantages below[5] [6]:

1. Improve the accuracy of diagnosis and treatment

   AI-assisted diagnosis: Artificial intelligence technology can quickly analyze large amounts of medical data, extract key information from it, and help doctors diagnose diseases more accurately. It is especially outstanding in fields such as image analysis and gene sequencing.

   Personalized treatment: Based on the patient's health data and genetic characteristics, smart medical care can formulate personalized treatment plans, making the treatment more targeted and helping to improve the efficacy.

2. Improve medical efficiency

   Automated processes: Using medical robots, automatic medicine dispensing systems and electronic health records (EHR), some routine medical operations and management processes can be automatically processed, reducing the workload of medical staff.

   Telemedicine: Allows doctors and experts to provide diagnosis and treatment services to patients in remote areas, reducing the time and cost patients spend seeking medical treatment, and making medical resources more efficiently utilized.

3. Reduce medical costs

   Preventive health management: Smart medical wearable devices and remote monitoring technology can monitor patients' health status in real time and detect abnormalities early, helping to prevent diseases and reduce the need for emergency rooms and hospitalization.

   Big data analysis: Through data analysis, the allocation of medical resources can be optimized, unnecessary examinations and medications can be reduced, and medical costs can be reduced.

4. Improve patient experience

   More convenient medical treatment process: The smart medical system can simplify the process of making an appointment, seeing a doctor, and getting medicine, allowing patients to seek medical treatment more conveniently without having to wait for a long time.

   Personalized services: Patient data can be analyzed by smart medical systems to provide customized health advice and care plans to improve patient satisfaction.

5. Improve the effectiveness of chronic disease management

   Continuous health monitoring: Smart bracelets, blood pressure monitors, blood glucose monitors and other devices can continuously monitor the health status of patients with chronic diseases and issue reminders when necessary to help patients better manage their diseases.

   Remote care: Medical staff can keep track of the status of patients with chronic diseases through remote monitoring systems and adjust treatment plans based on real-time data.

6. Promote medical research and innovation

   Big data assists the development of new drugs: Through the analysis of large amounts of health data, new disease patterns and drug targets can be discovered, and the research and development of new drugs can be accelerated.

7. Clinical decision support

   AI systems can quickly organize and analyze the latest medical research data and provide useful information to doctors to help formulate more reasonable treatment plans.

Technology in Smart hospitals:

In general, Smart Healthcare uses technological advantages to bring unprecedented innovation to the medical industry. It not only improves the quality and efficiency of medical services, but also allows patients to enjoy more efficient, more accurate, and more convenient health management. The establishment of smart hospitals will definitely be a trend in the future, especially in the face of the dual problems of the current shortage of medical personnel and the advent of an aging society resulting in an increasing number of people in need of care. The application of ICT and AI in the medical system has become more and more attention. Establishing smart hospital applications through smart Healthcare technology can improve medical quality more efficiently. A smart hospital is a modern medical system that uses advanced technology

and data analysis to improve medical efficiency and patient experience. Smart hospitals usually include the following aspects[7] [8]:

1. Internet of Things (IoT) devices:
   Smart hospitals will use devices connected to the Internet to monitor patients' vital signs, such as heart rate, blood pressure, blood oxygen concentration, etc. This data can be transmitted to medical staff's systems in real time for timely monitoring and response.

2. Electronic medical records (EMR):
   All patient medical records will be digitized and stored in the cloud, making it easier for medical staff to review and update them at any time, improving data accessibility and sharing.

3. Artificial intelligence (AI) technology:
   The use of artificial intelligence for disease diagnosis, drug recommendation, surgical assistance, etc. can help doctors make decisions faster and more accurately and reduce medical errors.

4. Robots:
   Surgical robots are sometimes used in smart hospitals to perform delicate surgical operations. Robots may also be used to perform daily tasks such as drug distribution and sample collection to reduce human burden.

5. Data analysis:
   Using big data technology to analyze patient data can predict disease trends, help hospitals plan resources, and detect signs of epidemics early.

6. Telemedicine:
   Smart hospitals support telemedicine, allowing patients to conduct diagnosis and consultation with doctors via video at home, which is particularly helpful for patients in remote areas.

7. Intelligent management system:
   From appointment registration, bed management, medicine inventory to ward equipment maintenance, all can be efficiently monitored and managed through the intelligent management system.

Smart hospitals in APEC economies

The development of smart hospitals in Asia-Pacific Economic Cooperation (APEC) economies is diverse. Due to differences in medical needs, technological development levels, and government policies, different economies have different development priorities and application levels of smart hospitals. The following is an overview of the development of smart hospitals in some major APEC economies:

Chinese Taipei:

Chinese Taipei's smart medical features combine advanced technology and high-quality medical resources to promote the modernization of overall medical services, including: artificial intelligence (AI) and big data applications, electronic medical records (EMR) and data integration, telemedicine and health management, smart wards and automation technology, personalized medicine (Precision Medicine) and effective government policy support. The characteristic of Chinese Taipei's smart medical care is the comprehensive use of advanced technologies such as AI, big data, IoT, and 5G to improve the quality and efficiency of medical services, and Through policy support and industrial cooperation, we will continue to promote the upgrading and innovation of the overall medical system.

The United States:

Technology leadership: As a technology-leading economy in the world, American smart hospitals extensively apply AI, machine learning, big data analysis, Internet of Things equipment and telemedicine technology. Many hospitals are partnering with technology companies to develop smart diagnostic systems and patient health monitoring platforms. The United States is leading the way in smart medical technology, especially in cancer screening, chronic disease management and precision medicine [9].

China:

Large-scale promotion: The development of smart hospitals in China is mainly driven by the government and included in the "Healthy China 2030" plan [10]. AI technology is widely used in imaging diagnosis, disease risk prediction, drug research and development and other fields, and many cities have established smart medical pilot projects. The application of telemedicine and Internet of Things technology in remote areas promotes the balanced distribution of medical resources.

Japan:

Addressing the challenges of aging: Due to the aging population, smart healthcare in Japan focuses on elder care, remote health monitoring and nursing robot technology.

Japan has a high level of development in surgical robots, health management applications and wearable device [11].

Korea:
Strong technological infrastructure: Korea has advanced ICT infrastructure, enabling the rapid development of smart healthcare. The popularization of 5G technology makes remote surgery and high-definition image transmission possible. Korean hospitals use AI technology for early disease detection and diagnosis, especially in lung diseases and cardiovascular diseases, with remarkable results[12].

Singapore:
Smart medical system: Singapore's smart hospital system is relatively mature, with comprehensive electronic medical records, intelligent management and patient health tracking systems. The government supports the development of innovative medical technologies, including the application of AI and big data in medical care[13].

Malaysia:
Smart medical pilot program: Malaysia is promoting smart medical pilot projects to improve the efficiency of medical services through digital management systems and telemedicine technology. Some hospitals have begun to introduce AI technology to assist in disease diagnosis and patient management[14].

Viet Nam:
Initial development of telemedicine: Smart healthcare in Viet Nam is still in its infancy, but telemedicine has begun to become popular. Especially during the epidemic, many hospitals implemented online diagnosis and treatment services, helping to solve the problem of medical resources being concentrated in big cities [15].

Canada:
Strong development of digital medicine: Canada has a high-quality medical system, and smart medical applications mainly focus on electronic medical records, remote health monitoring, and health data analysis and management. The epidemic has accelerated the development of telemedicine, allowing many patients to receive diagnosis and health guidance at home [16].

Australia:
Telemedicine: Australia has a vast territory, and telemedicine plays an important role in the development of smart healthcare, especially in remote areas. Remote diagnosis and

health monitoring systems effectively solve the problem of insufficient medical resources [17].

The development of smart hospitals in APEC economies is diversified, and economies adopt different technology application strategies based on their own needs. The United States and Korea are leading in the field of technology application, China and Japan are promoting the rapid development of smart medical technology with policies, Australia and Canada are focusing on the promotion of telemedicine and data privacy protection, and Southeast Asian economies such as Viet Nam and Malaysia are actively introducing technology. Gradually develop smart medical systems. The innovation and practice of smart medical technologies in these economies are contributing to improving the quality and efficiency of global medical services.

Regarding smart hospitals within the APEC economy, the determination of smart hospitals will mainly be evaluated based on several factors, including technological innovation, intelligence, service quality, and data integration. These rankings are usually published by some international health organizations, scientific research institutions and industry media, such as the annual "World's Best Smart Hospitals" list released by Newsweek in cooperation with Statista. According to "Newsweek's 2023 "Global Smart Hospital List" [18], some smart hospitals from APEC economies have been selected as the best smart hospitals in the world. The following are some of the selected smart hospitals:

1. The United States

   Mayo Clinic - Rochester: Ranked as one of the best hospitals in the world for many years in a row, the hospital is a leader in the application of smart medical technology, including AI-assisted diagnosis, electronic medical record systems and remote health management.

   Cleveland Clinic: Known for its advanced medical technology and intelligent surgical assistance, it applies machine learning and big data technology for personalized treatment plans.

2. Japan

   The Affiliated Hospital of the University of Tokyo School of Medicine: One of Japan's leading smart medical institutions, focusing on AI diagnosis, intelligent surgical systems and patient data management, especially in the diagnosis and treatment of cancer and cardiovascular diseases, with remarkable results.

   Keio University Hospital: Committed to promoting smart medical solutions, including surgical robots, AI image analysis and remote health monitoring.

3. Korea

   Seoul National University Hospital: One of the pioneers of smart medical care in Korea, it uses AI technology for accurate diagnosis and improves patient experience through smart ward management systems.
   Asan Medical Center: Famous for telemedicine, AI image analysis and electronic medical record systems supported by 5G technology, it has always been at the forefront of Asia in smart medical applications.

