Workshop on Health and Innovation

Building A Resilient Public Health System Capacity for A Stronger Economic Recovery from the COVID-19 Pandemic

APEC Health Working Group

August 2024

Asia-Pacific
Economic Cooperation

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APEC Project: HWG 08 2022A

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APEC#224-HT-04.4

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Acronyms

Acronyms	Full names
APEC	Asia Pacific Economic Cooperation
COVID-19	Corona Virus Disease 2019
GDP	Gross Domestic Product
AI	Artificial Intelligence
R&D	research and development
UHC	Universal Health Coverage
ICUs	intensive care units
NCDs	Non-communicable Diseases
UNICEF	United Nations Children's Fund
APACMed	Asia Pacific Medical Technology Association
US	United States
UK	The United Kingdom of Great Britain and Northern Ireland
GM	General Manager
NUS	National University of Singapore
HPV	human papilloma virus
Q&A	Question and Answer

1. Introduction

1.1 Backgrounds

As of 31 March 2024, there have been around 775 million confirmed cases of COVID-19 worldwide.(1) The disease has impacted almost every economy and territory in the region. In the meantime, the health systems of the APEC economies have been overwhelmed by this pandemic; even those of the richest and most prepared economies have been severely disrupted.(2-5) To build a resilient health system against such crises and future emergencies through fostering new technologies and adopting innovations, this proposed workshop was designed to invite APEC economies to participate, share, and learn from each other in an interconnected world where the health and well-being of people and economic recovery are the top priorities.

With a total population of 2.9 billion people, APEC is one of the most important economic cooperation fora in the world, contributing nearly half of global trade and USD48 trillion of the world's GDP. Unfortunately, COVID-19 has severely impacted global trade and investment, as well as economic mobility, leading to GDP contraction shortly after the outbreak.(6) In the meantime, it has impacted almost every economy and territory in the world. The pandemic led to unprecedented challenges, requiring a rapid response from both a public health and an economic perspective. There is an urgent need to improve the health and well-being of people, which will accelerate economic recovery and stimulate future growth.

COVID-19 also served as a wake-up call for the health sector to realize the importance of technology and innovation. Prior to and during COVID-19, multiple innovative technologies have been identified and implemented in the health care sector, such as artificial intelligence (AI), telemedicine, big data, blockchain,(7) virtual clinical trials, and smart health care devices.(8) The APEC region is home to a mixture of economies at various stages of development. Previous scholars have studied how technologies have been used in health care in the region, but those studies predated the pandemic.(9-13) Policymakers in the APEC region need to be updated with the most recent evidence and experiences, especially in relation to the COVID-19 pandemic and how health systems in the region coped with the challenges brought by it.

By following the Aotearoa Plan of Action's vision and objectives, this project aims to share experiences and best practices through a workshop to strengthen health systems in the APEC region that enable quality and equitable health access and outcomes for all from the pandemic.

1.2 Project Objectives

The objective of this project is to foster an enabling environment to initiate efforts and actions to accelerate multilateral collaborations and harness new opportunities in health technological innovations to strengthen health systems for recovery.

Through this project, developing APEC economies were expected to gain from lessons on how technological innovations have supported advancement and growth in building resilient public health systems to respond to health emergencies in the region. This project targeted efforts to gather best practices on how to incubate new technologies and implement innovations to (1) promote R&D and manufacturing capabilities, (2) address issues relating to health infrastructure, product supply, and distribution, and (3) improve domestic absorptive capacity to ensure that economies can utilize and benefit from knowledge and technology transfer. It looked at systems and processes that are deployed in developing networks between institutional actors, namely universities, research institutions, industry (firms), and society, to increase economics' capacity to create or adapt knowledge and be able to translate it into new technologies, service delivery mechanisms, and products to strengthen public health systems. In doing so, the project leverages best practices and key lessons learned that demonstrate the critical importance of fostering health technological innovation capacities, strong multi-stakeholder engagement, enhanced and improved systems and standards, and a good policy environment to build a resilient, equitable, and effective public health system to deliver high-quality and low-cost health services in the region, which are considered critical elements that guide the development of health technological innovations.

This project aims to have sustained benefits for both developed and developing economies. Having established these systems and networks, economies may diversify innovation outputs and enhance their comparative advantage. Adoption of best practices can help narrow the scientific and technological gap that exists between developed and developing economies and help recover and build resilience against disruptions caused by COVID-19.

This project aligns with the Aotearoa Plan of Action's vision and objectives to ensure that the Asia-Pacific region is resilient to shocks, crises, pandemics, and other emergencies. It aims to foster quality growth that brings palpable benefits and greater health and well-being to all through intensifying inclusive human resource development as well as economic and technical cooperation to better equip our people with the skills and knowledge for the future.

A wide range of APEC activities were aligned with the agenda to help primarily developing member economies in their efforts to:

- address and manage the economic impacts of COVID-19 through promoting health technological innovations;
- strengthen the public health system and innovative capacity building;

- expedite economic recovery, build resilience against future large-scale economic disruptions;
- facilitate APEC economies to better adapt to available tools and technologies to boost economic recovery and growth.

1.3 Structure of this report

This report is comprised of six sections. The first section lays out the background and the objective of the project; the second section describes the work undertaken to design and develop the workshop; and the third section gives an overview of what happened during the two days of the in-person workshop in Beijing. In Section four, we summarize the lessons learned and experiences shared during the lectures and discussions of the workshop and give our policy recommendations on health and innovation for the APEC region. Section five contains a few additional materials that support the arguments and evidences and section six includes all references cited in this report.

2. Developing the Workshop

2.1 An online survey on health and innovation

2.1.1 Methods

To better understand the needs and interests of APEC economies in terms of health and innovation, we started this project with an online survey. In this survey, health innovation refers to any technology that was invented for healthcare use or was initially invented for other sectors and was recently put to use in healthcare.(14, 15) This survey was divided into three sections, each measuring the status of health innovation from a different angle, with respective guiding conceptual frameworks and measurement dimensions.

Specifically, in Section one, we applied the mostly used model of the technology adoption pathway in healthcare, which recognizes it as a linear model that captures the process of innovation from ideas to the market. This process is referred to as the "life cycle of health innovation." So, in this section, we assessed health innovation in its full life cycle, from research and development to marketization, piloting, and adoption into public health policies, to identify priorities, strengths, and challenges facing health innovation across the life cycle in the APEC economies.

In Section two of the survey, we asked respondents to fill in health innovation types and areas of their interests. We understand that health innovation can take place in any sub-area within the health care field. The ongoing global call for Universal Health Coverage (UHC), joined by various regional and sub-regional -level strategic plans for health, is sending a strong message that health is a right for all people. In this section, we explore the status of health innovation in each APEC economy across different disease areas (infectious diseases, non-communicable diseases, mental illness, maternal, child, and nutritional health, frailty, trauma ,and injuries), demographics (older people, children and adolescents, women and pregnancies, those from lower income backgrounds, ethnic minorities, homeless people, and domestic immigrants), and across the life continuum of care (prevention, screening, diagnosis, treatment, survivorship, and end-of-life care).

Last but not least, Section three of the survey assessed the priorities and interests of respondents across different health system levels, from the primary health level to the secondary, and tertiary levels. The assessment of technology integration at different health system levels is crucial, as health innovation takes place inside the health system, which includes various functions, components, players, and processes. It is a dynamic and open system with a shifting landscape and targets. Different health system levels entail different infrastructure, human resources, interventions, and services. A better understanding of the heterogeneous nature of different health system levels and how they interact with technology in different ways is the key to a comprehensive, effective, and sustainable integration of health technology to achieve universal health coverage.

In total, this survey contains nine questions, including single-choice questions, multiple-choice questions, and open questions. See Appendix 5.2 for the questionnaire. Invitation emails were sent to all APEC economies on 17 July 2023, and follow-up emails were sent to those who hadn't responded on 31 July, 15 August, and 25 August 2024. Respondents can participate in this survey by either filling out the online survey or by filling out the Word file attached to the invitation email and sending it back to the research team.

