社会影响力
SOCIAL IMPACT

BUILDING CHINA'S WORLD-CLASS AND
PATIENT-CENTERED PUBLIC HEALTH SYSTEM

AmCham China | Social Impact Initiative

Public Health Track Final Report

2021

AmCham China
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US-CHINA BUSINESS
THE NEXT HUNDRED YEARS

The American Chamber of Commerce in the People's Republic of China

Building China's World-Class and Patient-Centered Public Health System

AmCham China 2020 Social Impact Initiative
Public Health Track Final Report

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Chairman's Message

Greg Gilligan
Chairman, AmChma China

2020 was an unprecedented year. The COVID-19 pandemic forced businesses all over the world to temporarily close or shutter their operations, triggered widespread unemployment, and forced many governments around the world to undertake substantial fiscal and monetary action to mitigate the worst impacts of the COVID-19 shock. In January and February, China enacted widespread containment measures, including a lockdown of Hubei province, national travel restrictions, and quarantines for migrant workers returning to work. These measures brought the economy to a standstill and caused a steep economic contraction but were also successful in bringing COVID-19 under control. China's success in controlling COVID-19 domestically by the end of Q1 2020 means that its economic recovery is ahead of many countries around the world, indeed its economy expanded by a reported 2.3 percent in 2020, the only major economy to do so. Despite this growth, the potential for new COVID-19 flareups and the challenging global economic environment mean that the economy is continuing to navigate a demanding situation.

The COVID-19 epidemic refocused both official and public attention on the importance of public health in China and around the world. Chinese leaders have therefore called for public health reforms and are committed to furthering international cooperation to tackle the COVID-19 pandemic including joining COVAX, a global program to distribute COVID-19 vaccines.

Just as 2020 was unprecedented due to the circumstances created by COVID-19, it also created new opportunities for AmCham China and our members to demonstrate our value as a bridge between the US and China and our commitment to the China market. In 2020, our members made over RMB 600 million in financial donations and PPE to the areas most severely impacted by COVID-19 in Hubei province. We established a volunteer task force to help connect qualified PPE providers and

manufacturers in China with hospital networks in the US and deliver much needed PPE. And in an unprecedented first for AmCham China, we organized our first ever charter flight from San Francisco to Beijing. On the flight were nearly 100 business executives, employees, educators, and their family members who work and live in China, a testament to the US-China relationship.

It is against this background that AmCham China launched the Social Impact Initiative (SII), a six-month effort culminating in the publication of this report. SII constitutes a series of working sessions and uses the AmCham China platform to bring together government, research institutions, global experts, and member companies to explore the public health sector and drive real change through discussion, collaboration, and the development of recommendations for policymakers across China.

SII is also an opportunity to highlight the important contributions our member companies have made and continue to make to improving public health in China. The private sector is an important provider of medical equipment, services, innovation, and expertise, and should play a key role in the continuing evolution of China's public health infrastructure. We hope the publication of this report marks the beginning of sustained collaboration among AmCham China, our members, the government, global experts, and research institutions, collaboration that is focused on improving public health outcomes in China and that it will serve as a model for continued cooperation in this respect between the US and China.

This year's SII would not have been possible without our sponsors, who provided not only financial support but also donated many hours of their time to shape the topics, participate in the working sessions, engage with guests from government, academia, and industry, and provide case studies contained within this report. To these sponsoring companies and their employees, I express my special appreciation. Thanks must also go to AmCham China's Government Affairs and Policy team for their work over 2020 to implement the SII and produce this final report that meets AmCham China's demanding standards and reflects the varied perspectives of the many groups who participated in this initiative.

And finally, the release of this report marks what we hope will be the beginning of the SII Public Health initiative rather than the end. COVID-19 and public health will continue to constitute global issues in 2021 and beyond. We plan to continue expanding the SII in 2021, both in terms of the participants and the topics covered, and we want to continue using the platform established this year to engage with government on the recommendations contained within the report.

So whether consumers of this report are public health experts with long experience in the sector or simply interested observers, we hope that this report is a useful resource for understanding public health in China and the opportunities for bilateral cooperation.

March 25, 2021

Background

Due to the impact of COVID-19, public health has become one of the most concerned topics among the Chinese public. As an independent, nonprofit organization with nearly 1000 member companies, AmCham China is uniquely positioned to develop a platform for multi-sector dialogue that bridges common principles and objectives. Though public health is not directly related to AmCham China's core area of expertise and operation, as a trusted organization with extensive experience in facilitating public-private partnerships to advance US-China collaborations, we are eager to utilize our capacity and platform to enable the private sector to contribute on-the-ground expertise, share best practices, and initiate thoughtful leadership regarding how their solutions and capabilities can be utilized to improve China's public health system.

With public health at the forefront of China's national mindset as a consequence of the COVID-19 pandemic, SII approaches the broad concept of "public health" from a multidimensional perspective to provide a well-rounded set of practical and actionable recommendations. This report aims to: (1) define and discuss the private sector's role in addressing public health issues; (2) identify solutions that can be leveraged on a wide-scale basis; (3) recognize the value of collaborative action and public-private partnerships; (4) share best practices; and (5) provide policy recommendations that support a more inclusive public health strategy. These recommendations are meant to complement the goals of government-led health reforms, outlined in policy documents such as the "13th Five-Year Plan" and "Healthy China 2030."

Private sector sponsors, government officials, and civil society representatives came together for a series of four working sessions between July and December 2020. The working sessions covered the following topics: (1) digital health and how the adoption of cutting-edge technologies can advance China's public health agenda; (2) disease prevention and control and how private sector can support government-sponsored efforts to ensure widespread impact across the population; and (3) health financing and how the private sector can help provide alternative financing options that ensure equitable access to quality healthcare.

Main Challenges

Within the public health track's three main topics of focus, participants established the primary challenges facing public health cut across three main areas: (1) healthcare delivery and quality; (2) healthcare funding and financing options; and (3) the need for a robust evaluation framework to aid in developing evidence-based policy reforms. This

report explores these challenges in greater detail and illustrates on-the-ground experiences of public health practitioners and stakeholders.

Healthcare quality and delivery in China suffers from insufficient institutional measures, gaps in infrastructure development, as well as a shortage of healthcare professionals. In addition, Healthcare funding remains scarce, health financing options are limited despite healthcare reforms, and the current assessment framework that aids policy reform still has room for improvement.

When assessing these challenges, the report also takes the overarching issues that affect China's public health status into consideration, specifically: urban-rural disparities, providing high-quality universal healthcare coverage, non-communicable disease burden, China's changing demographic, and emerging technology applications in the health field.

Recommendations

SII believes that the existing policy framework set forth by the government for the public, including the "13th Five-Year Plan" and "Healthy China 2030," provides a solid foundation for collective action to improve public health outcomes in China. The recommendations presented in this report are intended to build on existing efforts and provide perspectives and recommendations shared by the private sector.

To solve these challenges, SII recommends an integrated, multi-sectoral approach that leverages innovative and sustainable solutions in the areas of human capital, education, and training; multi-sector stakeholder participation; adoption of digital health technology; and health financing. Each recommendation area features practical and actionable steps, including specific examples and case studies of initiatives currently under implementation. Where relevant, we have also identified successful practices from other countries and organizations that China can potentially learn from. Our recommendations also reference existing community-level programs already implemented by SII sponsors as a testament to how public health goals are best addressed with a whole-of-society strategy. In summary, we recommend that:

First of all, we recommend strengthening current healthcare training programs and education. Promoting life-long learning programs can aid healthcare workers in acquiring the most updated and cutting-edge knowledge in their respective fields, while also supplementing theoretical learning with systematic on-the-job practice and PPP programs. In addition, a national multi-channel public health awareness campaign could also be launched to strengthen communication between the government and local

communities, as well as educate the public regarding health information and lifestyles through social media and corporate networks.