4. Chinese Taipei

   Taichung Veterans General Hospital: Smart hospitals combine medical care with advanced information and communication technologies, which can not only improve hospital service processes and efficiency, but also help promote preventive medicine, improve quality of life and other health goals.

5. Singapore

   National University Hospital of Singapore (NUH): With advanced smart medical applications, it has established a comprehensive electronic medical record and remote health management system to improve patient diagnosis and treatment experience.
   Changi General Hospital: Actively promote the application of AI and machine learning technology and achieve good results in patient data analysis and disease risk prediction.

6. **Australia**

   Royal Melbourne Hospital: As a leader in smart healthcare, the hospital actively applies data analytics and telemedicine technology to improve the treatment of acute and chronic diseases.
   Royal North Shore Hospital in Sydney: Leading technology application in intelligent health management, ward automation and patient remote monitoring.

These smart hospitals stand out in global rankings mainly because of: Application of AI and big data technology: Whether artificial intelligence and big data technology are effectively used to assist in diagnosis, treatment and prediction of diseases. IoT and smart devices: Extent of application in smart wards, remote health monitoring equipment, surgical robots, etc. Electronic medical record system: The integration and interoperability of electronic medical records can effectively share patient information across medical institutions. Patient management and experience: Use smart

technologies to improve patients' medical experience, such as smart registration systems, remote health monitoring, online consultation, etc. Innovation and research capabilities: Whether you have outstanding performance in smart medical research and technological innovation. By introducing the most advanced medical technology and intelligent management systems, smart hospitals in these APEC economies not only improve the medical experience of patients, but also promote the development of the smart medical industry. The promotion direction of smart hospitals mainly focuses on how to use advanced technology to improve the quality, efficiency and accessibility of medical services. However, there is still a lot of room for development, especially under the conditions of insufficient infrastructure and limited medical resources in remote areas. The following are several key directions for the future development of smart hospitals:

1. Artificial intelligence (AI) and machine learning applications
   Intelligent diagnosis and decision-making assistance: AI can help doctors make rapid diagnoses by analyzing large amounts of medical data, such as images, genetic data, and electronic medical records. For example, AI is used to identify early signs of cancer lesions, heart disease, and other chronic diseases. Personalized treatment plan: Use machine learning technology to analyze patients' personal data to tailor a treatment plan for each patient to improve treatment effects and patient satisfaction. Acceleration of drug research and development: AI can accelerate the drug research and development process, from drug screening to clinical trial data analysis, effectively shortening time and reducing costs.

2. Internet of Things (IoT) and Wearable Devices
   Remote health monitoring: Smart wearable devices can monitor patients' vital signs in real time, such as heart rate, blood sugar, blood pressure, etc., and transmit the data to the hospital system, allowing doctors to obtain the patient's health status in a timely manner. Smart ward: Through the Internet of Things technology, automatic control of ward equipment (such as lighting, air conditioning, bed adjustment) is realized to improve the patient's hospitalization experience. In addition, smart devices can help track patients' movements to ensure safety.

3. Electronic Health Records (EHR) and Data Integration
   Cross-institutional data sharing: Promote the standardization and interoperability of electronic medical record systems to ensure that different medical institutions can easily share patient information, avoid duplication of examinations, and

improve diagnosis and treatment efficiency. Big data analysis: Collect and analyze medical data from different sources to extract valuable information for disease prediction, resource allocation and public health management.

4. Telemedicine and virtual health services
   Remote diagnosis and consultation: Through video calls, patients can conduct diagnosis and consultation with doctors remotely. Especially for patients who live in remote areas or have limited mobility, telemedicine can greatly improve the accessibility of medical services. Remote surgical assistance: Using 5G technology and remote surgical robots, experts can guide or directly control the surgical robot to perform surgical operations remotely, achieving global medical collaboration.

5. Robot-assisted medical treatment
   Surgical Robots: Surgical robotics technology has been able to provide precise maneuvers in various surgeries, such as laparoscopic surgeries. This not only reduces risk but also shortens recovery time. Logistics robots and nursing robots: Logistics robots in hospitals can automatically transport drugs, samples and medical equipment, reducing the workload of medical staff; nursing robots can assist the elderly or patients with limited mobility and provide basic care and companionship services.

6. Data security and privacy protection
   Enhanced data security measures: As the use of electronic medical records and health data increases, protecting patient privacy becomes even more important. Smart hospitals need to adopt advanced data encryption and access control technologies to ensure data security. Privacy compliance: Smart hospitals should comply with strict privacy laws and regulations, such as GDPR or HIPAA, to ensure compliance with legal requirements when handling patient data.

7. Patient experience and intelligent management
   Intelligent appointment and queue management: Through mobile applications or online platforms, patients can make appointments and check queue information online, reducing waiting time and improving medical efficiency. Personalized health management: Based on big data analysis and the patient's health status, provide personalized health advice and management plans, such as diet and exercise advice, and remind patients to check regularly and take medication.

8. Comprehensive health management and preventive medicine
   Health management platform: Smart hospitals are committed to not only treating diseases, but also providing continuous health management services to achieve early disease prevention and health intervention through data analysis and remote monitoring.
   Public health data monitoring: Use smart medical systems to monitor public health trends to help early detection of epidemics and chronic disease trends, so as to take effective public health measures.

The future direction of smart hospitals is mainly focused on improving the breadth and depth of technology applications, promoting the integration and interoperability of medical data, enhancing patient experience, and ensuring data security and privacy protection. The combination of these technologies and strategies will help the medical system respond more effectively to the growing medical needs and achieve rational allocation of medical resources and precise health management.

2. Selected successful cases of digital transformation in smart hospital systems.

The purpose of establishing smart hospitals through information and communication technology is to facilitate digital transformation in the APEC region, particularly targeting policymakers, research institutions, hospitals, and private sectors with an interest in digital transformation. To enhance the understanding of smart healthcare models among APEC economies' participants, the goal of this seminar is to share and discuss the applications and benefits of smart hospitals in healthcare systems, as well as address relevant challenges and issues. In addition, a site-visit will also be arranged to showcase actual digital healthcare solutions, allowing participants to gain a more direct understanding of various applications of digital healthcare. This will enhance their grasp of service models for future healthcare solution adoption. We expect this seminar to bring tangible benefits to healthcare professionals and individuals in need of precision treatment, while also promoting the modernization and development of healthcare systems in the APEC region.

We chose a case of a demonstration base that uses smart technology to transform into a smart hospital service model to explain. The Smart Medical Promotion Center of Yang-Ming Chiao Tung University in Chinese Taipei builds a cloud artificial intelligence platform information infrastructure, using innovation and breakthroughs in artificial intelligence, wearable smart medical materials and high-end medical materials technology, and continues to combine imaging, physiology, genes, and medical record

information Big data develops precision medicine. After completing the construction of IOT infrastructure such as web pages, computing, and data servers, we introduced front-end and back-end information engineering development technologies to establish a smart hospital medical service model. The Smart Medical Promotion Center uses simulated wards as smart medical demonstration sites, uses a medical information system to upload and store various medical data, and completes testing to connect to the hospital system. The hardware equipment of the simulated ward maintains the flexibility of easy movement and assembly, and can be used to plan internal and external departments such as waiting rooms, clinics, wards, operating rooms, and dialysis rooms. The following are the smart medical technology projects of the Smart Medical Promotion Center Yang-Ming Chiao Tung University in Chinese Taipei [19]:

Solution	Technical cooperation unit
Medical Information and Network	
Intelligent cloud medical information system	Hehua Technology
Smart electronic medical records	Yang-Ming Chiao Tung University
5G private network	Savia Technologies
Medical artificial intelligence platform	Chunghwa Telecom
Outpatient service process	
3-dimensional face recognition and body temperature sensing	geographic information system
Smart check-in machine	Hehua Technology
Pre-hospital consultation	Yang-Ming Chiao Tung University
Automatic speech recognition	Yang-Ming Chiao Tung University
Hospitalization service process	
Smart mattress (breathing, heartbeat detection)	Furen Technology
Smart mattress (pressure point sensing)	World Intelligent Technology
Anti-fall detection	geographic information system
Electronic bedside card	Zhengda Technology
smart infusion pump	Inventa Technology
electronic whiteboard	Hehua Technology
Intelligent physiological signal monitoring	Wangbei Technology
Smart sensing service process	
Blood Pressure	Wangbei Technology
Single-lead ECG	Yang-Ming Chiao Tung University
Single-lead ECG	ACE BIOTEK
Multi-lead electrocardiogram	Yang-Ming Chiao Tung University
Blood Oxygen (Adult)	Wangbei Technology
Blood Oxygen (Adults and Newborns)	Aulisa Medical

Blood oxygen (flexible PPG chip)	Yang-Ming Chiao Tung University
Body temperature	iWEECARE
Motion sensing	Yang-Ming Chiao Tung University
Single channel wearable ultrasound geographic information system	GIS
Handheld Ultrasound	Aco Smartcare
Facial features mirror	Medimaging Integrated Solution Inc.
Electronic stethoscope	IMEDIPLUS
Wireless and wearable stethoscopes	Sound Land
Auxiliary medical service process	
In-hospital positioning system	Creatidea
E-paper tablet	E Ink Holdings Inc.
smart pen	ACE BIOTEK
Smart lamps	DELTA ELECTRONICS,INC.
AR indoor navigation	Yang-Ming Chiao Tung University
Indoor UV disinfection	United Microelectronics Corporation
Telemedicine service process	
Remote multiplexing video equipment	Cisco
Telemedicine related applications	Chunghwa Telecom
Health management service process	
Artificial intelligence-assisted home sleep assessment platform	Chunghwa Telecom
Cloud invisible hypoxemia monitoring platform	Chunghwa Telecom