2.1.2 Results

Participation of economies

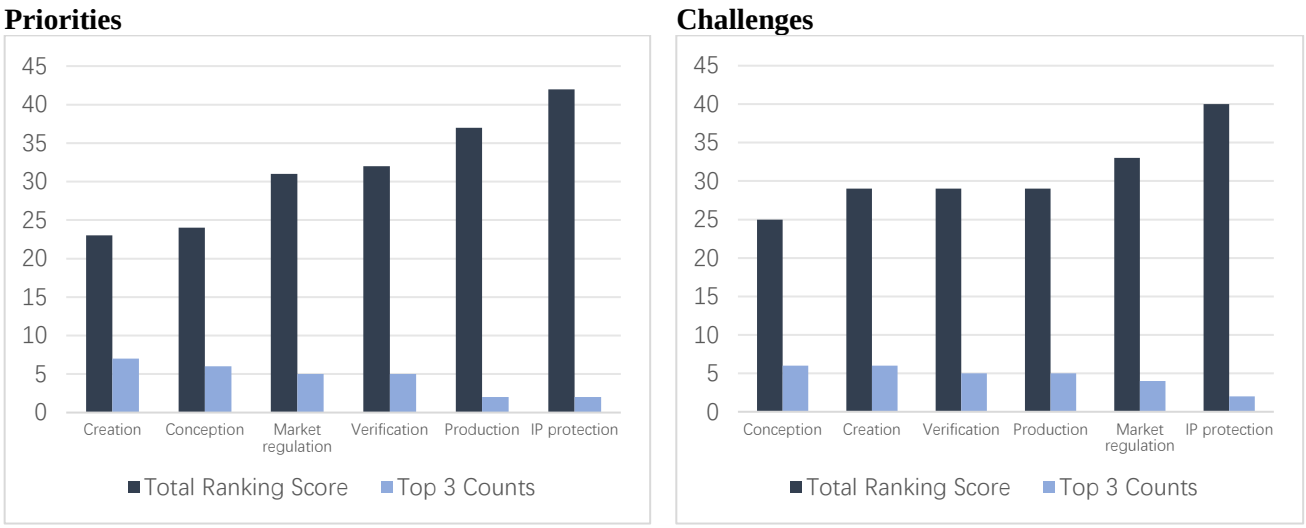
A total of 10 economies participated in the survey, which provided key insights into how those economies utilized technology in the health care sector, their priorities, interests, and challenges faced. We summarize those results in the section below. See Appendix Section 5.3 for a detailed list of economies.

In ranking questions, we used two different methods to summarize the results: 1) Total Ranking Score: adding up the ranks given by each respondent to each of the answers; the higher the total score, the lower the priority or interest level; 2) Top Three Counts: counting the number of economies that ranked it within the top three for each answer; the higher the counts, the higher the priority or interest level. In this section, we present the results for both methods. In all graphics presented in this section, the taller bars represent data of the Total Ranking Score, and the lower bars represent data of the Top Three Counts.

Across the life-cycle of health innovation

The top three priorities for APEC economies are: 1) creation: prototyping new ideas into innovative products for small scale testing; 2) conception: breeding new ideas and basic research for innovation in health care; and 3) market regulation: quality control, wide application, public acceptance, etc.; intellectual property rights protection. This ranking is robust using both methods. The top three challenges for APEC economies are: 1); Conception: breeding new ideas and basic research for innovation in health care; followed by 2); creation: prototyping new ideas into innovative products for small-scale testing; and then 3) Production: supporting the mass production of products and user case applications. See figure 1 for more details.

Figure 1. Priorities and challenges across the life-cycle of health innovation in APEC economies

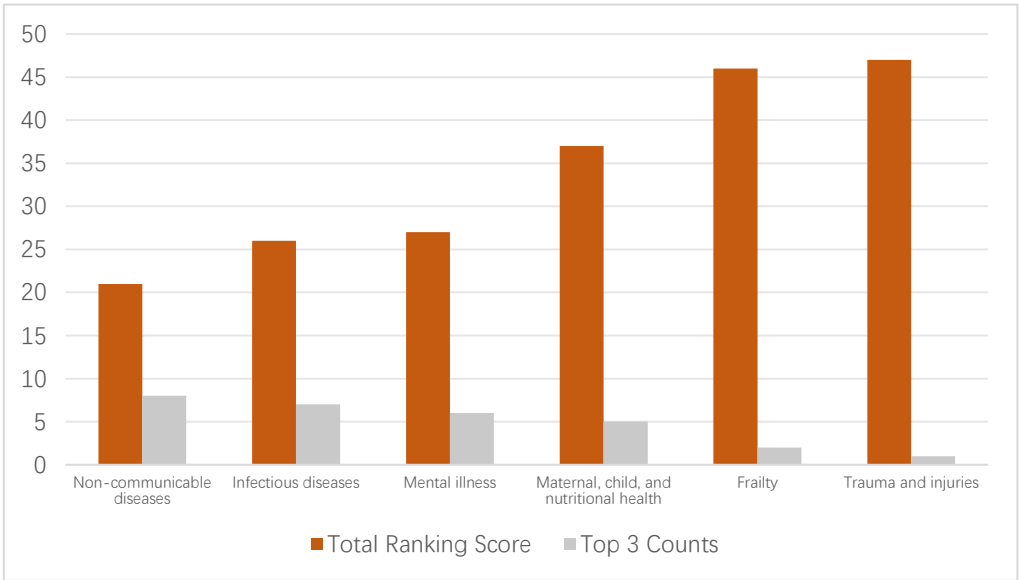


Notes: Conception: breeding new ideas and basic research for innovation in health care; Creation: prototyping new ideas into innovative products for small scale testing; Verification: Incubating new technology from small scale testing to more specific and mature products ready for the market; Production: supporting the mass production of products and user case applications; Market regulation: quality control, wide application, public acceptance etc.; Intellectual property rights protection.

Across the disease spectrum:

Applying either summarizing method, the disease areas of the top interest to APEC economies are the same: 1) non-communicable diseases, 2) infectious diseases, and 3) mental illness. See figure 2 for more details.

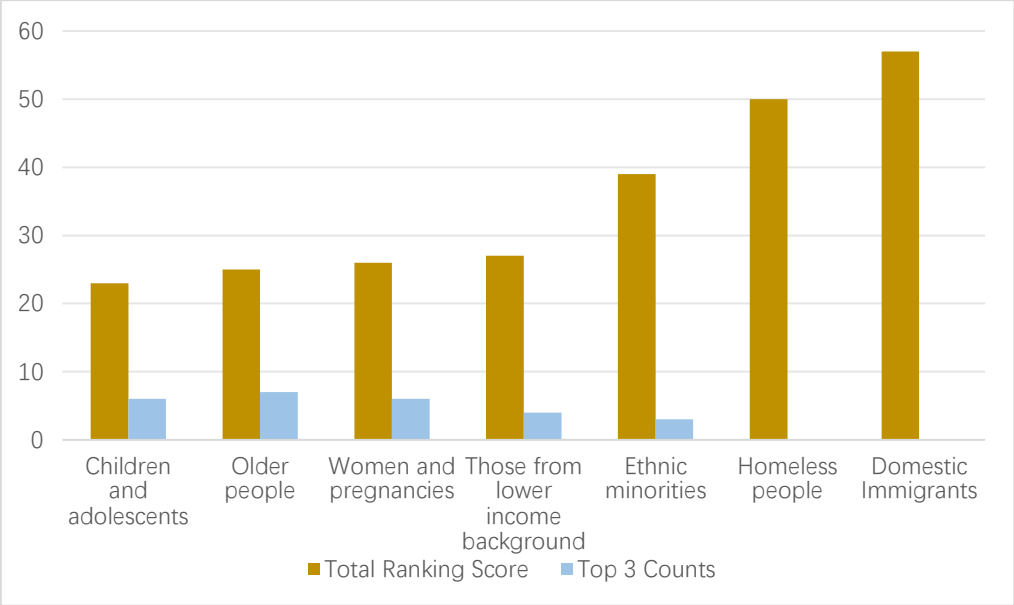
Figure 2. Interests of APEC economies across disease spectrum to apply health innovation to



Among different population subgroups

Using the Total Ranking Score, the population subgroup with the highest interests in APEC economies is children and adolescents, while using the top three counts, the highest interests lie in older people. However, using either method, the top three population subgroups stay the same: older people, children and adolescents, and women and pregnancies. See figure 3 for more details.