Though the development of China's public health system is primarily orchestrated by the government, participation from other parties such as the general public, NGOs, businesses, and academia is crucial in ensuring resilience in the public healthcare system and acceleration of the reform process. Although the government typically collects comments from the private sector prior to the official introduction of policies, it is often too late at that stage to make drastic changes based on new information as policies are nearly finalized by then. Hence, it is recommended that open dialogues with experts and leveraging resources from the private sector occur early on and consistently throughout the entire policy development process. In doing so, the government is able to gain a better understanding of the social contexts and mobilize resources more efficiently, especially during public health emergencies such as the COVID-19 outbreak, increasing the inclusiveness of future policies; and increase competition and therefore drive innovation in the healthcare sector. As made clear in 2020, viruses know no borders and international cooperation is crucial when the controlling of global pandemic outbreak, eradicating diseases, and ensuring public health. China has been on the forefront of the fighting the COVID-19 pandemic on a global scale and should continue to make important contributions. One effective practice could be through policy development where participation from the public is emphasized and prioritized in the process. For example, the government could potentially conduct national health surveys to better understand the diverse needs and preferences of the population and thus provide improved patient-centered solutions. In addition, the public health system should apply standardized reporting tools and quantitative indicators to measure the progress of programs, this could aid in feedback to be received in a timelier manner and adjustments to be made based on the feedback received.

Next, SII recommends accelerating the application of digital health care. The pandemic has exacerbated the inability to provide or receive healthcare in-person, exposed shortages of medical resources, and highlighted the importance of an up-to-date health management system. These challenges could be addressed through accelerating the construction of smart hospitals, promoting remote healthcare options, establishing national healthcare data systems, and investing in new infrastructure. By developing a more efficient national digital health strategy and further clarifying the policy framework for healthcare data-specific policies, the government will be able to enhance data interoperability while protecting people's data privacy, thus promoting digital health in a more robust and orderly manner.

Finally, SII urges all sectors to place a greater emphasis on innovating and promoting health care financing solutions. While basic health insurance has achieved universal

coverage thus far, the insurance market is still in need of further and higher quality development. Commercial health insurance will also play an increasingly important role in the market, through providing effective solutions to treating diseases and attending to diversifying medical needs. Additionally, financing and funding solutions have the potential to create a market that integrates digital health resources, prioritizes health management, amongst many other advantages.

Public Health Issues and Challenges in China

The state of China's public health system rose inevitably to the forefront as a result of the COVID-19 pandemic. While China has been successful in controlling COVID-19 domestically through enactment of strict oversight measures and strong public adherence to government guidelines, key gaps and issues in the country's public health system nonetheless have been highlighted over the course of 2020.

In an effort to better understand these challenges, SII stakeholders developed a working definition of public health that helped guide the SII public health working sessions. This working definition is based off of officially recognized definitions of public health and the expertise of participants of the SII working sessions. SII defines "public health" as follows:

> *"Public Health in China refers to the collection of efforts, actions, and policies taken by the government, society, and individual to prevent the spread of disease, ensure that quality treatment and care is available to all, improve the quality of life across the population, and otherwise ensure that people can be healthy. Achieving these outcomes require cooperation among public, private, and non-profit stakeholders."*

China's past successes in public health provided a robust starting point for determining working session discussion topics. The nation has achieved standards on par with many other developed countries through substantial attention, funding, and effort allocated to public health initiatives and reforms. For instance, China's average life expectancy of nearly 77 years is comparable to 78.5 years in the US. The country's infant mortality rate is currently seven per thousand live births, representing a significant decline from 42.1 per thousand live births in 1990. With respect to the Healthcare Access and Quality (HAQ) Index, China's score of 77.9 is below 88.7 for the US, but still higher than countries such as Brazil's 63.8 and India's 75.1.[1] By recognizing accessibility as a public health issue, [2] the National Health Commission (NHC) was able to provide increased medical services throughout the country.[3] As of 2019, China consisted of 1.01 million healthcare institutions nationwide providing nearly 8.8 million patient beds, with number of healthcare professionals totaling nearly 13 million.[4]

However, China's healthcare sector is not without its challenges. The "Healthy China 2030" initiative represents an effort by the Chinese government to improve health outcomes in the country while also bringing healthcare standards in line with those of more developed countries. To do so, the Chinese government will need to address some pressing issues in the health sector, including disparities in access to quality

healthcare between urban and rural locations. A system of basic health insurance that is currently known to be "vast, but shallow"[5] provides coverage to almost 95 percent of the country's population, however, the depth of coverage remains shallow due to the fact that segments of the population lack access to basic care, rising healthcare costs,[6] and a growing non-communicable disease burden, all of which require costly and long-term treatment plans. China's aging population is also a point of concern – the UN estimates that 26 percent of China's population will be over 65 by 2050, compared to the 12 percent currently, meaning the demands on the healthcare system will likely increase by drastic amounts in the next few decades.[7] Another important aspect to consider would be how emerging digital and innovative technologies can be implemented to further improve training, decision making, and quality of China's current healthcare system.

After deliberation, 2020 SII working topics were organized around three topics, namely digital health, disease prevention and control, and innovative health financing. The working sessions also discussed some of the common challenges in China's public health system (see Figure 1). As discussed in this report, addressing these common challenges through the adoption of innovative solutions will likely generate significant positive change in China's public healthcare system.

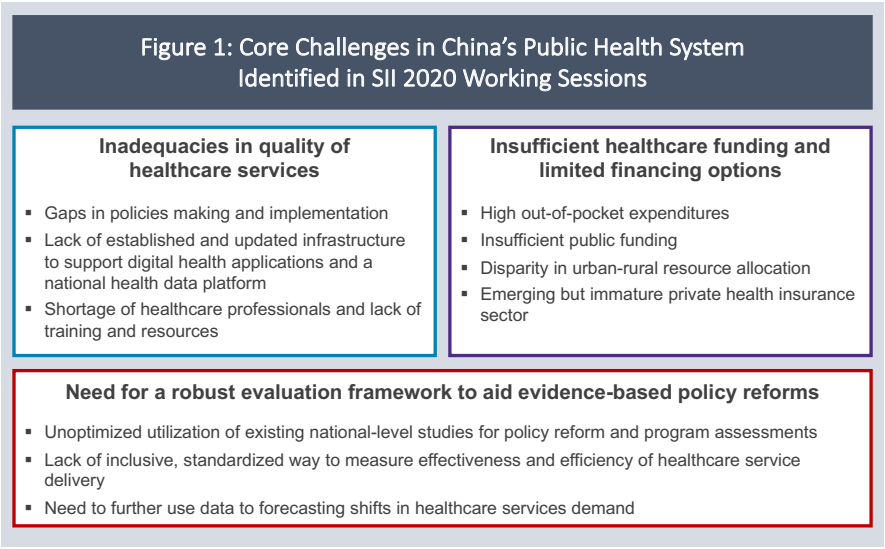
Challenge #1: Inadequacies in the Provision and Quality of Healthcare Services

The COVID-19 pandemic has magnified the importance of having a proactive, rather than reactive, public health system. In China, and elsewhere globally, a variety of policies had to be assembled rapidly to aid COVID-19 response efforts as existing programs, infrastructure, standards, and practices proved insufficient. Within the current reactive framework, it is difficult to avoid issues such as a misalignment across policies, systems, and institutions, a lack of mature and most up-to-date infrastructure; and insufficient capacity among healthcare professionals.