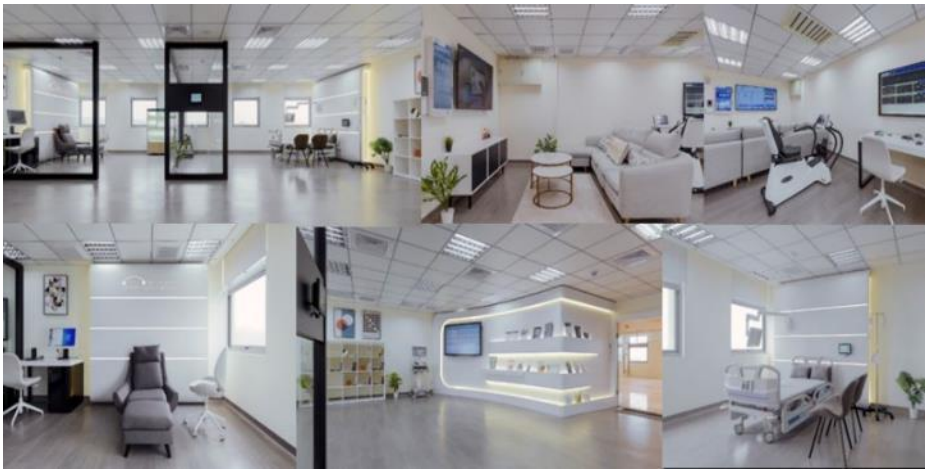


Fig 1. Site Visited in Digital Medicine and Smart Medical Promotion Center of Yang-Ming Chiao Tung University

Fig 2. Site Visited in Digital Medicine and Smart Medical Promotion Center of Yang-Ming Chiao Tung University

In addition to information and communication infrastructure, the Yang-Ming Chiao Tung University combines AI calculation methods and jointly develops different medical artificial intelligence application solutions with the medical center. The current smart medical technology has been introduced in Taipei Veterans General Hospital has applied and established a smart hospital service model, which can effectively improve the quality of medical services in disease treatment. The following list shows the current digital medical service technology projects of smart hospitals[19]:

1. Brain Assessment
   The technology is to employ the web diagnosis platform and deep learning model to provide the diagnosis of schizophrenia based on routine brain imaging used in the hospital. This platform can potentially extend to major neuropsychiatric diseases, providing precise evaluation for medical professionals, increasing quality of medical care and establishing connections to digital medicine industry.

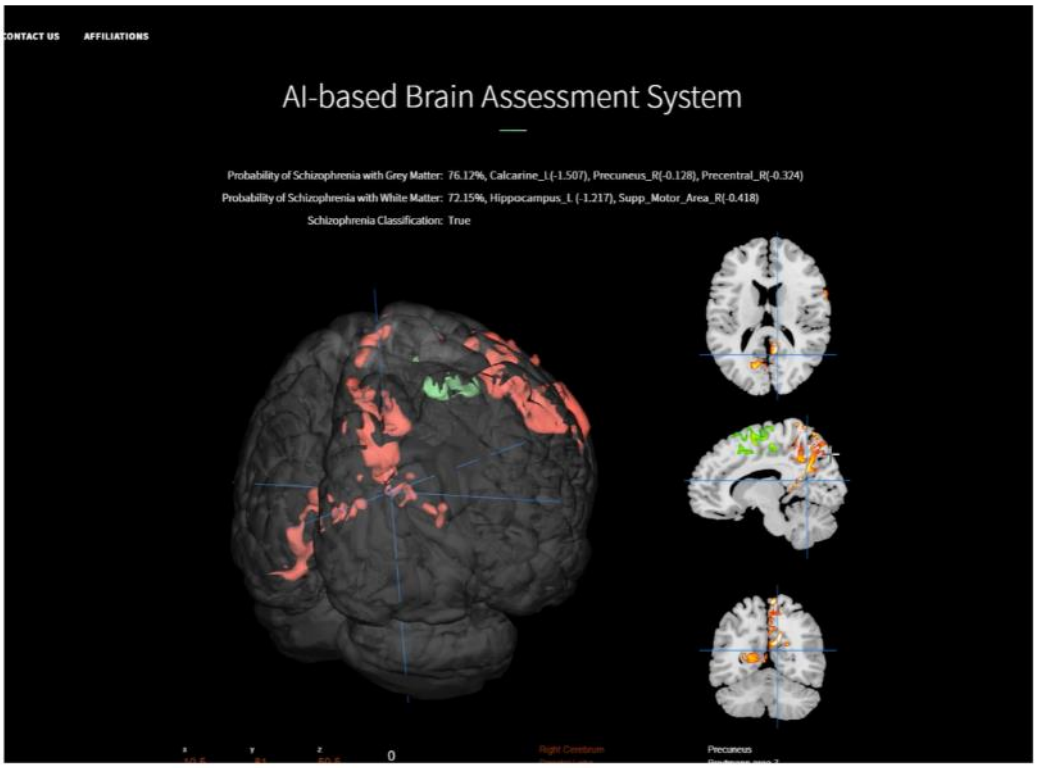


Fig 3. AI based Brain Assessment

2. Brain Intracranial Hemorrhage AI Assessment

   Upload brain computed tomography images online, browse the images online and obtain cerebral hemorrhage pattern assessment results

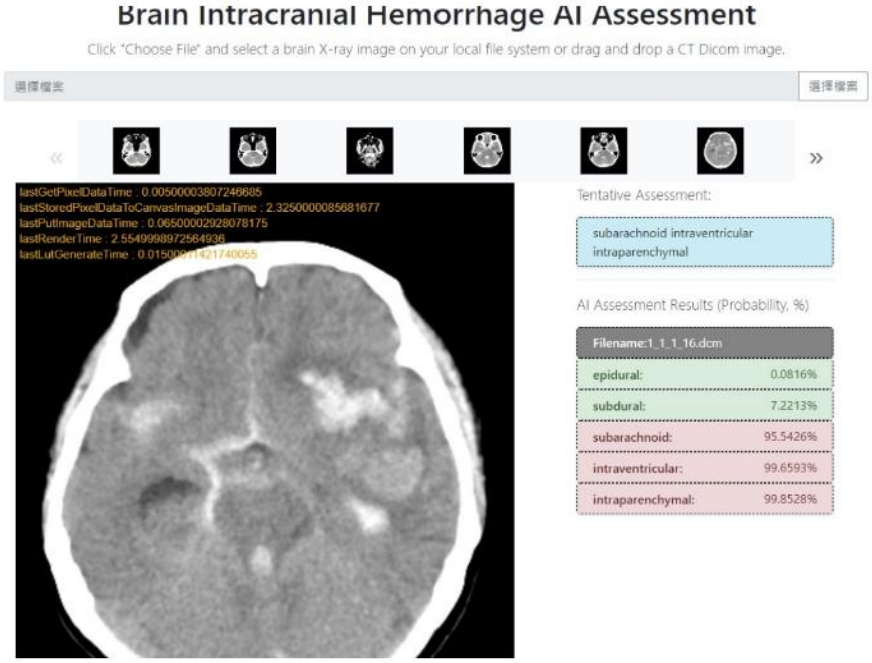


Fig 4. Brain Intracranial Hemorrhage AI Assessment

3. EEG-based Depression Severity Evaluation

   The EEG-based depression severity evaluation is based on a proprietary AI algorithm to analyze the EEG features that are characteristics for depression severity.

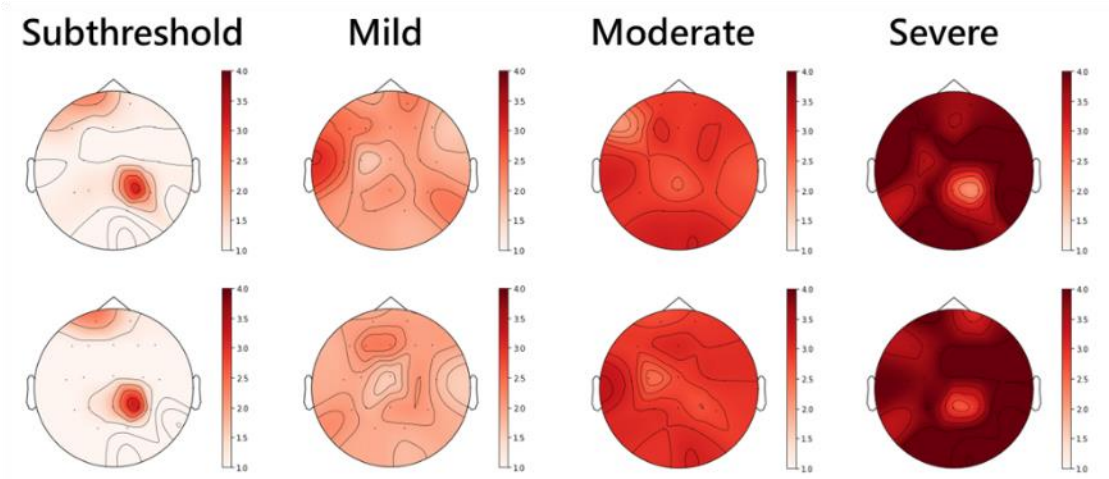


Fig 5. EEG-based Depression Severity Evalution

4. Chest X-Ray AI Assessment

   Upload X-ray images online and obtain evaluation results online. Interpret 14 types of chest X-ray abnormalities and automatically generate text reports.