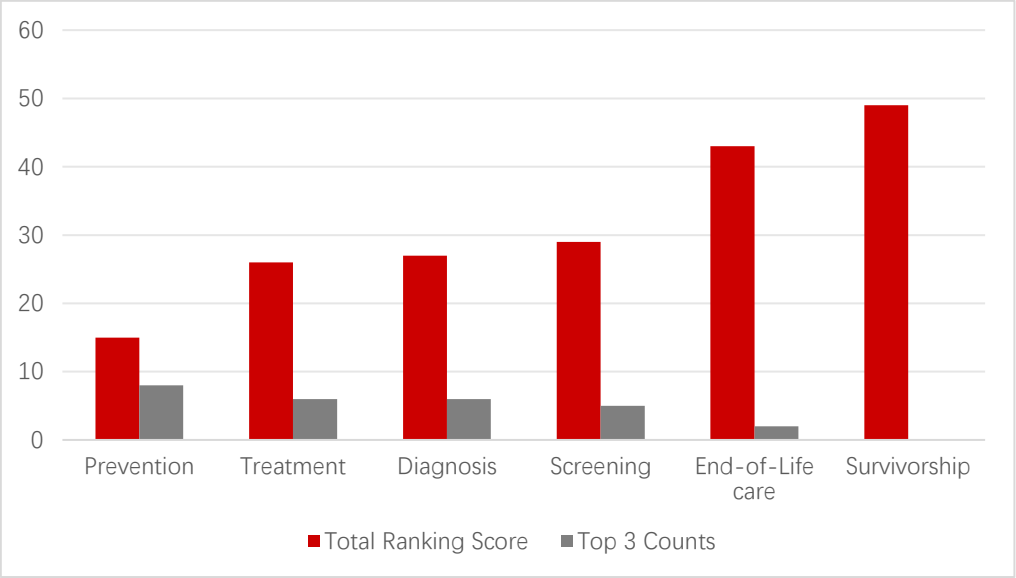
Figure 3. Interests of APEC economies among difference population subgroups to apply health innovation to



Across the life continuum of care:

Applying either summarizing method, the stages of care that are of the top interest to APEC economies are the same: 1) prevention, 2) treatment, and 3) diagnosis. See figure 4 for more details.

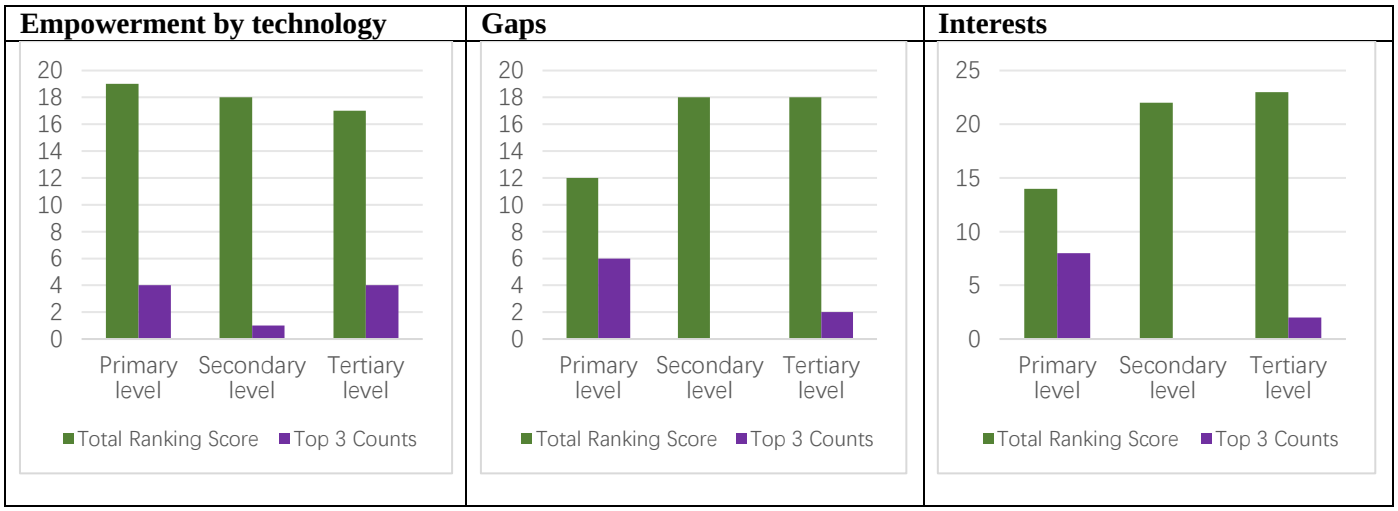
Figure 4. Interests of APEC economies across the life continuum of care to apply health innovation to



Across different health system levels:

In the last section of the survey, we asked each economy three questions regarding health system levels and innovation. It is quite interesting that most respondents think the tertiary-level health system is the most empowered by technology, while they are most interested in learning more about technology at the primary level. They also think the primary level health system is the one with the widest gap between the status quo and the expected level of technological involvement. See figure 5 for more details.

Figure 5. Technology empowerment, gaps and interests of APEC economies across the three health system levels for health innovation



Notes: Primary level: homes, community health centres, primary care clinics; Secondary level: hospitals, specialty consultants; Tertiary level: hospitals with more advanced specialty care, such as surgeries, ICUs, and other complex treatments or procedures.

In addition, we asked each respondent to list their rationales explaining why they think different levels of health systems need to be empowered by technology, and here is a summary of results from all APEC economies. The descriptions were paraphrased only in cases of grammatical errors and to remove the reference to specific APEC economies so their anonymity is protected and that summary reflects the overall situation in the APEC region rather than any specific economy.

Rationale of interests for each of the health system levels are listed below:

Table 1. Rationales of technology empowerment across the three health system levels

Health system levels	Rationales
Primary	● The standard treatment facility availability is sufficient; ● Prevention is key to coping with the chronic illness challenges faced by us. Also, a focus on the primary level has been the key principle of the health policies in the APEC region. ● There's been a shift in our interests towards primary and community care, in an effort to prevent and prolong quality of life, as our population ages. ● The first level of care is important because it is the initial contact for people to screen for potentially treatable diseases, even without leaving consequences or complications. In addition, prevention is applied to avoid or reduce the development of diseases, in addition to sending patients to the second and even the third level of care in a timely manner for their study and management. Due to the aforementioned, being a level where the majority of the population is served, it is necessary to know the strategies and policies that can empower them to have more participation in the Health System. ● Expand the application of primary care with an emphasis on health promotion. Implement tiered medical care and reduce the burden on medical personnel ● We have rich history in policy reforms at the primary level and have shared experiences of other APEC economies. ● The primary level is what we are surrounded by most often and where we could most likely have a strong impact.
Secondary	● Less complex requirements by still important ● We also need a good secondary level to smoothly transfer patients to where they need and to relieve the care burden of the tertiary level whenever possible. ● Interest to see how these services can plug existing care gaps. ● Like the first level of care, it is important to care for and solve acute and chronic health problems; although technologies have been directed and established at this level, there is an innovation of new technologies. It is necessary to know health policies that help improve and properly coordinate them with the first level of care. ● Enhance the quality of medical care and caregiving ● Similarly, we have already seen innovation and political efforts at this level. ● Secondary level is what we are around the most.
Tertiary	● New inventions in complex situations ● This is still the primary place of deaths for most patients in our economy so it is directly related to people's trust in and their satisfaction of the whole health system.

	• Interest in how better to design/ redesign hospital infrastructure and processes to healthcare costs affordable and achieve more with limited healthcare manpower. • No less important than the other two levels of care, it is necessary to know health policies that help plan the creation and distribution of these units in the economy, as well as how to coordinate between them and the other levels of care to provide an adequate and timely response to patients. • There is a lot of innovation directed towards this level of disruptive technologies that would change the healthcare delivery model in any system. • Enhance the equality of medical care and caregiving • We hope to share more updated information, other than technological innovation, about policy reforms at this level which could involve controversial discussions and technical complications. • This is where we have the least influence.