Gaps in Policy Making and Implementation

In the last few decades, China has become more prepared and responsive in emergencies and able to cater to the immediate healthcare needs of the people through the introduction of many government policies. Though significant progress has been made to build institutional capacity thus far, more work remains to achieve better alignment between the creation and implementation of policies in China's public health system.

Figure 1: Core Challenges in China's Public Health System Identified in SII 2020 Working Sessions



This challenge is most evident in the implementation of the National Basic Public Health Service Program (国家基本公共卫生服务项目).[8] While the program has gone through multiple service delivery improvements to accommodate the ever-changing demographics, lifestyles, and economies, there remains room for improvement in terms of increasing operational capacity and bettering healthcare intervention in certain communities.[9] A study reveals that village doctors are often overwhelmed by the demanding record-keeping and performance evaluation requirements, resulting in the quality of healthcare services to become compromised.[10] A disconnect among standard setting, policymaking, and grassroots-level experiences often adversely affects the ability of community healthcare institutions to deliver services effectively. In addition to accessibility, the efficient provision of care is also essential to achieve public health objectives and reduce disease burden for all countries, especially those of lower income.[11]

In addition, China's primary healthcare (PHC) system, a key pillar of the country's public health strategy and the first line of defense against emerging infectious diseases, often suffers from challenges related to the diagnostic accuracy among PHC providers.[12] Furthermore, despite increased government subsidies and funding, a lack of coordination between PHC centers and specialty care centers or hospitals adversely impacts patient experience as well as continuity of care.[13]

Relevant laws and regulations are, in many cases, inconsistent and lack the provisions needed to resolve issues. For example, a notable disconnect exists between the *Law on the Prevention and Control of Infectious Diseases* (《传染病防治法》) and the *Regulation on Responses to Public Health Emergencies* (《突发公共卫生事件应急条例》), where

the Law on the Prevention and Control of Infectious Diseases indicates that local or municipal governments can only take measures against infectious diseases after they report to and receive explicit command to act from higher level government authorities; while the Regulation on Responses to Public Health Emergencies give local governments the right and responsibility to act immediately and independently, and even the right to bypass immediate higher authority and report directly to provincial or national government. Similar disparities also exist regarding the right to publish warning alerts to the public, amongst many others.

In addition, improvements in the national emergency medical reserve system are also needed to ensure more efficient measures and response. While there are specific laws and policies to ensure the availability of medical supplies during emergencies and disasters —established shortly after the SARS epidemic in 2003 — there remains a need to revisit the management of supplies at both the policy and implementation levels. In fact, after the COVID-19 Outbreak, each province in China enacted their own emergency regulations for public health emergencies. At the same time, the Central Committee for the Comprehensive Rule of Law and the Standing Committee of the National People's Congress has been working on the revision of nine public health-related laws such as Prevention and Control of Infectious Diseases Law. At the height of the COVID-19 outbreak in China, the national emergency medical reserve system experienced shortcomings stemming from insufficient emergency medical supplies in reserve, inadequate emergency production capacity, and issues with command and control mechanisms for the deployment and transportation of emergency supplies.[14] The national government implemented policies and incentives to rapidly increase production capacity;[15] however, this surge in demand for medical supplies resulted in unexpected overcapacity issues for hundreds of Chinese manufacturers.[16]

Infrastructure Limitations Leading to Inability to Support Digital Healthcare and Public Health Data Platforms

Due to lack of funding and awareness of new solutions, devices, and technology, many healthcare facilities are outdated, especially in rural areas. This results in operational inefficiencies and the low quality of healthcare services. While there are some places are already adopting state-of-the-art facilities[17], the majority of facilities still have not adopted the latest technologies, putting pressure on the public health infrastructure.

Widespread adoption of digital health applications could benefit China's public health system by addressing gaps in capacity and provide remote areas with wider access to healthcare. However, one factor that hinders adoption is the lack of a formal platform to facilitate collaboration between healthcare institutions. Subsequently, the institutions that are lagging with respect to technological adoption cannot easily leverage the ex-

perience of institutions on the frontier to improve their own adoption.

Furthermore, though the construction of a unified national public health information platform seems to be on the government agenda, such platform still does not currently exist in China.[18] Vast amounts of data are generated by digital health applications including patient monitoring data, diagnosis and treatment information, as well as electronic health records. However, there is a lack of interoperability between data storage and management systems used by hospitals and healthcare centers across China. Data standards across provinces and cities are inconsistent, resulting in disjointed information flow between institutions, limiting prospects for continuity of patient care between centers. From an emergency response perspective, this can hinder timeliness of response and therefore further aggravate public health crises.[19]

Due to the sensitivity of patient information and health-related data, healthcare is one of – if not the most – sectors vulnerable to cybersecurity attacks. This challenge is not exclusive to China alone. According to an IBM-sponsored report, the global healthcare industry recorded the highest average costs per data breach, at nearly US $7.1 million, as compared with a global cross-industry average of $3.9 million. The high cost is attributable to the lengthy cycle between the identification and containment of a breach, which the report estimates averages around 329 days, whereas the global average across industries is closer to 280 days. [20]

Inadequate Capacity of Healthcare Professionals

The capacity of healthcare professionals to deliver high-quality healthcare services and respond to large-scale public health crises is hindered by limited resources, manpower, and training. Globally, there is a shortage of qualified healthcare workers, and China is not immune to this challenge. The WHO estimates the shortage could reach 18 million globally by 2030, with the largest portion (51 percent) forecast to occur in the East Asia and Pacific Region.[21] While China has an estimated 54 health workers (per population of 10,000) in 2017, higher than most upper-middle income countries, it is lower than the rates seen in developed countries like the US which has nearly 172 workers per population of 10,000.[22]

This shortage is especially acute in rural areas which have higher rates of chronic illness, a larger proportion of elderly residents, and a higher demand for PHC. In 2018, there were 1.82 doctors per population of 1,000 in rural areas compared to 4.01 doctors in urban areas. A similar discrepancy is true for nurses, with 4.63 nurses per population of 1,000 in rural areas and 5.08 per population of 1,000 in urban areas.[23] Trained healthcare professionals tend to drift towards urban areas for higher paying job opportunities. Rural healthcare institutions also typically have lower education requirements and/or

qualifications as compared to healthcare institutions in urban areas. An estimated 25 percent of doctors in community health centers and 42 percent of those in township health centers have a junior medical college level of education or below,[24] which only qualifies them to serve as licensed assistant doctors.