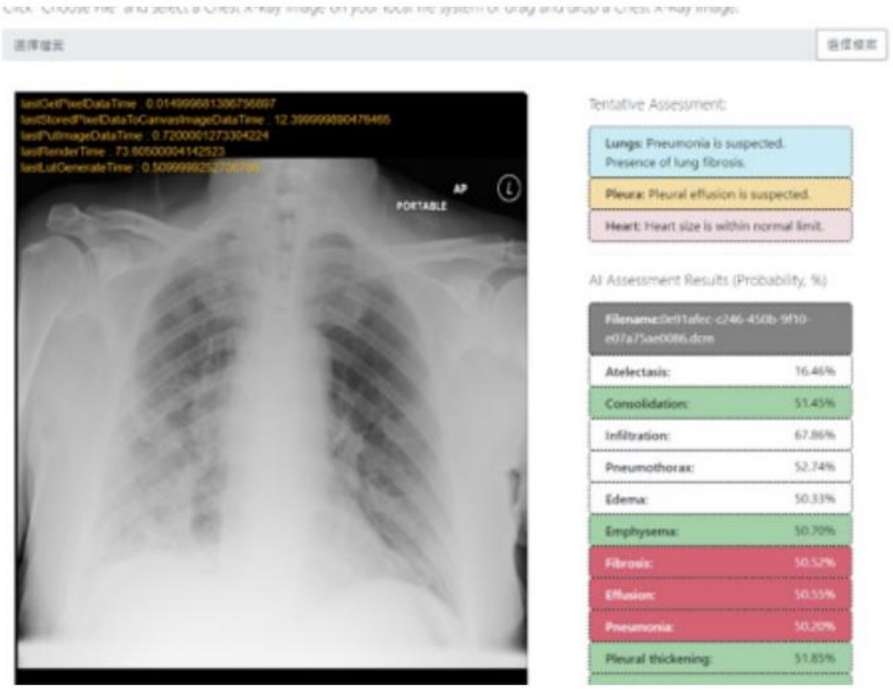


Fig 6. Chest X-Ray AI Assessment

5. Age-related macular degeneration OCT assessment platform
   Automated OCT image-assisted assessment Age-related macular degeneration

Fig 7. Age-related macular degeneration OCT assessment platform

6. Home sleep health care platform
   Rapid Screening: Online Artificial Intelligence Screening to Rapidly Assess Sleep Disorders. Accelerate communication between doctors and patients: Doctors have obtained AI analysis results before people go to the hospital for treatment
   Improve the clinical process: Solve the long wait for sleep center examination beds, and use medical resources more efficiently

Fig 8. Home sleep health care platform

7. COVID-19 Blood oxygen monitoring cloud platform
   Real-time monitoring reduces the difficulty of patient operations and reduces the risk of exposure to medical staff.

Fig 9. COVID-19 Blood oxygen monitoring cloud platform

8. Cognitive Function Test
   The Mini-Mental State Examination is used to test people's cognitive functions. The Pentagon Drawing Test is one of the important items in the entire test. Deep learning is used to determine the cognitive function of the person. Pentagram results and indirectly estimate the total score of the Brief Intelligence Test.

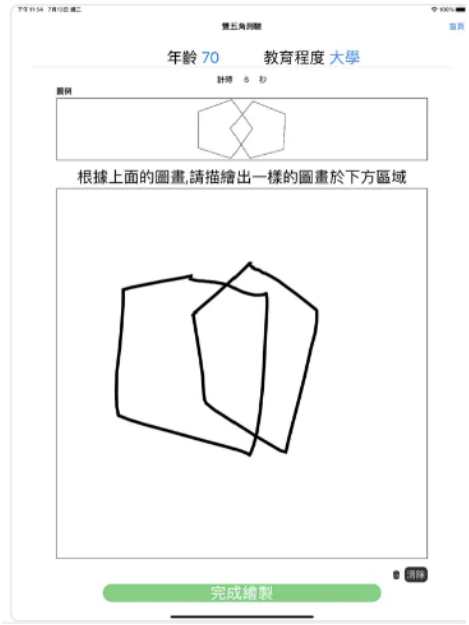


Fig 10. Cognitive Function Test

9. Verbal Fluency Test

   The Verbal Fluency Test is one of the clinical standards Cognitive function tests, which mainly measure executive functions and language abilities, and serve as Tools for screening for clinical dementia. This iOS mobile app brings language fluency to Test automation, using speech recognition technology to identify words spoken by subjects

Fig 11. Verbal Fluency Test

The Yang-Ming Chiao Tung University cooperates with the smart hospital planning. From the robot automatic body temperature sensing device, automatic face recognition and registration in the simulated patient reception area of the smart hospital, you can already feel the service model of the smart hospital; In the measurement area, various wearable and non-contact measurement equipment such as blood oxygen detection and

IOT are connected in series, so medical staff can accurately obtain patients' physiological information; the electronic form design in the treatment area, artificial intelligence brain imaging evaluation platform, The online brain computed tomography imaging cerebral hemorrhage assessment platform, online artificial intelligence chest X-ray interpretation system, next-generation new medical information system and telemedicine system will efficiently assist medical staff in diagnosis and treatment; the nursing station and ward area are constructed Wireless positioning, smart medical lighting systems, sepsis detection systems, mattress detection and anti-fall detection systems also provide prototypes of smart wards that are more humane and comfortable.

In terms of cloud applications of medical information systems, this system will have various features such as cloud version, modularization, and built-in artificial intelligence. At the same time, it is hoped that this will reduce the past innovation difficulties in the revision and upgrade of HIS systems. In addition, the most important core spirit of the cloud version of HIS is to assist doctors in various disciplines in automatic consultation and information exchange. For example, when a diabetic patient goes to the hospital for treatment, in addition to a specific diagnosis, the doctor will also think of possible complications, such as high blood pressure and hyperlipidemia, but these must be accumulated through clinical experience. , will notice. And sometimes it may be ignored due to busy clinical work. Therefore, we hope to use the cloud version of HIS to connect clinical big data and analyze the relationship between diseases, so that doctors can enter other possible diagnoses in the outpatient system after inputting the main diagnosis. Diagnosis and improve all aspects of outpatient judgment. Yang Zhijie emphasized that the modular function selection method and the online version of the private cloud have given a new dawn to the previous stand-alone version of HIS updates. In terms of AI systems, including computer tomography, physiological signals, big data and other databases, the Yang-Ming Chiao Tung University team has established many machine learning models and is rapidly deploying them in clinical applications. Among them, there are many applications for sleep apnea, including Insomnia analysis, sleep analysis, careful selection of medical materials, etc.

The Yang-Ming Chiao Tung University is transferring digital medical technology to smart hospitals, including the use of AI imaging technology, cloud technology, image-assisted discrimination, physiological monitoring analysis, etc. It is expected that smart hospitals will be able to perform the following application. The following are the medical application models currently developed through smart medical technology.

Technology	Data source
Neuropsychiatry	
Structural and functional magnetic resonance imaging assists in the diagnosis of schizophrenia	MRI
Brain waves assist in assessing severity of depression	brain waves
Brain waves help predict efficacy of Prozac drug	brain waves
Brain waves assist in predicting the efficacy of electroconvulsive treatment	brain waves
Structural magnetic resonance imaging assists in assessing brain age	MRI
Structural magnetic resonance imaging assists in predicting dementia regression	MRI
Structural magnetic resonance imaging assists in predicting the transformation of mild cognitive impairment into dementia	MRI
Brain waves assist in assessing psychiatric and behavioral symptoms of dementia	brain waves
Sleep medicine	
Pittsburgh Sleep Quality Scale assists in the differential diagnosis of insomnia and apnea	Questionnaire
ECG signal assists in sleep stage assessment (AIOT application)	ECG signal
PPG signal assists in sleep stage assessment (AIOT application)	PPG signal
Blood oxygen signal assists in assessing the severity of apnea (AIOT application)	blood oxygen signal
Brainwave-assisted assessment of sleep stages	brain waves
Brainwave-assisted assessment of insomnia	brain waves
Diagnostic Radiology Department	
Brain computed tomography assists in assessing cerebral hemorrhage patterns	CT
Chest X-ray assisted diagnosis of fourteen abnormal findings	X-ray
Chest X-ray auxiliary markers and diagnosis of pneumonia types	X-ray
Ophthalmology	
Optical coherence tomography OCT assists in the diagnosis of age-related macular degeneration	OCT
Cardiology	
Heart rhythm interval aids in the diagnosis of atrial fibrillation	heart rate interval signal
Twelve-lead ECG signals assist in diagnosing atrial fibrillation	ECG signal
Twelve-lead electrocardiogram assists in the diagnosis of left ventricular hypertrophy	ECG signal

Intensive care	
Sepsis Early Warning System (AIOT Application)	vital signs
Premature infant blood oxygen and body temperature monitoring system (AIOT application)	vital signs
Electronic medical records	
Correlative diagnostic system	Health insurance data
Epidemic prevention	
Invisible hypoxemia monitoring system (AIOT application)	Blood oxygen signal
COVID- vaccine severe side effects prediction system	Clinical data
Other	
Raman spectroscopy-assisted detection of nicotine	Raman spectrum

Since the industrial revolution, medicine has made great progress. With the help of scientific and technological progress, various technologies can be used to understand the occurrence principles and changes of diseases, and further solve the medical needs of aging population, remote medical care and other medical needs in APEC member economies. The revolutionary breakthrough of digital medicine, combining medicine and information, to interpret the hidden patterns behind medical big data, is an important area of medical care for the new generation in the future. Smart medical care touches every aspect of medicine. It establishes a trustworthy medical artificial intelligence model and integrates it into the clinical process. It will be used to build an affordable, efficient, safe and reliable health care service model. "Face-to-face" treatment methods will evolve with the advancement of new technologies. There is bound to be a change. In the past, most medical behaviors took place in hospitals, but now the cloud can be used to collect a large amount of medical data. After deep learning and further analysis using artificial intelligence, real-time prevention and precision medicine are more possible. This is also the case. Important challenges for the development of smart healthcare in the next ten years. Biomedical signals are important tools for measuring physiological functions, including brain waves, blood pressure, respiration, ECG signals, etc. The analysis of biomedical signals can not only be used as a tool for disease diagnosis, but also helps to understand the mechanism of physiological operation, which is an important foundation for smart medical applications. This time, the Digital Medicine Promotion Center of Yang-Ming Chiao Tung University in Chinese Taipei is used as a case study to observe and share the application of digital technology in various medical treatments, such as building a medical information system to provide various data uploads, storage, and connection to HIS systems. Let smart medical applications be tested and integrated in simulated fields

and implemented in real hospitals, so that participating APEC members can better understand the process of transforming digital medical care into smart hospitals.