2.2 Workshop agenda: considerations and rationales

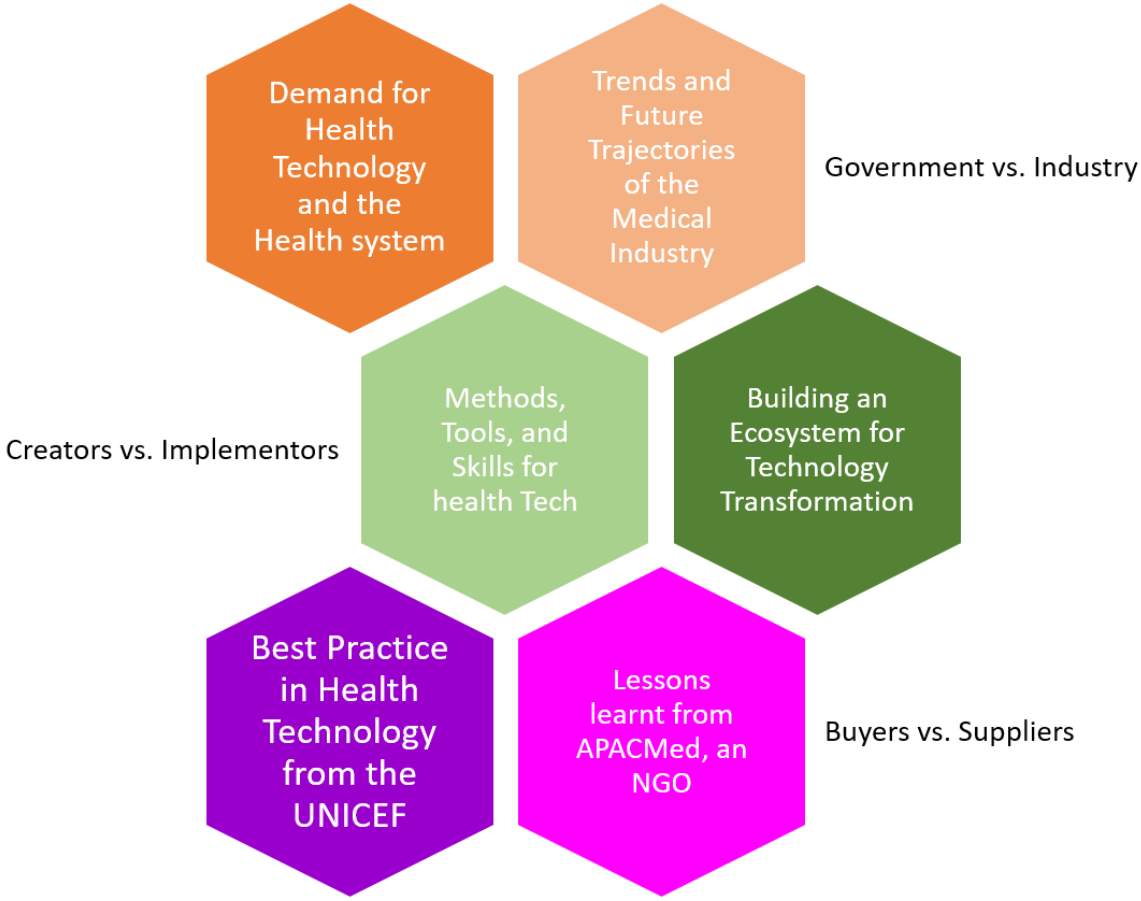
Based on the online survey, as described in detail in this section, we developed the workshop agenda that addresses the topics within health and innovation that APEC economies are most interested in learning about. Specifically, the expertise of invited speakers focuses on the key areas identified from the online survey: 1)

The survey revealed a few priority areas for the audience: 1) early processes of technology conception and creation; 2) infectious diseases, NCDs, and mental illness; 3) children and adolescents, women and pregnancies, and older people; 4) prevention; and 5) primary level health system.

This workshop was meticulously designed to foster a dynamic exchange of ideas, bridging the gap between policymakers and industry leaders, implementers and creators of health technology, and between non-profit buyers and for-profit entities in the health sector. Over the two days, through insightful lectures, information sharing, and engaging group discussions, we aimed to ignite transformative and innovative thinking on fundamental strategies, methodologies, instruments, and policy directions. Our goal was to cultivate an enabling environment to initiate efforts and actions that will accelerate multilateral collaborations, tapping into new opportunities in health and innovation to build resilient health systems.

Those priorities were shared with all invited and confirmed speakers to help them design their session. For some speakers, we worked together with them to modify their slides to emphasize the lessons around those priority areas. See Appendix Section 5.4 for the overview and agenda of the workshop.

Figure 6. Thematic blocks of the workshop



The workshop was designed to bring out the most possible clash of ideas (Figure 6). For each half-day of lectures, we invited speakers from two opposite sides of the issue to provoke thoughts and inspire new thinking outside of the traditional realms. On the morning of the first day, we invited Dr Zhao, the former deputy director of the Center for Comprehensive Evaluation of Drugs and Technology Evaluations of China's National Health Commission, to talk about the demand side of health technologies from the policymakers' point of view, followed by a lecture by Dr Tao Ming Wang, an industry leader, to talk about the supply side of health technologies. In the afternoon that followed, Prof. Kiesha Prem from Singapore National University introduced how technologies are created and evaluated using mathematical tools such as modeling and simulation, followed by Dr Patcharin Tantiworrawit's presentation on how she was able to build an ecosystem to foster the creation and implementation of new ideas, products, and services in a community. On the morning of the second day, we first had Dr Basil Rodriguez introducing how UNICEF adopted technology in their programs as a buyer and then had Ms. Alicia Chang introducing how APACMed, a pharmaceutical association in the APEC region, promoted technologies as a sellers' alliance. The next section presents the highlights of each presentation.

3. Overview of the Workshop on 9-10 December 2023

3.1 Workshop introduction

At the beginning of the workshop, Prof. Kun Tang, the Project Overseer, gave a welcome remark and a brief introduction of the background work that went into the design and organization of the workshop. He stressed the diverse audience this workshop had assembled and reiterated the goal of cultivating an enabling environment to accelerate multilateral collaborations, bridging gaps, and nurturing new opportunities in health and innovation to build resilient health systems.

He also introduced the work of the online survey, and summarized the key results from the survey, and then introduced each speaker, the background, and why they were invited to this workshop.

Last but not least, Prof. Tang introduced the technological advantage of having Tsinghua University as a partner, since it is the top university in the world in science and technology, where multiple world-renown groundbreaking innovative technologies in fields like aerospace, computer science, and artificial intelligence were generated and incubated. All audience members would have the opportunity to tour around the Tsinghua University Global Health Innovation Center to witness firsthand how students, scholars, and entrepreneurs in science and technology are making significant contributions to healthcare.

3.2 Opening remarks

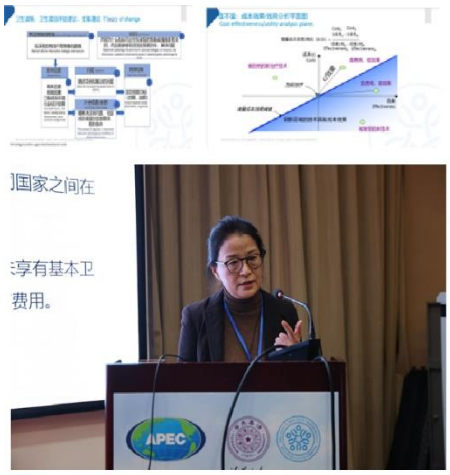
After Prof. Tang, Dr She Zhiwen from China's National Health Commission delivered the opening remarks on behalf of his team, which is the focal point for the Health Working Group of APEC in China.

He reiterated China's commitment to reinforcing connections with APEC and APEC economies, as well as China's resolve to put people's health at the center of the economy's development strategies. The COVID pandemic exposed systemic weaknesses in health systems across the world, and even the well-performing ones suffered tremendous losses, in and beyond the healthcare sector. It only reminded us how important health care is, not only for people's health but also for economic and social development.

Dr She reminded the audience that APEC is an assembly of economies with diverse cultures, demographics, and development levels. There are vast learning opportunities to share experiences among ourselves and to create global public goods for economies in other regions.