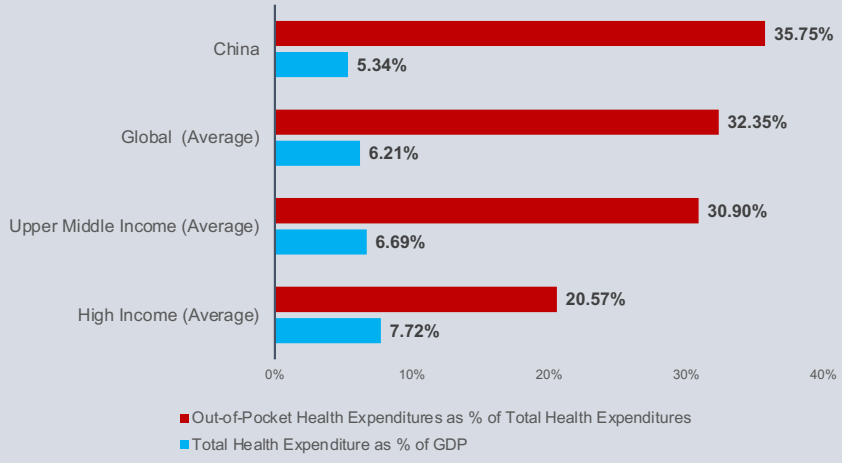
SII working session discussions focused on digital health reaffirmed that early adopters of new healthcare technologies often lack adequate training to use them effectively. The necessary IT-support services and for healthcare technology is more challenging to provide in rural locations. Any effort to extend technology-enabled services to rural geographical areas should be accompanied by sufficient training of local healthcare staff in order to leverage use of these services. Telemedicine, or the use of information, communication, and monitoring technologies which allows healthcare providers to remotely provide healthcare services, is a potential solution to address the shortage of healthcare workers in rural areas by connecting doctors from urban areas to patients in the further, more remote communities. However, for this to be effective, the community itself requires doctors and staff who are capable of employing these technologies correctly, and provide post-treatment service to their patients as needed.

Challenge #2: Insufficient Healthcare Funding and Limited Financing Options

Facing an aging population, China is likely to experience a growing demand for healthcare over the coming years and decades. Despite an increase in public healthcare spending, out-of-pocket expenditures continue to constitute a significant portion of total healthcare expenditure in China and alternative financing options available to supplement costs are still underdeveloped. According to data from the WHO, out-of-pocket healthcare spending in China accounted for 35 percent of total healthcare expenditures in 2018 (see Figure 2).[25] While this is a significant decrease from its peak of 64 percent in 2001, the number is still relatively compared to the global average of 32 percent, an average of 16 percent in developed countries, and upper-middle income countries' average of 33 percent.[26] High out-of-pocket spending disproportionately affects lower income households.[27]

The increase in government funding has helped to mitigate the large sum of current out-of-pocket healthcare spending.[28] The share of government spending on total healthcare expenditures more than doubled from 22 percent in 2000 to 58 percent in 2018.[29] However, health expenditures in 2018 only amounted to 5.34 percent of China's GDP.[30] In comparison, the US spent 16.89 percent, Germany 11.43 percent, and Japan 10.95 percent of their annual GDP on healthcare expenditure.[31]

Figure 2: Comparison of Healthcare Expenditure Proportions, 2018, *percentage*



Source: "Global Health Expenditure Database," *World Health Organization*

China's fiscal budget for medical services (RMB 1.5 trillion in 2018)[32] should place priority on more developed areas. According to the HAQ Index results in 2016, although the healthcare available in Beijing is comparable to that of California and the Greater London area,[33] Guizhou and Tibet, two of China's underdeveloped provinces, rank in the bottom half of the index globally with respect to healthcare access and quality.

China has issued several editions of the *National Basic Public Service Specifications* (《国家基本公共服务标准》), most recently in February 2021, which helps to define a range of standards for public services, including the delivery of public health services. In an effort to establish a degree of equity in financing for basic public health services across provinces, the National Primary Public Health Service approved a minimum standard for per capita public investment into a program of public health services, initially RMB 15 in 2009,[34] and increased to RMB 45 in 2016, RMB 50 in 2017, and RMB 55 in 2018.[35] This system, however, assumes that local or provincial government had already sufficiently funded the operation of local public health institutions, and the national subsidy should only be used as subsidy for the programs themselves. It might be true for high-income Eastern provinces, but low-income Western provinces often had trouble in funding the local healthcare institutions, forcing them to rely heavily on the national subsidy for operation, and thus can hardly manage the provision of services, resulting in a huge disparity in the grass-root operation of health institutions across the nation.

To help to address problems of inequity while alleviating the financial burden of healthcare, [36] the government devised the BMI system financed through increased public health funding.[37] The BMI provides basic insurance coverage to an estimated 95 percent of the Chinese population, a commendable achievement given China's population size and geographic diversity.[38]

Nevertheless, there are challenges. The BMI covers only the most basic healthcare services. Requirements for the BMI vary as implementation is managed at the provincial level. Reimbursement ceilings and co-payments are applied differently according to each local BMI scheme. More developed provinces typically have higher reimbursement ceilings as compared with their less developed counterparts. The BMI also restricts its coverage to public healthcare facilities and provides selective coverage for critical illnesses, coverage of which is defined at the provincial level. Furthermore, it restricts reimbursement to certain drugs and treatment schemes, limiting access to alternative and innovative healthcare services and treatment options.

BMI's enrollment eligibility is limited according to an individual's "hukou,"[39] and requires a formal employment contract, thereby disproportionately affecting rural-to-urban migrant workers and informal sector workers. This leaves them even more vulnerable to high healthcare expenses and little to no alternative financing options.

Provinces in China's eastern region enjoy the highest proportion of health financing from private health insurance (PHI), with an average of 47.2 percent in 2016,[40] which makes sense given that this region contains many of China's cities with the highest income. The proportion of government-funded health expenditure is 38.5 percent in the Western region, as compared with 26.1 percent in the Eastern region.[41] This urban-rural disparity in healthcare resources and quality of service results in healthcare accessibility and affordability challenges.[42]

PHI aims to fill in gaps in the BMI by offering more comprehensive health coverage options, which could reduce out-of-pocket spending and enable access to better healthcare services for more people. However, China's health management mode and PHI market still has room for development, as the PHI penetration rate in China remains low at 0.71% in 2019. In addition, out of 100 RMB worth of health-related expenses, PMI compensation only covers less than 4 RMB, which creates minimal impact to the current healthcare system.[43]

Furthermore, digital health applications also play a big part in China's PHI environment. In countries with mature health insurance industries such as the US, standardized electronic health records are employed to help insurers to offer tailored insurance, manage risks, and facilitate the insurance claims and reimbursement processes, which are currently unavailable in China.[44] More broadly, the use of digital health applications is not

widespread due to conservative regulatory approval procedures. The underutilization of innovative technologies results in a less diverse set of product offerings. In the absence of high-quality patient and insurance data, PHI providers are limited in their ability to develop new products consistent with the needs of Chinese consumers.

Alternative financing solutions — namely microinsurance,[45] online mutual aid platforms,[46] charity organizations,[47] and government-funded medical financial assistance programs[48] — have been established to specifically cater to low-income households and those most who are the most financially vulnerable to catastrophic healthcare expenditures. Microinsurance is extremely helpful for farmers and informal sector workers, while online mutual aid platforms are targeted more towards urban-rural migrant workers. However, these alternative financing options also face similar challenges to those facing PHI, such as inadequate accessibility, minimal coverage, and limited distribution. [49]

Challenge #3: Need for a Robust Evaluation Framework to Aid Evidence-Based Policy Reforms

China's rapid economic growth and urbanization have raised incomes and improved overall health conditions. However, this growth has also been accompanied by certain "unhealthy" lifestyle habits including declined levels of physical activity.[50] As healthcare needs of the population have multiplied, available healthcare services are currently struggling to keep up.[51] Furthermore, densely populated urban centers have a different set of requirements compared to the rural areas.