3. Achievements and policy recommendations based on the seminar conclusion.

The core of smart hospitals and smart medical care lies in how to use the power of information technology to comprehensively optimize clinical processes, with patient safety as the top priority. With the continuous updating of policies and the advancement of technology, the scope of telemedicine in the future will continue to expand to include remote diagnosis and treatment, cross-field expert consultation, community health integrated care, home-based care, and health and disease management. By integrating IoT technology, we can automate processes, reduce human errors, and ensure medical safety through a closed-loop management system. With the integration of AI predictive technology, doctors can make clinical decisions more effectively. The combination of mobile devices, the Internet, the Internet of Things, cloud computing and 5G technology has provided strong support for big data analysis, artificial intelligence, precision medicine and telemedicine, promoting the integration of smart medicine to a higher level. and applications.

3.1 Japan

Japan is very advanced in the field of smart medical care, combining a variety of modern technologies such as artificial intelligence, big data, and robotics to improve the efficiency and quality of medical services. Japanese medical institutions use AI technology for early diagnosis and prediction of diseases. AI can analyze large amounts of medical images, genetic data, and electronic medical records to help doctors detect early signs of diseases, such as cancer, more quickly. In addition, Japan is also developing an AI system that can predict epidemic trends for better public health management. Japan is a leader in robotics technology, and the application of smart medical robots is very common. For example, "Da Vinci" surgical robots are widely used in many hospitals in Japan. These robots can perform precise minimally invasive surgeries and reduce patient recovery time. In addition, robots are also used in nursing and rehabilitation, such as assisting elderly patients to walk, carry items, and even provide psychological support. Japan attaches particular importance to the development of telemedicine, especially in remote areas and outlying islands. Through the remote diagnosis and treatment system, patients can communicate with doctors through video and obtain

professional diagnosis and treatment suggestions without going to hospitals in big cities. This has played a positive role in improving the distribution of medical resources and reducing regional medical disparities. Due to the serious aging of Japan's population, smart medical care plays an important role in elderly care. Technologies such as smart nursing beds, health monitoring systems, and robot caregivers provide more life support for the elderly and reduce the pressure on medical and nursing staff. Japan uses big data technology to promote the development of precision medicine. By collecting and analyzing large amounts of genetic and medical data, medical institutions can more accurately develop personalized treatment plans for patients, thereby improving treatment effectiveness and reducing side effects. For example, in cancer treatment, precision medicine technology can select the most suitable treatment plan based on the patient's genetic characteristics.

Generally speaking, Japan's smart medical development combines advanced technology with actual medical needs, especially in precision medicine, telemedicine and elderly care, with remarkable achievements. This not only improves the quality of medical services, but also effectively addresses challenges such as aging and uneven distribution of medical resources.

Fig 12. Recommendations and seminar conclusion by Japan.

3.2 Malaysia

Malaysia's development in the field of smart healthcare is gradually accelerating, with the government and private sector working together to use digital technology to improve medical services and efficiency. Malaysia attaches special importance to the development of telemedicine to solve the problem of insufficient medical resources in remote areas. Through telemedicine platforms, patients can conduct video consultations with doctors and obtain professional diagnosis and treatment advice without having to travel long distances to hospitals in big cities. This is especially convenient for people with chronic illnesses and seniors with limited mobility. Artificial intelligence technology is used in fields such as medical image analysis, diagnostic assistance, and disease prediction. For example, AI can quickly analyze X-rays, MRI and CT scans, helping doctors diagnose diseases such as cancer faster and more accurately. In addition, some medical institutions in Malaysia are also using AI to analyze patient data to predict disease trends and patient health risks. Malaysia is actively promoting the construction of smart hospitals to provide a more convenient medical experience. Malaysia has launched many health management apps that allow users to track their health status, such as monitoring weight, blood pressure, blood sugar and other data. Some applications are also connected to medical institutions, allowing medical staff to monitor and provide health advice in real time, which is particularly useful in the management of chronic diseases. Especially during the COVID-19 epidemic, Malaysia launched the "MySejahtera" application to track the epidemic and help users manage vaccination status.

The Malaysian government promotes the digital economy plan "MyDIGITAL", of which smart healthcare is an important part. The government has formulated a number of policies to support medical technology innovation, including providing financial subsidies, technical support and infrastructure construction. These initiatives have attracted many technology companies and medical start-ups to enter the market, promoting the further development of smart medical care. Overall, smart healthcare in Malaysia is developing rapidly, improving the efficiency and quality of medical services through the application of digital technology, and actively responding to uneven medical resources and public health challenges. With the continuous advancement of technology, smart medical care in Malaysia will become more mature and popular in the future.

Fig 13. Recommendations and seminar conclusion by Malaysia

3.3 Singapore

Singapore has made many important achievements in the development of smart healthcare, including the use of advanced technology and data analysis to improve the efficiency and quality of medical services. The following is a discussion of the current development direction of medical technology at Changi Hospital. Changi Hospital uses artificial intelligence technology to help doctors make diagnoses, especially in image analysis, such as the radiology department and pathology department. AI systems can quickly and accurately analyze medical images and help identify abnormalities, thereby speeding up the diagnostic process and reducing error rates. In addition, in order to achieve precision medical purposes, Singapore Changi Hospital has introduced surgical robots to assist surgical operations. These robots are able to perform precise, minimally invasive surgeries, reducing patient recovery time and reducing surgical risks. Robotic surgical systems also allow surgeons to perform remote surgical operations, increasing the flexibility of medical resources. For data analysis and personalized medicine, Singapore Changi Hospital uses big data and machine learning technology. The hospital can analyze a large amount of patient data and provide personalized treatment plans. This not only helps to diagnose the condition more accurately, but also provides treatment based on the patient's specific conditions to improve treatment effects. It also uses IoT technology to connect medical equipment, ward equipment and medical monitoring devices, allowing medical staff to monitor patients in real time. health status. For example, remote health monitoring equipment can help patients with chronic diseases manage their health at home

and reduce the frequency of visits to the hospital.

Changi Hospital in Singapore adopts an electronic medical record (EMR) system and fully uses the electronic medical record system to improve the efficiency of patient information sharing and query. Medical staff can quickly obtain important information such as patient history, allergies, and examination results through the EMR system, thereby making faster and more accurate medical decisions. The hospital has a self-service registration and navigation system. Patients can complete registration through self-service machines when entering the hospital, reducing waiting time in line. In addition, the smart navigation system can help patients find clinics, examination rooms and pharmacies in the hospital, improving the medical experience. The application of these smart medical technologies enables Changi Hospital to achieve more efficient and precise services in patient diagnosis and treatment, surgical treatment, health management and other aspects, and promotes the modernization of Singapore's overall medical system.

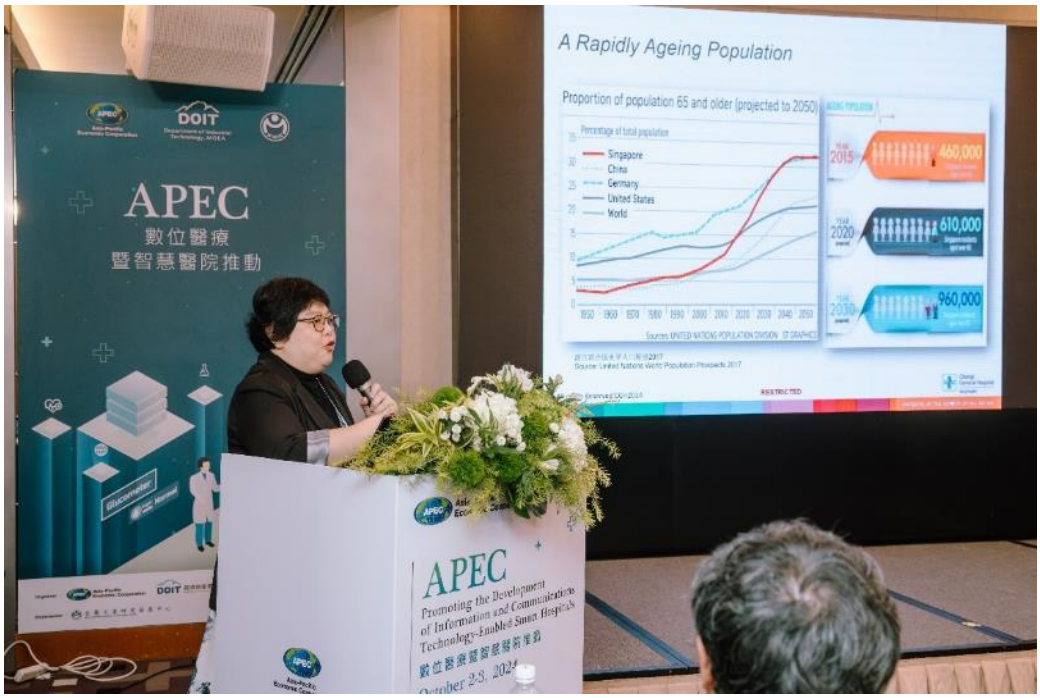


Fig 14. Recommendations and seminar conclusion by Singapore.