3.3 Presentation highlights

Picture 1



Session 1: Demand for Health Technology and the Health system（Picture 1）

Prof. Kun Zhao, former executive deputy director of the Center for Comprehensive Evaluation of Drugs and Health Technologies, National Health Commission

Prof. Zhao started her talk with the epidemiological background that almost all APEC economies are facing, including the aging population, rising inequity, and an epidemiological transition from infectious disease to non-communicable and chronic illnesses. She then introduced key concepts and frameworks used in technology evaluation by China; Germany; Japan; and the US. She also gave examples and cases where economic evaluation of health technology was conducted and applied to policymaking.

- We are facing global challenges of aging populations, rising inequity, an increased burden of chronic illnesses, and public spending on health falling short of the growing healthcare needs.
- At the same time, innovative technologies continue to emerge, which save lives but also add to healthcare costs.
- Developed economies such as the UK, Japan, the US and Germany have developed their own comprehensive health care system reforms, with respective advantages and challenges
- A health system should be: 1) people-centered; 2) across the care continuum; and 3) focused on primary care.

In the discussion session, participants discussed with Dr Zhao the emergence of telemedicine in APEC economies. Dr Zhao acknowledged the rapid development of telemedicine, in various forms, in the APEC region, and thinks, as policymakers, the most important task is to define the respective responsibilities for all stakeholders involved in the process and make sure patients' rights and health are protected.

Session 2: Trends and Future Trajectories of the Medical Industry (Picture 2)

Dr Tao Ming Wang, the chief strategy and technology officer, General Manager of Global R&D Strategic Cooperation of Haier Group, Managing Partner/General Manager (GM) of Haier Incubation Accelerator; co-founder, Jiangsu Industrial Technology Research Institute, an institute on social aging

Picture 2

Dr Wang started his talk with an industry overview and then delved into how technology is empowering the private sector to better serve the health care market. He focused his talk on health care for the senior population, including control of non-communicable disease, esthetic products for older people— a newly found market pain point by the big data analysis, palliative care, and nursing home facilities.

- The medical industry is shifting from providing products to building platforms that provide comprehensive solutions to users in a particular scenario.
- Big data mining helps companies design better products tailored to the needs of their users (the case of skin care products for the elderly);
- The new model for innovation is through an open innovation platform where creators, designers, financiers, suppliers, manufacturers, and users are all incentivized to interact freely and to contribute throughout the value chain.
- The future of the health aging industry will be about: 1) digitalization; 2) personalization; 3) prevention; and 4) AI.

In his presentation, Dr Wang used a project he is currently leading on senior care in China to explain how the government, the private sector, and academia all have different roles to play in promoting innovation in health care and what the challenges are in putting them to work together. To better serve the senior population in China, he is working with the China National Committee on Aging to define and promote care standards for the senior population at home and in communities. A joint venture was set up between the government and the

private sector to incubate and grow tech companies that provide those solutions. Harvard University was brought in to channel all the best technologies that come out of scientists at Harvard University to be piloted, verified, and upgraded to market.

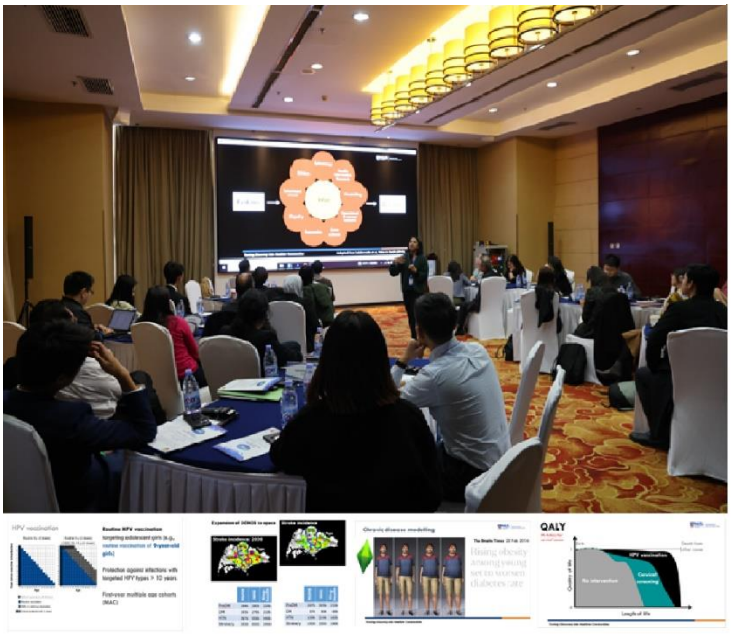
Session 3: Methods, Tools, and Skills for health Technology (Picture 3)

Prof. Kiesha Prem, an assistant professor at the NUS Saw Swee Hock School of Public Health and the London School of Hygiene & Tropical Medicine

As an infectious disease modeler, Prof. Prem pivoted most of her presentation to one key area of infectious diseases that is of great concern among APEC economies: the HPV vaccine. She introduced key concepts and rationales behind mathematical modeling in public health and used HPV vaccination as an example to show how scientists' research can help policymakers make better use of public resources and save more lives.

- In the face of limited resources, policymakers almost always need to make a choice between different resource allocation plans, and this is where modeling comes in.
- Health economic modeling includes many types, including 1) proportionate outcome model, 2) Markov model, 3) comparative dynamic model, and 4) agent-based model;
- Optimized HPV vaccination saves the most lives with the fewest resources;
- Giving as many girls HPV vaccines as possible, even if they only get 1-dose, is more cost-effective than completing 2-doses for half the girls.

Picture 3



In the Q&A session, participants first asked a question on the generalizability of modeling research and to what extent we could use the evidence generated in another economy to inform our own decision-making. Prof. Prem suggested that for any government to make use of a modeling study conducted in another setting, the government needs a modeling specialist in the team to understand all the nuances of the particular modeling study. In addition, the government needs experts who really understand local context and how people interact with policies to transfer modeling studies into evidence for more informed policy-making. The participants also discussed the necessity to vaccine boys, and acknowledged that, while it should be an issue of equal concern as

boys contribute to the problem in equal ways, whether it can be a priority on the agenda is highly dependent on local situations. Prof. Prem also mentioned that scientists and modelers are increasingly paying attention to technology products in their early development stages, before they are widely available on markets, as well as to smaller-sized innovators.

Session 4: Building an Ecosystem for Technology Transformation (Picture 4)

By Dr Patcharin Tantiworrawit, Medical Officer at the Senior Professional Level at the Disease Prevention and Health Innovation Center, Department of Disease Control, Ministry of Public Health, Thailand

Picture 4

- A successful and sustainable innovation that combines the thinking of a capitalist, a humanist, and a technologist is desirable, viable, feasible, and has integrity.
- The incubation of innovative technologies takes more than the public sector; there needs to be an ecosystem of multiple partners and a cognitive, caring, and dedicated community that starts with cheap, simple experiments and moves fast.

In the discussion session, Dr Tantiworrawit elaborated further on the dilemmas innovators usually find themselves in: innovation needs to be eye-catching for investors while also being sustainable in the communities they are designed to serve. The secret of being a good innovator is to find the balance between these two ends and make your innovation truly serve the people you intend to.

Session 5: Best Practice in Health Technology Innovation (Picture 5)

Dr Basil Rodriques, Health adviser, UNICEF Regional Office

- The approach to innovation in health focuses on two strategic goals: 1) scale and sustain innovations for impact, and 2) harness a culture of innovation in programs;
- Utilizing existing technologies can be much more cost-effective than developing new technologies;
- Implementation science is important for projects introducing novel technologies: a majority of them fail due to dysfunctional delivery and discoordination.
- UNICEF takes a system-wide approach to identifying, adopting, and adapting new technologies;
- Partnerships are key.

Picture 5

In the discussion session that followed, Dr Rodriques emphasized that advocacy is a key part of the organization's work, including identifying areas that need more support in economies where immunization efforts are ongoing, and that partnerships and fundraising are key to achieving goals, with a focus on leveraging ideas and expertise from outside the economy. Participants joined the discussion and proposed ways to bridge the gap between investments and infrastructure, including involving communities in the solution, incentivizing the private sector to join the resource allocation with a well-defined accountability system, and strengthening human resources as an initial step to strengthening health systems.