The government has put in place several programs to monitor and evaluate China's current public health programs and services. One of which is the National Healthcare Improvement Initiative (NHI, 改善医疗服务行动计划) , launched by the NHC in response to the State Council's call to monitor the progress of public hospital reform and to evaluate the status of China's healthcare delivery system.[52] The NHII is a survey-based monitoring and evaluation program that records patient experiences. Patient surveys conducted in the three years following the launch of the NHII found a steady improvement in patient satisfaction.[53] However, the NHII's use of standard metrics to evaluate patient satisfaction does not reflect unique local patient demands and the capabilities of local healthcare providers, which differ across the various urban, rural, and socioeconomic contexts within China.[54]

The China National Health Development Research Center (中国卫生发展研究中心) has a mandate to conduct health policy evaluations and technology assessments. The center has developed an evaluation framework consistent with China's context,

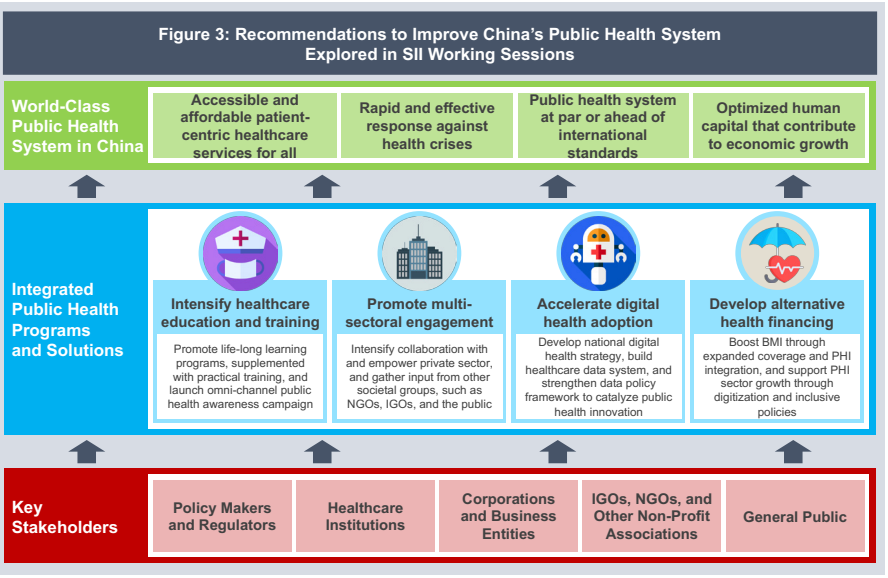
including a degree flexibility and room for experimentation. However, there is room for improvement with respect to a national level framework for measuring healthcare outcomes. A report (2016) from the World Bank, WHO and the China government contends that more robust and systematic mechanisms are required to gather data and derive insights from which to improve the system.[55] A lack of standardized data and inconsistent interpretations of the results affect the ability of national and local policymakers to agree on the development of needed health policies and regulations. The capacity of healthcare professionals to accurately benchmark healthcare service quality and to respond to shifts in the demand for public health services across the country is also limited.

An Integrated, Multi-Sectoral Solution

The importance of a fully-functioning, efficient, and patient-centric healthcare system – which impacts not only the well-being of the people but also the economic and social stability of the country – has been fully demonstrated through the COVID-19 pandemic. And while significant strides have been made throughout the past two decades in terms of implementing reforms and improving the state of public health in China, the challenges identified in the previous section must be addressed to fully achieve a world-class healthcare sector.

The existing measures introduced by the government through the "13th Year Plan" and "Healthy China 2030" already provide a good foundation for China to accelerate the development of its public health system. As such, the SII recommends an integrated, multi-sectoral approach to intensify healthcare education and training, promote multi-sectoral engagement, accelerate digital health adoption, and develop reliable health financing options (see Figure 3).

Figure 3: Recommendations to Improve China's Public Health System Explored in SII Working Sessions



Recommendation #1: Intensify Healthcare Education and Training

The adoption of digital technologies, best practices, and other important developments in health and medical sciences can significantly improve the quality of healthcare service and address challenges, including gaps in resource allocation and shortages of healthcare professionals across the country. Healthcare sector participants must first understand how to effectively utilize and leverage these advances within their roles to maximize potential benefits.

Figure 4: Intensify Healthcare Education and Training – Suggested Action Points per Stakeholder

 Policymakers and Regulators	▪ Build, maintain, assess and improve lifelong learning programs ▪ Form partnerships with private sector to provide practical on-the-job training ▪ Launch omnichannel public health awareness campaign
 Private Sector Entities	▪ Contribute content to lifelong learning programs ▪ Leverage experience and expertise to provide on-the-job training for healthcare professionals ▪ Conduct outreach campaigns aligned with government's awareness campaign
 IGOs, NGOs, and Other Non-Profit Groups	▪ Contribute to and validate content of lifelong learning programs ▪ Conduct outreach campaigns aligned with government's awareness campaign
 Healthcare Institutions	▪ Ensure healthcare professionals utilize lifelong learning programs ▪ Participate in evaluating effectiveness of training of healthcare professionals
 General Public	▪ Participate in disease prevention and control ▪ Join community outreach initiatives ▪ Leverage available channels to improve knowledge on public health

As such, it is vital to provide those in the healthcare sector with training programs that can upskill them in a broad range of areas, including the use of technology; development of new functional and soft skills; and a greater understanding of how these tools can help improve the accessibility, effectiveness, and overall quality of healthcare services. Similarly, the public, as the primary beneficiary of healthcare services, should be empowered to engage more in public health and their own health. Therefore, the SII recommends development and provision of a strengthened public health training and education program that provides healthcare professionals with lifelong learning programs combining theoretical and practical approaches, along with an integrated, omnichannel national public health awareness campaign to better educate the public.

Promote Lifelong Learning Programs to Equip Healthcare Professionals with the Right Capabilities

The Chinese government began accelerating training programs in 2009, after realizing the need to elevate skills of healthcare professionals to improve delivery of public health services, particularly in local communities. Focused on refreshing knowledge and learning new skills, these trainings were initially delivered in person, with web-based trainings introduced later on.[56]

The SII encourages the National Health Commission to introduce an online lifelong learning model for healthcare professional training, which could offer equitable access to opportunities for urban and rural healthcare professionals to update their knowledge and skills. This lifelong learning program should be modular and personalized with the ability to determine training paths according to the needs and preferences of healthcare professionals, which accommodates variations in skills, allowing more advanced learners to take on higher-level courses.

Such trainings should be competency-based, which is a more efficient approach than time-based trainings, where focus is placed on learning competencies rather than spending a defined amount of time to complete a course. Enabling healthcare professionals to complete courses at a flexible pace would allow better integration of studying schedules into their workflows and would address differences in individual learning abilities, allowing learners to progress at their own pace.

To motivate healthcare professionals to participate in these training programs, it would be important to make course modules interactive and available in different formats. While traditional prose-style documents and video-based lectures remain effective in imparting knowledge, innovative training methods such as gamification and virtual simulation would make learning programs more interactive and interesting.

The content of these programs should be revisited annually to ensure that recent trends

and developments around new technologies, practices, and other advancements in healthcare are fully integrated. This would provide new paths to professional growth and assist the goal of developing world-class healthcare professionals. To ensure the effectiveness and success of the training programs, performance evaluations of courses and participants should be conducted before and after each training to identify areas for improvement and their effectiveness.