3.4 Chinese Taipei

The characteristic of Chinese Taipei's smart medical industry lies in cross-domain cooperation between clinical needs and technology R&D manufacturers, integrating professional knowledge in the fields of medicine, information and communication technology, and biotechnology to improve medical services and improve patients' quality of life. The maturity of smart medical technology will

provide a reference model for the Asia-Pacific region, and will also help promote cross-border cooperation and promote the upgrading of the overall medical industry. The Ministry of Economic Affairs subsidizes legal persons and industry players to participate in the early development of key technologies and overall solutions required for smart medical care to accelerate the formation and promotion of the smart medical industry chain.

With the global COVID-19 epidemic and changes in AI technology, smart telemedicine is a key development area of global medical technology today. The development of smart telemedicine is crucial to human health and well-being, and Chinese Taipei is an international semiconductor supply chain as an important player, Chinese Taipei began to leverage technology in the 1990s to promote a series of changes such as medical digitization and medical integration, which helped Chinese Taipei 's medical care service model rank first in the world for eight consecutive years. Medical care and information communications are the two most competitive industries in Chinese Taipei. Integrating the technological advantages of these two fields to successfully promote the development of smart medical technology will significantly improve the quality of medical services and enhance the competitiveness of the international medical industry market through the output of smart medical technology. The development of smart medical technology can not only improve medical accuracy, but also use innovative applications such as telemedicine and data analysis to meet the medical needs of different regions. In addition, optimizing medical management processes through information and communication technology can reduce medical costs.

The medical system in Chinese Taipei has gone through the process of "medical electronics, information system interoperability and intelligence", from the initial method of logging all information on paper to now developing a variety of smart medical solutions. Chinese Taipei has been able to develop various types of smart hospital solutions. Chinese Taipei offers different smart hospital model solutions, such as: (1) regional hospitals connected through IoT hardware, providing primary care services; (2) regional hospitals built with AIoT technology, offering intermediate-level medical services; and finally, (3) AI-powered wall-less medical centers, which not only provide advanced medical care but also offer intelligent telemedicine to meet healthcare needs across different regions, working towards the goal of healthcare equity. Chinese Taipei have combined our strengths in industry and technology, including (1) a comprehensive network infrastructure and (2) digital technologies from the ICT and AI industries. Chinese Taipei internet

penetration rate has reached 84.3%, and the mobile broadband penetration rate is 81%. Chinese Taipei also have globally renowned ICT and AI industries, such as TSMC, UMC, Wistron, Quanta, and Powerchip, among others. By integrating these technologies with the healthcare system, we have developed a wide range of medical solutions. For example, Quanta's AI telemedicine platform provides smart medical solutions for telemedicine consultation systems, Acer Healthcare offers a precision medical solution for diabetic retinopathy, and Wistron's healthcare platform helps optimize hospital management efficiency. Chinese Taipei utilize these various solutions to address different healthcare needs.

Chinese Taipei has utilized smart healthcare technologies to meet the diverse medical needs of different regions and the demands of precision medicine. These technologies have also been applied to hospital workforce management systems, enabling healthcare workers to have more flexible work schedules and better patient care management. For example, by implementing intelligent ICT systems, the time healthcare workers previously spent—60-70 minutes daily—on verifying medication information from the pharmacy to the patient’s bedside has been significantly reduced to less than 20 minutes. This also improves the hospital's management of medication costs. Additionally, for tasks such as reviewing patient medical records and verifying physician orders, healthcare staff can use digital information systems to reduce the daily average time spent from 40-50 minutes to under 20 minutes. In Chinese Taipei, we effectively enhance workforce management in healthcare through digital ICT technologies, allowing medical staff to cut down about 1.5 hours per day on clinical tasks and shift changes, providing more time and focus on patient care. Through Infrastructure-as-a-Service, Platform-as-a-Service, and Software-as-a-Service, we're not just crafting solutions; Chinese Taipei tailoring a healthcare revolution that’s both efficient and accessible. These digital tools are our way of ensuring that the value of healthcare doesn't just lie in the cost but in its reach and impact. With these services, we're extending the healing hands of our medical community to the farthest corners of Chinese Taipei.

In recent years, under the coordination of the Metal Industry Research and Development Center, it has consulted on different medical industries and clinical medical needs, provided medical equipment, information and communications and other technical connections, and led smart medical manufacturers in Chinese Taipei towards a more flexible digital medical service model. At the same time, the metal center assists Chinese Taipei medical materials and technology

manufacturers to enter the international CDMO supply chain, effectively establishing cooperation and business opportunities with international manufacturers, and expanding the international market.

Fig 15. Recommendations and seminar conclusion by Chinese Taipei.

The cooperation between medical equipment manufacturers or hospitals and metal industry research and development centers will provide complete medical solutions for auxiliary diagnosis for the current aging population or diseases. For example, the symptoms of esophageal cancer are not easy to detect in the early stage, and doctors need to spend a lot of time to diagnose the cancer. For the interpretation of lesions, through the integration of endoscopic equipment and AI software through digital medical technology, signs of disease can be identified during medical outpatient procedures, increasing the accuracy of medical diagnosis. Recently, digital medical AI calculations and data management have begun to be applied to hospital management, from bed management, patient medication to hospital cost reduction. In addition to improving the accuracy of medical treatment, digital medical technology can also further allow medical staff to have more time to care for patients. In addition, the Metal Industry Research and Development Center attempts to establish a complete industrial chain on the medical technology platform by integrating domestic industry and university academic research, aiming to support the development of the digital medical industry.

3.5 Thailand

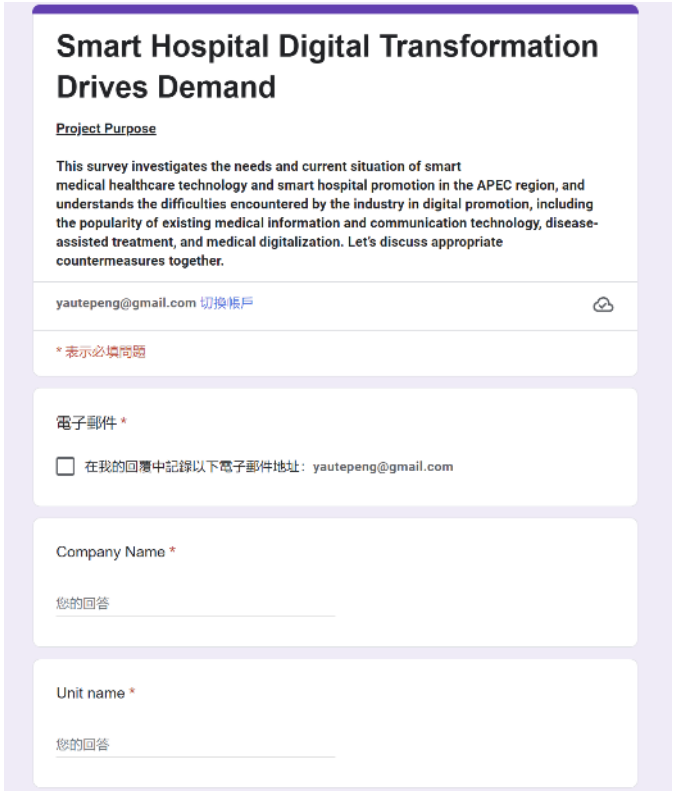
Thailand is gradually advancing the development of smart medical care. The government and private institutions are cooperating to introduce modern technology to improve the efficiency and service quality of the medical system. Telemedicine is an important direction of smart healthcare in Thailand, especially for remote areas and areas where medical resources are difficult to access. Through the remote diagnosis and treatment platform, patients can conduct video consultations with doctors directly through mobile phones or computers, and obtain medical advice and diagnosis, reducing the need for travel. This has been widely used during the COVID-19 epidemic and has promoted the rapid development of telemedicine infrastructure. In addition, Thai medical institutions have begun to use IoT devices to monitor patients' health data in real time, such as heart rate, blood sugar, blood pressure, etc. These devices can sound alarms when data is abnormal, reminding medical staff or patients to take timely action, which is particularly helpful in the daily health management of patients with chronic diseases. Thailand is building and renovating several smart hospitals, which are equipped with modern medical equipment, intelligent ward management systems and self-service facilities. For example, patients can use self-service registration machines in smart hospitals to quickly complete registration and payment, greatly reducing queue waiting time. In addition, smart wards can automatically adjust indoor temperature and lighting through digital control systems, and even monitor patients' sleep quality.

The Thai government has launched a series of policies and initiatives to encourage the development of smart healthcare. For example, the "Thailand 4.0" plan clearly points out the need to develop the digital economy, and smart healthcare, as an important part of it, receives strong support from the government, especially in technology research and development and infrastructure construction. Thailand's smart medical care is constantly developing and maturing. Although there is still room for improvement compared with some advanced economies , with policy promotion and continuous technological upgrading, Thailand's medical system is moving in a more digital and intelligent direction.