Dr Rodriques also led a discussion on the challenges of implementing health care innovations in the East Asia and Pacific region. He started the discussion with an example of how a well-equipped ambulance can save lives by providing timely pregnancy and delivery services to remote areas. Participants joined the discussion and raised a few key challenges to implementing health care innovations in their respective economies, including quality concerns with telemedicine, the security issue of patient data in the digital revolution, the vicious loop of lack of data and lack of evidence-based decision-making, as well as continuity in government initiatives despite changes in administration.

Session 6: Lessons Learned from Health Technology Innovations (Picture 6)

By Ms. Alicia Chang, China lead, Asia Pacific Medical Technology Association (APACMed)

- The medical industry provides four types of innovative products and services: 1) clinical education services, 2) care coordination services, 3) clinical operations and analytics services, and 4) direct to patient clinical services.

Picture 6

- APACMed is promoting "regulatory reliance" within the APEC region for fast adaptation of new technologies across economies, especially in economies with limited research and development resources;
- Since COVID-19, APEC economies have been developing and promoting telemedicine options, such as the sand box project promoted by the Singaporean Ministry of Health.
- The challenges of out-of-hospital care are: qualification of healthcare professionals, patient and technical equipment qualification, technology and device solutions, recognition of healthcare workers' labor value, funding model, and home-based care delivery.

Ms. Chang started her presentation with an introduction to the Asia Pacific Medical Technology Association (APACMed), a non-governmental organization that focuses on creating and maintaining enabling environments for health care innovation within the APEC region. To achieve this goal, they involved multiple stakeholders, including legislators, pharmaceutical companies, market regulators, etc.

She led an interactive session where participants were involved in each part of her presentation. The audience first discussed what innovation is, and mentioned a few areas of high interest to them, including artificial intelligence, digital health, new medicine, and medical devices. The second discussion was around what constitutes good innovation. A few parameters were proposed by representatives from different APEC economies, including good health outcomes for the people, a more efficient health system, an improved decision-making process, and so forth.

A heated discussion happened around the generalizability of successful experiences from one particular economies to the whole region. Representatives from some economies warned about the potential harm people could cause if they applied experiences and policies from other settings without assessing the evidence thoroughly and taking into account local situations. While the industry would like to see new things being tried out and upscaled, the public sector has to be very cautious about scaling up. Ms. Chang acknowledged this concern and proposed that this is exactly what we need to do as the innovation community: promote information sharing and fill the evidence gap required to make appropriate health policies available to benefit a larger population.

Field Trip to Tsinghua University Global Health Innovation Center

Facilitated by Ms. Chang and Ms. Li at the Tsinghua University Global Health Innovation Center

- All participants took part in a half-day tour of the Tsinghua University Global Health Innovation Center, where Ms. Chang and Ms. Li gave a tour of the display hall and a few incubated programs at the center, including the Bill & Melinda Gates Foundation Lab for Bio-medical Research and a program making robotic arms for surgeries.
- At the center, delegations from each APEC economy shared best practices and lessons learned on health and innovation from their own work and discussed opportunities for further collaboration.

3.4 Group discussion and Open forum highlights

In the afternoon of 12 December 2023, and after the tour at the Tsinghua University Global Health Innovation Center, active participants from different APEC economies shared success stories and lessons learned from each of their economies regarding health and innovation. The key takeaways are summarized in this section.

COVID-19 pandemic as a propellent for health care innovation

Shortly after the outbreak of COVID-19 in the region, multiple economies implemented strict lock-down measures. They posed great challenges to the health care system, whose disruption can be detrimental and, at times, fatal. Multiple representatives from APEC economies introduced and initiated their telemedicine projects as a much-needed solution during the lockdown periods. For other economies whose telemedicine had already been developed prior to the COVID-19 outbreak, this pandemic necessitated increased investments to further strengthen the infrastructure and human resources to provide quality and timely services, especially for patients with chronic illnesses.

In addition, during the pandemic, governments across the world realized how important it is to have locally manufactured medical goods so they don’t have to rely on imports, which was largely disrupted due to the pandemic and the control measures around the world. It stimulated further investments in local production and innovation capacities.

Telemedicine and remote healthcare

Participants from multiple APEC economies shared their experience building telemedicine platforms, especially during the COVID-19 pandemic. Those projects take the form of either added online or remote services provided by public or private hospitals or new initiatives led by a government department that involve both the

public and private sectors. Either form has proven effective in improving people's access to health care and saving costs across the region.

However, with the current level of evidence presented during the open forum session, it is difficult to compare costs and cost-effectiveness. Some projects measured and presented costs to patients, others, hospitals, or the health system. More research is needed to create generalizable knowledge from those shared experiences and generate global public goods that can benefit the whole APEC region and beyond.

Local production of medical products

While some economies such as China, have a mature local industry for various medical products, most other APEC economies don't. Among those economies, there are also two different cases: 1) economies with the capacity to build their own local production; and 2) economies that will have to rely on others for medical products and thus would like to strengthen their capacity to import, implement, adapt, and regulate innovative products.

One economy gave an example of how they decided to go to universities and worked with professors to develop new products as an alternative to the private sector, so it was easier to negotiate lower prices. Other economies went directly to the private sector, offering direct procurement contracts and other incentives. They all faced difficulties and were deemed failures by the participants. As one participant put it. "We are so used to using imported products rather than making products that suddenly you want to switch, it is difficult, even for things as simple as consumables like plastics." As a result, some economies proposed for companies from more advanced economies such as "China" to come in and help them build up local manufacturers.

Regulatory infrastructure for health innovation

Participants also discussed what the government needs to do to support health innovation development and implementation within the economy and agreed that it is key to have the right government set-up to provide key coordination, incentive, product certification and buy-in, as well as market regulation. One participant used their own experience to showcase the importance of having a high-level government leader as the "champion for change," which creates window opportunities for policy changes.

The right government set-up guarantees that a strategic, innovative lens is provided throughout the planning of health care, even in other traditional service areas. It also supports long-term planning for technology innovation, not for five years but for 10, 20, or even 50 years.

Artificial Intelligence (AI) and Robotics

Participants showed great interest in leveraging AI and robotics to improve health care efficiency and reduce costs. The application of AI and robotics already showed great potential during the pandemic, when robotics

were used to deliver drugs, care for patients in wards, and provide individualized interactive care experiences to patients and their family caregivers. Strategic partnerships with the private sector are the key, since most of the innovation in AI came out of the private sector first.

Making use of existing technologies to build incremental innovations

During the pandemic, hospitals had to go online and provide remote services, while for many others, there was no existing platform and no resources to build one from scratch. Coincidentally and understandably, multiple health teams across the APEC region made use of existing remote communication platforms for online consultation service delivery, including Google, Zoom, and Skype. To ensure patients and doctors' rights are protected, the medical council or relevant departments within the ministry of health had to be brought in to make sure the practice aligns with medical service regulations and can be properly recorded for quality assurance.

4. Conclusions and policy recommendations

APEC economies have implemented similar projects that deliver remote care, online medical consultation, and home-based, more advanced care. **More research and investigation on those projects can help identify common challenges and solutions and serve as important global public goods for other areas.**

The respective roles of governments and industries in promoting health innovation are yet to be defined and agreed upon. **All sides realize partnerships are key, but what kind of partnerships best serve us all remains unknown.**

APEC economies share multiple health care challenges together, including the increasing costs and demands for health care. There's great incentive and untapped potential for concerted efforts to promote innovation in health care.

This workshop identified a few key areas that warrant more in-depth investigation:

- Comparing different delivery and implementation models of a particular health innovation, such as online consultation or AI-facilitated diagnosis, in different APEC economies or within an economy in different settings to identify common challenges, solutions, and lessons learned.
- Further exploring the partnership models and collaborative processes that bring together the authority of public institutions and the innovation capability of the industry.
- Understanding the diverse and sometimes contrasting demands of APEC economies for health and innovation will help policymakers in each economy make more informed decisions to better serve their people.