Supplement Theoretical Learning with On-The-Job Practice Applications

Capacity-building is most effective when healthcare professionals clearly understand how to apply acquired skills to daily situations in public health institutions. For example, cross-facility training is an innovative approach to providing hands-on experience. Through cross-site visits or short-term internships, healthcare professionals from remote areas can be exposed to facilities utilizing the latest healthcare technologies, practices,

SII Spotlight: ECDC's Continuous Professional Development (CPD)

Activities aimed at addressing the institutional needs of Coordinating Competent Member States to maintain a competent workforce to adequately respond to cross-border health threats

Coverage

- Available for healthcare professionals in the Member States engaged in communicable disease control with cross-border relevance
- Seeks to improve competencies and capabilities of public health institutions to respond to health crises and emergencies brought about by infectious diseases
- Covers preparedness, prevention, detection, assessment and control, and communication

Offerings

- Face-to-face training
  - Short courses
  - Simulation exercises
- E-learning
  - Online courses
  - Webinars
- Professional exchange visits
- Training materials for trainers

Rationale – Develop and implement competency-based framework for the prevention and control of communicable diseases and other public health threats with cross-border implications

Source: "Compendium of 2021 ECDC Continuous Professional Development (CPD) Training Activities," *European Center for Disease Prevention and Control*

and methodologies. Such experience allows healthcare professionals to experience first-hand how to apply these skills to their daily tasks and responsibilities, enabling a faster learning-to-application process.

To support such efforts, private sector or subject matter experts could be utilized to provide more in-depth and specialized training in an actual working environment. For example, Bell Helicopter, in partnership with Med-Trans Corporation, demonstrated the effectiveness of this approach when it collaboratively developed and introduced a training course for the development of Air Medical Services (AMS). The course addresses the skills and experience gap that currently exists around China's emerging AMS operations.[57] From an international perspective, this is exemplified by the European Center for Disease Prevention and Control's (ECDC) Continuous Professional Development (CPD) program. CPD is an umbrella program for all ECDC training activities, including instructor-facilitated training, e-learning, professional exchange visits, and relevant training materials for trainers (see SII Spotlight: ECDC's Continuous Professional Development (CPD) for more details).[58]

The US CDC also has a model for lifelong learning called Continuing Education (CE), which provides accreditation services to CDC programs as well as partners independently developing their own educational materials. CE activities are presented in diverse formats to cater to a broader range of target audiences, including live activities (e.g., conferences, webcasts, and workshops) and enduring materials (e-learning, podcasts, and printed content). The program also includes evaluation of CE activities, measuring changes in learner competence, compliance with professional practice requirements, and learner satisfaction and participation.[59]

Launch an Omnichannel National Public Health Awareness Campaign

Raising public awareness and promoting public engagement will fortify the public health system's resilience. Therefore, the SII calls for an integrated national public health awareness campaign. Such campaign could start at the grassroots level by intensifying basic health education in schools and communities. Education curricula should incorporate courses that promote positive lifestyle changes, such as regular exercise and healthy eating, as well as deliver easy-to-understand information on common diseases. Greater attention should be given to educating children on simple practices that contribute to disease prevention and control so that children can also promote such practices at home.

In conjunction with these public education efforts, the SII also encourages the government to intensify outreach initiatives in local communities. By doing so, policymakers and regulators can better understand the point of view of the public – the challenges

faced and areas in need of support – and, in turn, implement more inclusive policy reforms.

An omnichannel content delivery strategy that seamlessly integrates new digital channels with traditional mass media channels can improve the effectiveness and scope of public health awareness campaigns. Face-to-face and community-driven initiatives, though more effective, require significantly more investments in manpower and logistical resources. Digital channels, such as WeChat or Weibo, can be leveraged to boost a campaign's longevity and accessibility and are used regularly by a large portion of the population. These digital channels also allow for delivery of interactive content on-demand, which can be more easily tailored to the target audience. As an example, Qinhuangdao's Haigang District launched a program to communicate with its citizens using the chat group function within WeChat, which helped them achieve nearly district-wide coverage, allowing the local government to fully implement its epidemic prevention and control work, as well as extending grassroots governance to every village, building, and household within the entire community.[60]

The private sector could also help to reinforce and deepen public health awareness campaigns. Xian Janssen Pharmaceuticals Ltd. and its parent company, Johnson & Johnson ("J&J") have developed a remote consultation and education platform for MDR-TB patients to eradicate concerns of patients and their families regarding the treatment and long-term management of TB. Merck launched partnership programs with the Beijing Hongyi Medical Development Foundation and the China Women's Development Foundation, with the aim to raise public awareness on hypothyroidism and infertility. Microsoft's health awareness campaign for diabetes leverages its Responsible AI and chatbot technology to reach the public. Meanwhile, United Family Healthcare (UFH) and its affiliated United Foundation for China's Health developed and tested a program for rapid, large scale cervical cancer screening and treatment for women in remote areas with little-to-no access to healthcare.

Health-related information campaigns in particular need to be on the alert to potential circulation of inaccurate and unverifiable data. Program proponents should actively leverage multiple sources, such as research and academic institutions, the private sector, and subject matter experts to guarantee the accuracy and quality of content disseminated to the public.

[CASE STUDY]

Stepping up Efforts to Improve Multi-Drug Resistant Tuberculosis Diagnosis and Treatment
Supporting China in Accomplishing the End TB Strategy

Tuberculosis ("TB") is one of China's major public health concerns, with a reported incidence rate that ranks second amongst infectious diseases in China. 1 According to data published by WHO in 2019, China faced approximately 800,000 new cases of TB and an annual death toll surpassing 31,000. 2 The same year, there were an estimated 65,000 incident cases of multi-drug resistant tuberculosis ("MDR-TB") and rifampicin-resistant tuberculosis ("RR-TB"), but only 18,200 patients, roughly 28% of those infected, were diagnosed, and out of those who were diagnosed, only 13,500 received proper treatment.2 This situation could be attributed to the nature of MDR-TB's lower case detection rate, lower cure rate, and longer communicable periods. Additionally, treatment of MDR-TB takes substantial amounts of time and patient compliance is typically poor, making treating the disease an even more difficult task. Specialized medical personnel for TB prevention and control in China are therefore advised to stay up to date with the latest knowledge of the disease to maximize efficiency and success of MDR-TB treatments.

Since 2011, Xian Janssen Pharmaceuticals Ltd. and its parent company, Johnson & Johnson ("J&J") have established a strategic partnership with the Chinese government to provide support for solving this public health issue and accomplish the "End TB Strategy". In this plan, they developed a remote consultation and education platform for MDR-TB and cooperated with more than 200 TB hospitals and institutions to launch medical education activities. From 2017 to 2020, Xian Janssen worked with the National Health Commission, the Bill Gates & Melinda Gates Foundation, and the Beijing Chest Hospital on the Tuberculosis New Drug Introduction and Protection (NDIP) Project, training medical staffs to provide diagnosis and treatment schemes for MDR-TB patients in 98 TB-specialized hospitals across 31 provinces in China. The project enabled 1,513 MDR-TB patients to receive free Sirturo medication treatment. In addition, from 2018 to 2021, J&J established partnerships with the International Health Exchange and Cooperation Center of the National Health Commission and the Chinese Center for Disease Control and Prevention to launch the TB and MDR-TB case finding project. This project aimed to reduce missing cases, cutting off further transmissions of TB, and update effective diagnosis and treatment methods by introducing rapid molecular diagnosis. This project successfully helped over 10 million people in 22 poverty-stricken counties of Jiangxi, Shaanxi, and Shanxi; and set up a framework of practices to improve the detection of MDR-TB patients and optimize the methods of diagnosis for future use.

Xian Janssen plays a key role as a witness and supporter of China's public health development. In the wake of the COVID-19 outbreak during the beginning of

2020, the company amped up their support and commitment to MDR-TB related programs by providing new innovative online platforms to help with disease education and patient management care, and aid to patients in poverty-stricken areas. On March 24, 2020, the 25th annual World Tuberculosis Day, Xian Janssen collaborated with its partners to launch a series awareness-raise campaign fight the COVID-19 pandemic as well as tuberculosis. The series featured many renowned experts in public health, reaching 550 million audiences, raising awareness for TB as well as other public health issues greatly.