Fig 16. Recommendations and seminar conclusion by Thailand

4. **Results and analysis of pre-seminar survey**

To understand the current status of the application of information and communication technology in hospitals within the APEC region, we will conduct an online survey prior to the In-Person seminar. The survey questionnaire is divided into two parts. The first part focuses on data collection, including the development, application, and demand of information and communication technology in hospitals across APEC economies. The second part gathers information on topics of interest, suggestions, and the willingness to serve as speakers in demonstrations or seminars. The format of the questionnaire is as follows:



Smart Hospital Digital Transformation Drives Demand

Project Purpose

This survey investigates the needs and current situation of smart medical healthcare technology and smart hospital promotion in the APEC region, and understands the difficulties encountered by the industry in digital promotion, including the popularity of existing medical information and communication technology, disease-assisted treatment, and medical digitalization. Let's discuss appropriate countermeasures together.

yautepeng@gmail.com 切換帳戶

* 表示必填問題

電子郵件 *

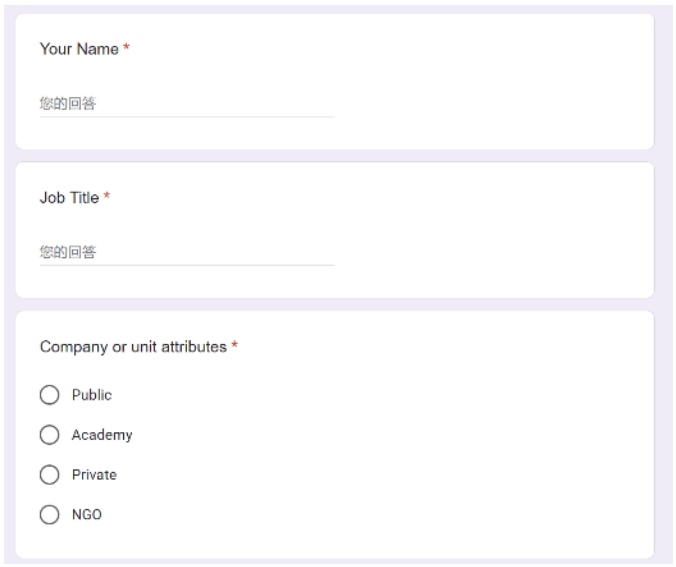
在我的回覆中記錄以下電子郵件地址：yautepeng@gmail.com

Company Name *

您的回答

Unit name *

您的回答



Your Name *

您的回答

Job Title *

您的回答

Company or unit attributes *

- Public
- Academy
- Private
- NGO

Economy *

- ◯ Australia
- ◯ Brunei Darussalam
- ◯ Canada
- ◯ Chile
- ◯ People's Republic of China
- ◯ Hong Kong, China
- ◯ Indonesia
- ◯ Japan
- ◯ Republic of Korea
- ◯ Malaysia
- ◯ Mexico
- ◯ New Zealand
- ◯ Papua New Guinea
- ◯ Peru
- ◯ The Philippines
- ◯ Russia
- ◯ Singapore
- ◯ Chinese Taipei
- ◯ Thailand
- ◯ The United States
- ◯ Viet Nam

1. Do you think Smart Healthcare can significantly improve medical care and welfare? *

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2.How important do you think the necessity of digital transformation of smart healthcare is in the region? *

	1	2	3	4	5	
Insignificant	◯	◯	◯	◯	◯	Significant

3.What do you think of smart medical construction and related technologies in your economy? *

	1	2	3	4	5	
Insufficient	◯	◯	◯	◯	◯	Very Well

4.Do you agree that smart healthcare will be the future trend in the medical field? *

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

5.What is the current level of smart healthcare in your economy? *

- [ ] AI disease sensing and prediction
- [ ] telemedicine
- [ ] digital technology assistive devices
- [ ] None
- [ ] 其他:

6.What do you think are the advantages of smart healthcare? *

- [ ] Save time and cost
- [ ] Improve the accuracy of medical diagnosis
- [ ] Promote the balance of medical resources
- [ ] Reduce medical manpower
- [ ] 其他:

7.What do you think are the disadvantages of smart healthcare? *

- [ ] High construction cost
- [ ] Technical complexity and difficulty in operation
- [ ] Security and privacy risks
- [ ] Low acceptance of medical care
- [ ] 其他:

8.What problems and difficulties are encountered in the smart medical healthcare transformation of your economy? *

- [ ] Information and communication cloud technology
- [ ] Medical sensing AI technology
- [ ] Digital talents
- [ ] Funds
- [ ] 其他:

9.What do you think your economy is doing to promote the transformation of medical intelligence? *

- [ ] Cooperation with medical units
- [ ] Digital talent recruitment
- [ ] Technology introduction and exchange
- [ ] 其他:

10.What are your views on the role the government should play in promoting smart healthcare? *

- [ ] Strong support and provision of relevant resources
- [ ] Provide appropriate support
- [ ] Should not interfere with the development of smart medical care
- [ ] 其他:

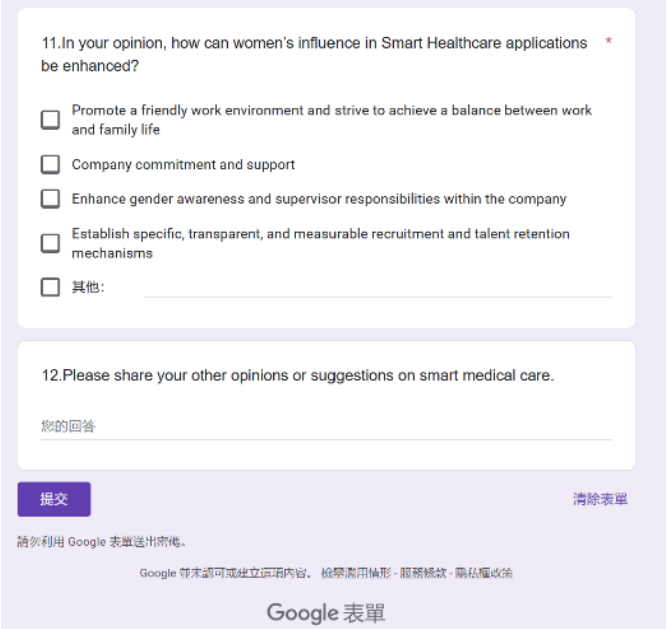


Fig 17. format of the questionnaire

A total of 60 questionnaires were collected for statistical analysis. From the results of the first part, we can know that members within the APEC have a high degree of recognition that smart medical technology can improve medical care (the average score is 4.7 points/ The total score is 5 points), and the necessity of medical transformation within the APEC through digital technology is quite necessary (the average score is 4.7 points / the total score is 5 points), and for the digital health care in the economy where the questionnaire filler is located The role played by transformation construction and related technologies is slightly insufficient (average score is 3.6 points/total score 5), but there is a high degree of recognition of whether smart medical care is a future trend (average score is 4.6 points/total score 5 point)

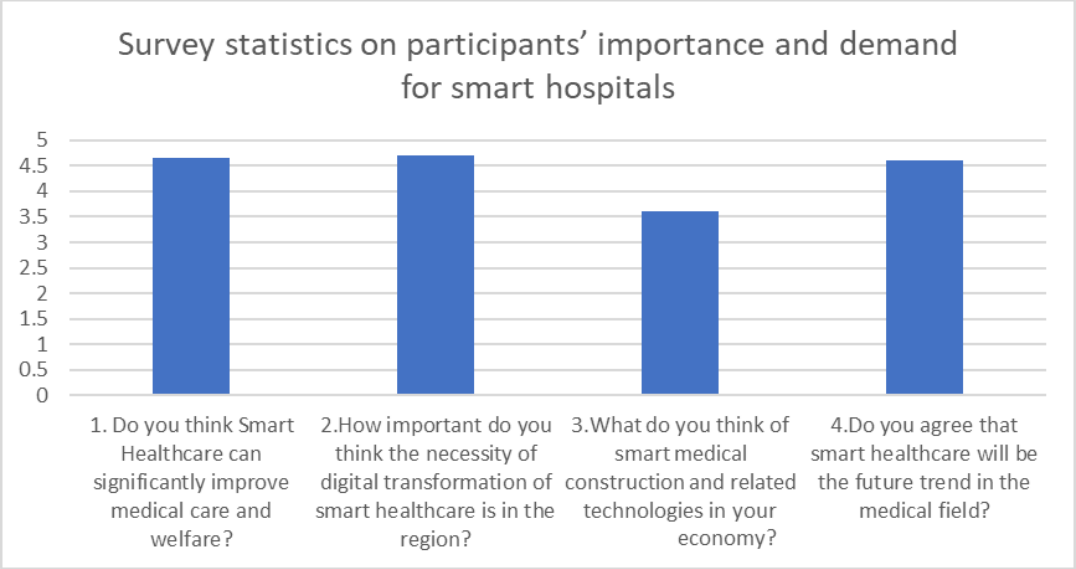


Fig 18. format of the questionnaire

In the "What is the current level of smart healthcare in your economy" option, we can know from the questionnaire statistics that currently about 40% of smart healthcare applications among members within the APEC economy are focused on AI assistance. Regarding the application of tools, such as AI disease auxiliary diagnosis, prediction and other auxiliary assistance in clinical treatment, 40% of the proportion is focused on the application of telemedicine, such as: the transmission of medical information through network infrastructure, and Combining medical applications to provide medical care in rural areas, this part is also related to projects actively invested in the economies of Thailand and Malaysia under discussion, and another 14% is still through the introduction of digital medical technology at this stage. and construction to form a smart medical service model. Finally, about 6% of statistics believe that smart medical technology or products have not yet been seen in the corresponding economy.