5. Appendix

5.1 Online survey questionnaire

Health Innovation in APEC Economies
Survey on Knowledge, Attitude and Practice

This survey is divided into three sections, each measuring the status of health innovation from a different angle, with respective guiding conceptual frameworks and measurement dimensions. In this survey, health innovation refers to any technology that was invented for healthcare use or was invented initially for other sectors and was recently put to use in healthcare. This survey aims to assess health innovation in its full life cycle, from research and development to marketization, piloting, and adoption into public health policies.

Health innovation has been raised to particular significance in light of the global COVID-19 pandemic. In this survey, we aim to assess both the impact of COVID-19 on health innovation and the potential of health innovation in building a resilience post-pandemic health system for all.

This survey contains nine questions, with single-choice questions, multiple-choice questions, and open questions. It is meant for health policy makers and/or health officials at the central government level to fill out and will take about 30 minutes.

Section 1: Life cycle of Health Innovation:

The most used model of the technology adoption pathway in healthcare is a linear model that captures the process of innovation from ideas to the market, which we refer to as the life cycle of health innovation. This section aims to identify priorities, strengths and challenges facing health innovation across the life cycle in your economy.

Q1. Among the following stages of health innovation, which are identified priorities for your work? Please mark those stages using numbers in descending order of priority for you, with one being the most important area of your concern, and explain what policies you have launched to support it in two to three sentences:
□Conception (breeding new ideas and basic research for innovation in health care)
□Creation (prototyping new ideas into innovative products for small scale testing)
□Verification (Incubating new technology from small scale testing to more specific and mature products ready for the market)
□Production (supporting the mass production of products and user case applications)
□Market regulation (quality control, wide application, public acceptance etc.)
□Intellectual property rights protection

Q2. Among the following stages of health innovation, what stage do you think is the most challenging to manage/promote/regulate? Please mark those stages using numbers in descending order of priority for you, with one being the most challenging, and use one to two sentences to describe the challenges you face in your work:
□Conception (breeding new ideas and basic research for innovation in health care)
□Creation (prototyping new ideas into innovative products for small scale testing)

□Verification (Incubating new technology from small scale testing to more specific and mature products ready for the market)
□Production (supporting the mass production of products and user case applications)
□Market regulation (quality control, wide application, public acceptance etc.)
□Intellectual property rights protection

Section 2: Health Innovation types and areas:

Health innovation can take place in any sub-area within the health care field. The ongoing global call for Universal Health Coverage (UHC), joined by various regional and sub-regional level strategic plans for health, is sending a strong message that health is a right for all people. In this section, we explore the status of health innovation in your economy across different spectrums.

Q3. For the following condition areas, please rank them using numbers in descending order of your interest to learn more from this workshop, with one being the most interesting to you. In the boxes below, briefly describe what health innovations has come out in your economy.
□infectious diseases
□non-communicable diseases
□trauma and injuries
□maternal, child, and nutritional health
□frailty
□Mental illness
□Others, please fill: _____

Q4. For the following population sub-groups, rank them using numbers in descending order of your interest to learn more from this workshop, with one being the most interesting to you. In the boxes below, briefly describe what health innovation has come out in your economy to serve those population sub-groups.
□Children and adolescents
□Those from lower income background
□Homeless people (refugees and internally displaced people)
□ Domestic Immigrants
□Ethnic minorities
□Women and pregnancies
□Older people

Q5. For the following stages across the life continuum of care, please rank them using numbers in descending order of your interest to learn more from this workshop, and for each of them, list what health innovations have come out in your economy.
□Prevention
□Screening
□Diagnosis
□Treatment
□Survivorship
□End-of-Life care

Section 3: Health Innovation and Health System:

Health innovation takes place inside the health system which includes various functions, components, players, and processes. It is a dynamic and open system with shifting landscape and targets. This section aims to explore the interaction point of health innovation with the health system and identify challenges.

Q6. Please mark the following three levels in your economy based on how empowered by technology and innovation they are, with one being the most empowered, and three being the least. List one to two innovations that have taken place for each of the level:
□Primary level (homes, community health centres, primary care clinics)
□secondary level (hospitals, specialty consultants)
□tertiary level (hospitals with more advanced specialty care, such as surgeries, ICUs, and other complex treatments or procedures).

Q7. Please mark the following three levels in your economy based on the gap between the status quo and the expected level of innovation and technology involvement, with one being the widest gap, and three being the narrowest. List one to two innovations that is not yet implemented but you think has the potential to fill the gap.
□Primary level (homes, community health centres, primary care clinics)
□secondary level (hospitals, specialty consultants)
□tertiary level (hospitals with more advanced specialty care, such as surgeries, ICUs, and other complex treatments or procedures).

Q8. Please mark the following three levels based on how much you would like to learn more about from this workshop, with one being the most interesting to you. In the boxes below, list your reasons, if there's specific ones.
□Primary level (homes, community health centres, primary care clinics)
□secondary level (hospitals, specialty consultants)
□tertiary level (hospitals with more advanced specialty care, such as surgeries, ICUs, and other complex treatments or procedures).

Q9. Is there anything else about health innovation not mentioned in the above sections that might be of interests to you? Please fill in the box with less than 300 words:

5.2 Participating economies for the online survey and the in-person workshop in Beijing

APEC Economies	Participated in the survey	Joined the workshop in person
Chile	√	√
China	√	√
Indonesia	√	√
Japan	√	
Malaysia	√	√
Mexico	√	
The Philippines	√	√
Singapore	√	√
Chinese Taipei		
Thailand	√	√
United States	√	√
Total	10	8

5.3 General Information Circular: workshop overview and agenda

AGENDA

DAY 1	Agenda	PIC/Speakers
08:30-09:00	Registration	
09:00-09:15	Opening ceremony - Welcome speech by Prof. Kun Tang - Opening remarks by guest speaker(s)	Dr. Zhiwen She, National Health Commission, China
09:15-09:30	- Introduction of speakers and active participants - Workshop/program timetable - Housekeeping announcements - Group photo	
09:30-12:30	Theme 1: Health Technology Innovation and Health System Strengthening	
09:30-10:50	Seminar 1: Demand for Health Technology Innovation in the Health System	Dr. Kun Zhao, Vanke School of Public Health, Tsinghua University
10:50-11:10	Tea Break	
11:10-12:30	Seminar 2: Trends and Future Trajectories of the Medical Industry	Prof. Tao Ming Wang, Jiangsu Industrial Technology and Research Institute
12:30-14:00	Lunchtime	
14:00-17:20	Theme 2: Incubation and Transformation of Health Technology Innovation	
14:00-15:30	Seminar 1: Methods, Tools, and Skills for Health Technology Innovation	Prof. Kiesha Prem, National University of Singapore
15:30-15:50	Tea Break	
15:50-17:20	Seminar 2: Building an Ecosystem for Technology Transformation: From Research to Industry Implementation	Dr. Patcharin Tantiworrawit, Ministry of Health, Thailand

DAY 2	Agenda	PIC/Speakers
09:00-12:00	Theme 3: Best Practices and Lessons Learned on Health Technology Innovation	
09:00-10:20	Seminar 1: Best Practices in Health Technology Innovation	Dr. Basil Rodriques, UNICEF East Asia and Pacific Regional Office
10:20-10:40	Tea Break	
10:40-12:00	Seminar 2: Lessons Learned from Health Technology Innovations	Ms. Alicia Chang, Asia Pacific Medical Technology Association (APACMed)
12:00-13:30	Lunchtime	
13:30-17:20	Field Trip & Closing Session	
14:00-15:30	Tour of the Tsinghua University Global Health Innovation Center, internal exchange and sharing, and facilitated group discussions	Facilitated by Ms. Li and Ms. Chang, at the Tsinghua University Global Health Innovation Center
15:30-15:50	Tea Break	
15:50-17:20	Group presentation, discussion on next steps and wrap-up	
17:20-18:00	Return to hotel	