To increase further awareness for MDR-TB and ensure patients receive the needed care and support, the China Primary Health Care Foundation launched the To Be Safe - MDR-TB Patient Caring Project with the help of Xian Janssen as a sponsor to provide free medical consultations and disease education for patients, patients' families, and caretakers. The project provides a platform for patients with MDR-TB to access educational seminars, visualized communications of disease knowledge, and video observed therapy. The platform is aimed to eradicate concerns of patients and their families regarding the treatment and long-term management of TB. As of the end of January 2021, the project has successfully delivered refined management to more than 430 patients and launched more than 240 educational activities for 9,000 patients with MDR-TB. The project has also made treatment donations to patients with limited living allowances and 6 poverty-stricken areas .

Through the company's commitments to expand diagnosis methods for MDR-TB, innovate products for treatment, and serve patients with care, Xian Janssen has played a crucial role in addressing the public health concern and helping China accomplish the End TB Strategy, and is dedicated to continuing their work well into the future.

(This case study is for use only by the AmCham China 2020 Social Impact Report. The English translation is for reference only, in case of any discrepancy, the Chinese version is considered the official case study.)

References:

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[CASE STUDY]

Using AI Evaluation Project to Prevent and Address Hypothyroidism/Atypical Disease

Currently, over 90 million people in China have hypothyroidism, which is one out of every 15 people. Hypothyroidism is a disease with complex cause, insidious onset, long course, and atypical symptoms, which lacks specific symptoms or signs in many patients, therefore it is poorly understood by the public. Due to the lack of public awareness, people susceptible to hypothyroidism often lose the opportunity of early consultation and diagnosis.

AI screening program helps hypothyroidism patients diagnose

To address this issue, Merck joined hands with Beijing Hongyi Medical Development Foundation in 2018, and used artificial intelligence developed by Baidu to create "AI Screening Project for Hypothyroidism," aiming at raising public awareness of hypothyroidism, so that early consultation and diagnosis would be made possible.

With the help of natural language understanding technology developed by Baidu, the project succeeded in building AI-chat bot, and improved its understanding and identification of hypothyroidism-related diseases through deep learning of medical materials. Through keywords searched by users on the internet, the AI chatbot can guide users on platforms such as Baidu and Ping An Health to make preliminary judgments on whether they have indications of hypothyroidism through AI self-assessment, and suggest users to go to hospital for formal diagnosis, thus help potential patients to an early diagnosis. The chatbot:

- Covered 2,810, 000 people in five cities
- Tallied more than 290,000 readings of disease education articles
- Helped in determining that 79% of self-tested users were at high risk of hypothyroidism who were subsequently given a suggestion to see a doctor offline

Thyroid Public Education Competition Promotes Public Awareness

Merck sponsored the Thyroid Public Education Competition project, which was held by the Beijing Hongyi Medical Development Foundation and Chinese Medical Doctor Association's sub association of medical education. The competition collected the public education work related to hypothyroidism and thyroid cancer,

which were initially screened by medical experts, followed by public voting and the offline final. As of today, the Thyroid Public Education Competition has been successfully held for two sessions, gaining widespread attention through official platforms and multimedia platforms, contributing to the popularity of thyroid disease in China. The Competition:

- Collected 135 works in 2019
- Reached 4.8 million people, with more than 176,000 thumbs ups collected online
- Selected seven winning projects through the program's expert committee

[CASE STUDY]

Efficient Screening and Immediate Treatment for HPV-Positive Women in Remote Areas

Cervical cancer is the third most common cancer among women worldwide with more than 600,000 cases globally in 2020.1 In China, cervical cancer is the second leading cancer among women younger than 45 with over 100,000 new cases per year and the cause of death for over 30,000 women per year3 due to late diagnosis or inadequate treatment. Cervical cancer rates are especially high in China due to the lack of widespread screening and convenient associated treatment. Although HPV vaccines are available, they are quite expensive and have limited availability. As such, HPV and cervical cancer will continue to impact millions of women for the foreseeable future.

Early intervention and treatment of HPV-positive patients can prevent further development into much more devastating and often untreatable diseases. Up until now, screening programs in China generally involved local doctors sampling for Thin-Prep Cytology Test one woman at a time. This method limits the number of women who can be screened by a given number of doctors. Test results tend to only become available days to weeks after the screening. By then, in remote locations, it will be hard to track women with positive results for follow up treatment.

As such, UFH and its affiliated United Foundation for China's Health have developed and tested out a program for rapid, large scale screening and immediate treatment for women, especially in remote areas that lack easy access to healthcare. The program utilizes a faster screening process for HPV that allows women who test positive for the HPV virus to be evaluated and treated for precancerous changes before the virus develops into cancer.

The program requires women from rural areas to gather for onsite screening in a centralized location. The process includes self-sampling, ten women at a time. As a result, a small team of two to three doctors and two to three assistants can screen up to 500 women per day.

When necessary, the institution will carry out immediate treatment at the same screening location on the same day. Digital cervicography is performed on subjects who are HPV positive, and if the DC is positive for cervical abnormalities, a cervical biopsy will be performed. Cryotherapy is performed on subjects with suspected low grade (CIN1) lesions; LEEP may be performed on subjects when the DC is suspicious for CIN2+ lesions. Biopsy samples are taken for analysis to a central United Family Pathology Lab. Patients whose follow up pathology is suspicious for invasive carcinoma will be contacted and referred to local hospitals, for additional evaluation and treatment.

UFH has provided this screening service free of charge with volunteer doctors during missions to impoverished rural areas in Inner Mongolia, Yunnan, Shaanxi, Ningxia and Sichuan. Over 12,000 women have been screened, and more than 1,000 have been treated for early abnormalities. Additionally, they were also given the opportunity to receive education about the importance of annual HPV screening, sexually transmitted disease (STD) prevention and general sexual health.

[CASE STUDY]

Training Programs and Consultant-Based Services to Support China Develop its Nascent Air Medical Services

Today in China, general access to emergency response services poses a significant challenge for the Chinese healthcare system. More than 600,000 traffic-related deaths in China between 2007-2016.1 Whether in remote areas or within high-traffic and congested areas, getting patients to a high level of care quickly and having the means to administer care to patients in emergency situations within the "golden hour," are very difficult without a system capable of responding to such needs, which often results in deaths and undesirable outcomes that could be prevented. A system which supports and provides patients access to emergency medical services through robust and comprehensive Air Medical Services ("AMS") can go a long way toward addressing this challenge and evolving the level of emergency care provided in China.

The Chinese government has recognized the importance of such services and the potential benefits they offer for the country. As a testament, the Civil Aviation Authority of China ("CAAC") and the National Health Commission ("NHC") are commissioning a Joint Implementation Plan (JIP) for the development of a regulatory structure surrounding AMS. Bell has worked closely, both directly and through its in-country partners, to provide guidance and inputs to the JIP.

But AMS operations are only emerging and very little operational proficiency exists within the segment. There are currently just over 100 civil air medical helicopters serving the 1.4B population of China. Existing air medical programs are relatively rare and underdeveloped, and they often lack the fundamental knowledge, operational proficiency and the adequate resources to know how and where to start in building safe and effective life-saving services the society greatly needs.