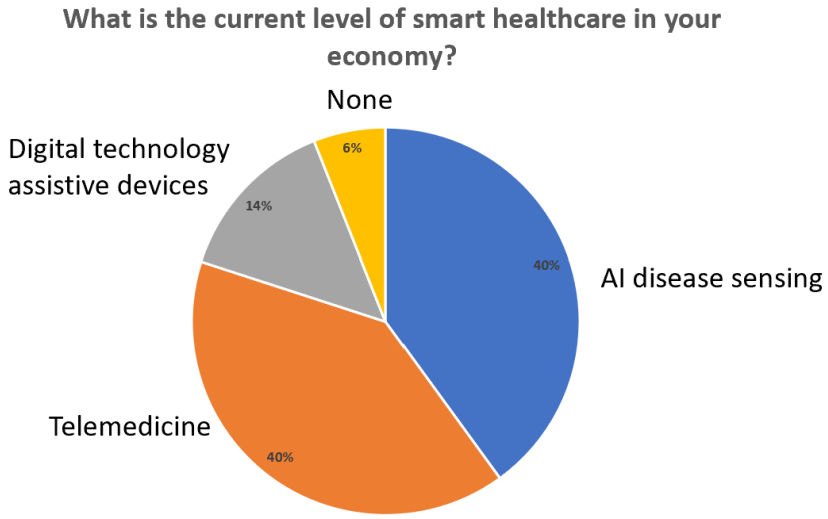


Fig 19. the statistics result of What is the current level of smart healthcare in your economy

In the "What do you think are the advantages of smart healthcare" option, we can know from the questionnaire statistics that the current suggestions of the APEC economies on the advantages of smart healthcare are (1) about 30% of them agree It can reduce medical time and costs; (2) About 28% agree that smart medical care can improve the accuracy and accuracy of treatment; (3) About 26% agree that the introduction of smart medical care can promote balance Distribution of medical resources; (4) About 16% agree that the use of smart medical care can reduce the cost and labor burden of medical care.

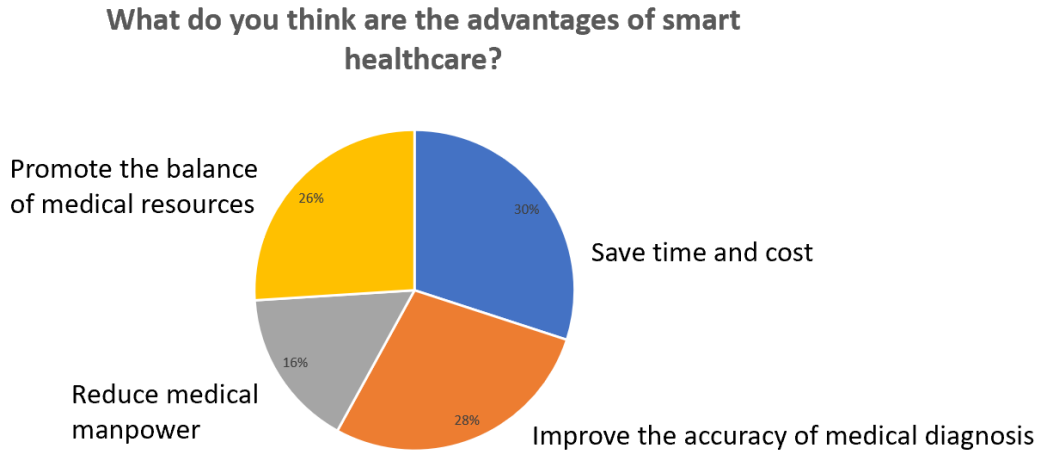


Fig 20. the statistics result of What do you think are the advantages of smart healthcare

In the "What do you think are the disadvantages of smart healthcare" section, from the survey results, we can see that although there is a high level of recognition and a significant need for the adoption of smart healthcare among APEC economies, there are still other concerns. These include: (1) about 34% believe that implementing smart healthcare solutions requires high costs; (2) approximately 20% think that smart healthcare technologies may be complex or difficult to operate; (3) around 19% feel that some medical personnel may not yet fully accept the use of smart healthcare technologies; (4) approximately 27% believe that the information used in smart healthcare may pose risks related to data security and privacy.

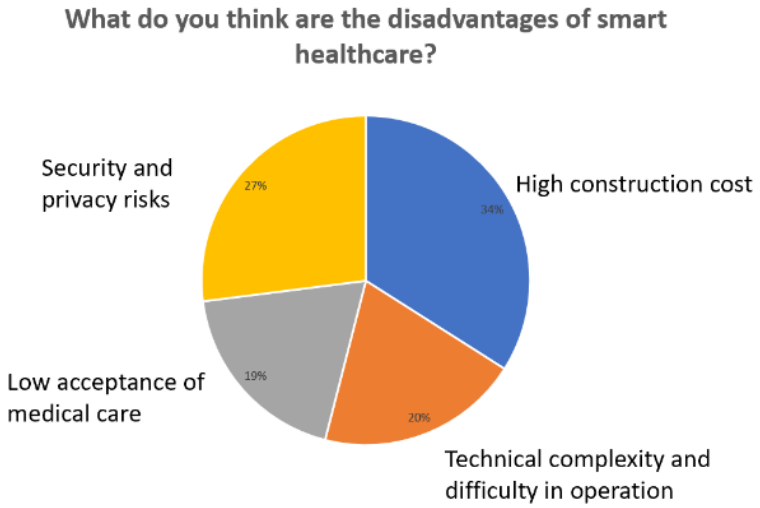


Fig 21. the statistics result of What do you think are the disadvantages of smart healthcare

In the "What do you think your economy is doing to promote the transformation of medical intelligence?" section, the survey results show that members of APEC strongly agree that the application of smart healthcare is a critical future trend. During the process of digital healthcare transformation, about 38% believe that direct collaboration with healthcare institutions is very important, while another 38% think that cooperation through the introduction of technology is needed to accelerate the development of smart healthcare. Additionally, around 24% believe there is a need to bring in digital information talent. From this, we can understand that smart healthcare requires collaboration with hospitals, technology transfer partnerships, and the introduction of information technology talent to comprehensively promote the smart healthcare service model.

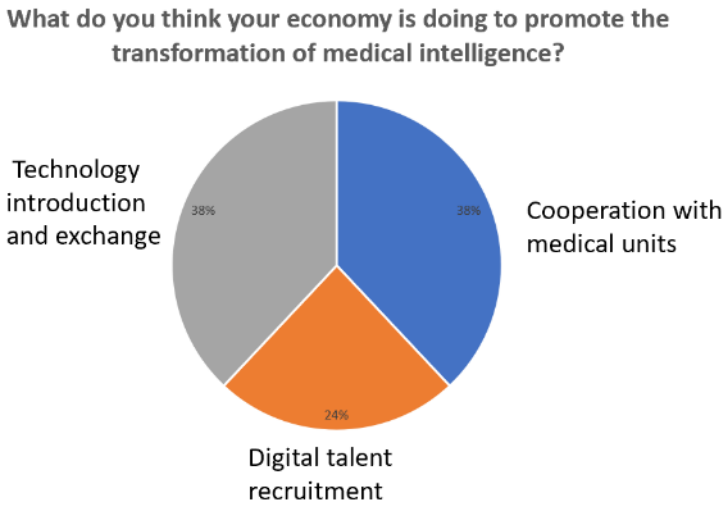


Fig 22. the statistics result of What do you think your economy is doing to promote the transformation of medical intelligence

In the "What are your views on the role the government should play in promoting smart healthcare" section, the survey results show that APEC economies believe government support is very important in the process of digital healthcare transformation. About 42% think that strong support and resource allocation are necessary, while 44% believe that moderate and appropriate support is needed. Lastly, around 14% think there should be no government intervention in the development of smart healthcare.

Finally, we summarize our suggestions for smart medical care. There are signs of progress in smart medical development. However, more efforts are needed to advance digitization. It must be improved that the medical team believes in AI research developed in their own economy . We should change our mindset about digital transformation and AI technology, and promote absolutely to achieve a digital level which reduces human power and cost as well. Laws and regulations are often outdated and need to be updated to support implementation of technologies. Ethical issues also should be carefully considered and addressed. Although the technology is highly benefit but due to high cost, access to smart medical may limited to some area, some group of people. Since most projects in smart medical care are still in the infancy stage it is very costly to have these operate but if theres any way for it to become cheaper and more accessible to the public. Not now, because this issue is still in development. No specific information and no clear items have been smooth operated in current situation. The continuous improvement on medical care enhances the quality of the patient's treatment and healthcare. To make smart medical care even better, there are several steps that can be made, like creating electronic health records (EHRs) that can easily be shared

between healthcare providers; this would allow seamless access to a patient's medical records wherever they go. Using AI to help diagnose illnesses quickly and accurately, and adopting robotic-assisted surgery to improve precision and recovery times. We should also develop apps that help patients stay engaged with their health, expand remote patient monitoring to manage chronic conditions and use blockchain to keep patient data secure. By also integrating genomic information, we can offer more personalized treatments, and using virtual and augmented reality can enhance medical training and procedures. Investing in smart hospital infrastructure with IoT devices can optimize hospital operations, and analyzing big data can help us understand health trends and improve public health strategies. These steps will make healthcare more efficient, effective, and patient-centered. Smart medical care should considering and applying Privacy Protection for Medical Data sharing. Privacy protection must be highest consideration in smart medical care to protect patients data. APEC economies should collaborate by sharing the best practices, experiences and knowledge on smart medical care.

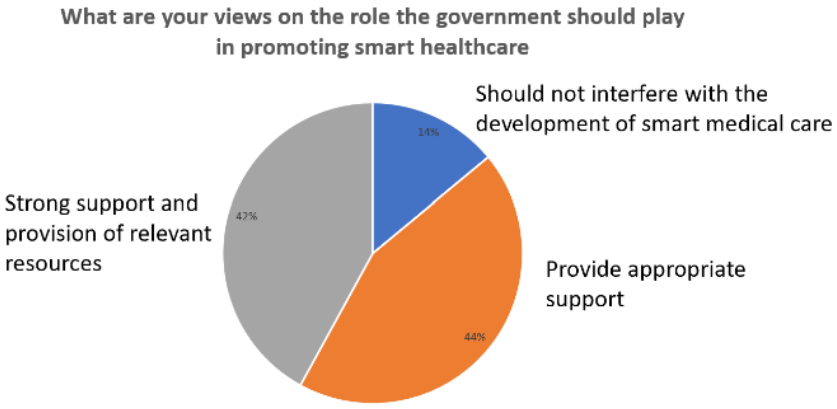


Fig 23. the statistics result of What are your views on the role the government should play in promoting smart healthcare

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