5.4 Speakers biographies

Speaker Biographies

Dr. Kun Zhao

Dr. Kun Zhao is a Distinguished Visiting Professor at Vanke School of Public Health, Tsinghua University, and a researcher at the Center for Comprehensive Evaluation of Drugs and Health Technologies, National Health Commission, China. She also holds positions as the Deputy Chair of the National Health Commission's Committee on Diagnosis, Treatment, and Security for Rare Diseases, the Deputy Chair/Secretary-General of the Health Technology Economic Evaluation Committee at the Chinese Health Economics Association, the Deputy Chair of the Committee on Health Measurement and Evaluation of Chinese Preventive Medicine Association, and the Chairperson of the Asian Health Technology Assessment Alliance (2022-2023). Her past work includes leading the third-party evaluation of the hierarchical medical system construction by the National Health Commission, evaluation of the national key clinical specialty construction projects, evaluation of national and regional medical centers, World Bank comprehensive medical reform projects in Fujian and Anhui provinces, Comprehensive Medical Evaluation System construction project by the National Administration of Traditional Chinese Medicine, economic evaluations of hepatitis B and C treatments by the World Health Organization in China, economic evaluations of stroke treatment models in China, health economics evaluations of chest pain centers, targeted therapy for non-small cell lung cancer health technology assessment, etc. Dr. Zhao Kun has published more than 80 papers in leading journals and serves as the chief editor of the textbook *Health Technology Assessment* of the National Health Commission's 12th Five-Year Plan. She is also responsible for advancing the national comprehensive clinical evaluation of pharmaceuticals and organizing the compilation of various guidelines on the evaluation of pharmaceuticals.

Prof. Tao Ming Wang

Prof. Tao Ming Wang is an innovative strategy and technology executive with a successful track record of developing and executing global strategy road mapping and operational support in various global Fortune 500 corporations, with expertise in the Asia Pacific market. He is a value-driven and visionary leader who has consistently led cross functional teams through concept-to-execution to create transformational change and a strong strategic thinker and doer with an entrepreneurial mindset and experience in the best incubation practice for disruptive technologies and new business portfolios through global VC/PE incubation and open innovation platforms. He served as professor at the Department of Machinery, Northwestern University; the Corporate Managing Director, Asia Tech Center-China, India, Korea, of Illinois Tool Group (ITW); the chief strategy and technology officer of Haier Group; General Manager of Global R&D Strategic Cooperation; Managing Partner/GM of Haier Haichuang Foreign Exchange in Qingdao, China Vice President of Hanergy Holding Group and CEO of Hanergy Mobile Energy Product Incubation Center. In December 2017, he joined Ciprun Group Co., Ltd. as the senior vice president , in charge of the group's strategy and innovation, the new management system, and global resource integration. Currently, he is the co-founder of the Jiangsu Institute of Industrial Technology -the Institute of Social Science and Technology Innovation for the Aged, presiding over the cooperation between the Innovation Center and the Department of Global Health and Social Medicine of Harvard Medical School to establish the Harvard University Global Social Science and Technology Research Center for the Aged and the Harvard International China Office. He is also the executive vice president of international business development at the American TRAMEC HOLDING LLC and a visiting professor of Kettering University in the United States and a special consultant on China affairs. He has set up an operation center in Asia to prepare for the establishment of "Kettering University Applied Technology Company KUARC", which is oriented towards industry-university-research cooperation of the next generation of smart driving and new energy vehicles.

Speaker Biographies

Prof. Kiesha Prem

Prof. Kiesha Prem is an Assistant Professor at the National University of Singapore (NUS) Saw See School of Public Health and the London School of Hygiene & Tropical Medicine. As an infectious disease modeller, she builds computational models to understand the population impact and cost-effectiveness of interventions against infectious diseases. Her research involves evaluating the population impact and cost-effectiveness of single-dose schedules for Human Papillomavirus (HPV) vaccination globally, reviewing new evidence on HPV vaccination and responding to questions from governments and other decision-makers. Kiesha led the development and updates of the global age- and location-specific synthetic contact matrices for infectious disease transmission. She also leads the NUS public health office in Lao PDR and provides technical expertise to Lao's Tuberculosis and HIV programmes and other local partners in Cambodia.

Dr. Patcharin Tantiworrawit is the Medical Officer at the Senior Professional Level at the Disease Prevention and Health Innovation Center, Department of Disease Control, Ministry of Public Health, Thailand. She is the incubation program lead of Disease Prevention and Health Innovation Centers which has teams across Thailand. Her responsibility includes leading healthcare innovation programs. She develops a community of coaching for change. She has been a field epidemiologist for more than 10 years. She also serves as a lecturer, consultant and advisor on design thinking and service design in brief, as well as surveillance and its applications.

Dr. Patcharin Tantiworrawit

Dr. Basil Rodriques

Dr. Basil Rodriques is a Public Health Professional with a background in Epidemiology, Maternal and Child Health. He has served in several capacities with UNICEF across multiple continents and countries over the past 30 years, starting with the strengthening and expansion of Primary Health Care at the community level. He then continued his Public Health efforts, leading the development of a strategic path for improved Nutrition across South Asia, followed by supporting Maternal/Child Health services strengthening and Polio Eradication efforts in China. He continued to serve as Regional Immunization Adviser for the East Asia and Pacific Region (based in Bangkok), and later as Senior Adviser for Emerging Infectious Diseases in UNICEF, New York. He continued in his Regional Health Adviser roles in East Asia & Pacific as well as Europe and Central Asia, based in Geneva, Switzerland. He has recently returned to the East Asia and Pacific Region, where he currently serves as the Senior Regional Health/HIV Adviser for East Asia & Pacific.

Speaker Biographies

Ms. Alicia Chang

Ms. Alicia Chang is currently Country Lead for the Asia Pacific Medical Technology Association (APACMed) in China, the only regional MedTech Association in APAC. Before joining APACMed, she was the senior international cooperation manager for over 10 years at China Chamber Of Commerce for Import & Export Of Medicines & Health Products (CCCMPHIE) under Ministry of Commerce of China. In her past experiences, she has been a key facilitator of multiple government-led bilateral and multilateral cooperation mechanisms. She led a number of global health research projects under both China's National Health Commission (NHC) and in collaboration with international organizations, such as BMGF, and released nearly 20 articles in mainstay industry media and peer-reviewed journals, such as BMJ Global Health. An EU-certified conference interpreter, Alicia received her master's degree in the University of International Business and Economics in Beijing and completed her second master's degree in Public Health from the Vanke School of Public Health at Tsinghua University.

5.5 Six-month post-APEC evaluation form

APEC Project Evaluation Survey: Seminar, Symposium, Workshop

APEC Project Name/Number: _Workshop on Health and Innovation Building a Resilient Public Health System Capacity for a Stronger Economic Recovery from the COVID-19 Pandemic/HWG 08 2022A_____

Date___9-10 December 2023_____

Instructions: Please indicate your level of agreement with the statements listed in the table below.

	Strongly Agree	Agree	Disagree	COMMENTS (Continue on back if necessary)
The objectives of the training were clearly defined				
The project achieved its intended objectives				
The agenda items and topics covered were relevant				
The content was well organized and easy to follow				
Sufficient representation and active participation of women was observed at the workshop				
The trainers/experts or facilitators were well prepared and knowledgeable about the topic				
The materials distributed were useful				
The time allotted for the training was sufficient.				

1. How relevant was this project to you and your economy?

5	4	3	2	1
very	mostly	somewhat	a little	not much

*Explain:*_____

2. In your view what were the project's results/achievements?

*Explain:*_____

3. What new skills and knowledge did you gain from this event?

*Explain:*_____

4. Rate your level of knowledge of and skills in the topic prior to participating in the event:

5	4	3	2	1
very high	high	medium	low	very low

5. Rate your level of knowledge of and skills in the topic after participating in the event:

5	4	3	2	1
very high	high	medium	low	very low

*Explain:*_____

6. How will you apply the project's content and knowledge gained at your workplace? Please provide examples (e.g. develop new policy initiatives, organise trainings, develop work plans/strategies, draft regulations, develop new procedures/tools etc.).

*Explain:*_____

7. What needs to be done next by APEC? Are there plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies?

_____

8. How could this project have been improved? Please provide comments on how to improve the project, if relevant.

_____

Participant information (identifying information is optional):

Name:

Organisation/Economy:

Email:

Gender: M / F

Thank you. Your evaluation is important in helping us assess this project, improve project quality and plan next steps.

6. References

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