In 2019, Bell developed and introduced the first training course in a series intended to facilitate the development of AMS capabilities in China. Bell collaborated with Med-Trans Corporation to draw on their recent experience in the area of emergency medical services operations, and together designed a unique training program for China to address the skills and experience gap that currently exists. The program was developed around best practices and industry standards, and tailored to the needs and experience level of the Chinese AMS industry. Bell delivered this first course – Inter-Hospital Patient Transport – to its local partner, Shaanxi Helicopter Corporation and Shaanxi People's Hospital, as well as the CAAC.

Over the course of two-weeks, training participants received fundamental academic training, which served as a knowledge foundation. The course built on that through a series of practical exercises and simulated air medical transport intended to foster operational experience and application of knowledge and procedures.

Trainees were put into teams to conduct exercises as a crew, with each exercise building on the last, becoming more complex and similar to a real-life air medical environment. During the two-week training course, over 40 trainees participated, including doctors, nurses, pilots and maintenance technicians. The training addressed both medical and aviation function at the individual, crew and organization level. At the end of the training course, a recommendation plan was provided so the organizations could continue to develop their capability.

As part of its Consultant Services, Bell is continuing to develop this AMS training to offer Scene Response training in 2021 and further explore ways to establish expanded medical support to remote and underserved communities as the next iteration of the program, which will be followed by the capstone session covering Emergency Response.

Positive Social Impact Created

By the end of the course, trainees demonstrated a significant increase in the ability to conduct an air medical transport process and said they felt more comfortable knowing what to do and how to do it safely. A survey was conducted, and 100% of the trainee respondents said they will recommend the course to others. On a scale of one to 10 with 10 being the best, the respondents rated the training as a 9.7. Additionally, 100% of respondents stated they felt safe and understood the value of safety from the training.

Organizations in China recognize the need for providing Air Medical Services. The training program and support services that Bell provides are designed to help them develop those capabilities with proper knowledge and techniques. While additional processes, policies, infrastructure and development plans are needed as emergency services evolve in China, the organizations that participated in this training now have the fundamental knowledge to start building an air medical program.

The consultant-based services and training program is an extension of Bell's previous work to influence the regulatory guidelines and industry best practices necessary for establishing operational capability. Without this type of training, knowledge will remain theoretical in-nature. Bell, with the assistance of Med-Trans Corporation, created a solution that provides a pathway for the industry to move to the next stage of developing these services in a safe and effective way to better serve the citizens of China.

Ethical Principles for Artificial Intelligence (AI)

"AI isn't just another piece of technology. It could be one of the world's most fundamental pieces of technology the human race has ever created."

- Satya Nadella

As we adopt more AI-empowered systems into our daily life, it is critical to make sure that the algorithms and data can deliver the intended value. However, as powerful as AI may be, bias still exists and may lead to unexpected consequences (see chart on the right for examples). Especially when it comes to healthcare, biases can mean life and death.

To address this challenge, Microsoft has committed to the advancement of AI driven by ethical principles that put people first.

Examples	Allocation	Quality of Service	Stereotyping	Denigration	Over- or Under-representation
Hiring system does not rank women as highly as men for technical jobs	x		x		x
Gender classification software misclassifies darker-skin women		x			
Machine translation system exhibits male/female gender stereotypes			x	x	
Photo management program labels image of black people as "gorillas"		x		x	
Image searches for "CEO" yield only photos of white men on first page			x		x

In healthcare, Microsoft puts Six Principles of Responsible AI into practice:

Fairness – AI systems should treat all users and patients fair
Reliability and Safety – Health AI systems should perform reliably and safely
Privacy and Security – Health AI systems should be secure and respect privacy
Inclusiveness – Health AI systems should empower everyone and engage people
Transparency – Health AI systems should be understandable
Accountability – Health IT should be accountable for AI systems

Microsoft's thought leadership in Responsible AI helps the health industry in following aspects:

Understand built-in data bias. AI and big data analysis have proven to be a power tool for recognizing hidden patterns that provide insights to help medical professionals better diagnose. However, we need to be mindful that the massive data being analyzed may have hidden bias to a specific segment or profile of the target population with heavier representation. Microsoft has developed a set of open-sourced tools in GitHub called InterpretML to help enterprises and developers better identify potential hidden bias in their AI data and algorithms.

Empower others. Microsoft helps health organizations cultivate a responsible AI-ready culture in their businesses and put principles into place from implementation to governance with practices, tools, and technologies built on multidisciplinary research, shared learning, and leading innovation for patients.

Foster positive impact. Microsoft is committed to ensuring AI technology has a lasting positive impact for everyone by helping to shape public policy, contributing to industry working groups, and empowering those working to address society's greatest challenges through our AI for Good initiative.

Diabetes Chatbot, an Application of Microsoft's Responsible AI

Leveraging its Responsible AI principles, Microsoft in partnership with Nordisk is introducing an educational Chinese-speaking chatbot for diabetes patients. In China, there are 121 million diabetes patients with estimated 61.3 million still undiagnosed. Of which, only 16% can control their disease due to the lack of timely diagnosis, insufficient attention, medication and understanding about it, indicating a huge gap between demand and supply in diabetic treatment consulting. This Chinese-speaking AI chatbot will help improve patients' knowledge of the disease for better self-management. It will also include other features such as medication reminders, customized recipes, psychological counseling, AE/AR reporting and medical article recommendations.

Recommendation #2: Promote Multi-Sectoral Engagement

As a public good, the SII advocates for an enhanced whole-of-society approach to promoting public health interests that allows the government, non-profit sector, and business communities to come together to identify current healthcare needs, develop impactful reforms and solutions, and implement collaborative programs that promote positive change in the healthcare sector. Specifically, the SII encourages the government to: (1) more actively leverage the private sector's expertise and resources in the policy development process; (2) increase healthcare industry competitiveness and innovativeness through more inclusive policies; (3) develop a framework for public-private partnerships to streamline private sector participation; (4) catalyze collaboration with international counterparts to access new trends and strengthen global partnerships; (5) develop a comprehensive and sustainable national health survey framework; and (6) build standardized metrics for monitoring the progress and success of healthcare programs and disease management.

Leverage Private Sector Expertise and Resources in the Policy Development Process

The process of healthcare reform policymaking relies on the close interplay between the central and local governments. Based on this policymaking structure, including dialogue with private sector stakeholders during the policymaking process further ensures inclusivity and effectiveness of policies.

The government could consider adopting a collaborative structure that invites stakeholders from the private sector, academia, and the public to come together and speak freely on challenging issues in which they share vested interests in addressing. As dialogue is the first step towards identifying and enacting solutions, such a format could potentially help break down silos across government agencies and other segments of society, leading to consensus-building efforts with respect to policy development and implementation.

Increase Healthcare Industry Competitiveness and Innovativeness through more Inclusive Policies

Private sector participation on issues of public interest has proven to be effective in ensuring public participation and expanding coverage. The private sector has demonstrated its value in emergency relief response by providing much-needed supplies and consumables to affected communities and institutions during major disasters and

SII Spotlight: ECDC's Continuous Professional Development (CPD)

Activities aimed at addressing the institutional needs of Coordinating Competent Member States to maintain a competent workforce to adequately respond to cross-border health threats

Coverage

- Available for healthcare professionals in the Member States engaged in communicable disease control with cross-border relevance
- Seeks to improve competencies and capabilities of public health institutions to respond to health crises and emergencies brought about by infectious diseases
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Offerings

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  - Short courses
  - Simulation exercises
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  - Webinars
- Professional exchange visits
- Training materials for trainers

Rationale – Develop and implement competency-based framework for the prevention and control of communicable diseases and other public health threats with cross-border implications

Source: "Compendium of 2021 ECDC Continuous Professional Development (CPD) Training Activities," *European Center for Disease Prevention and Control*

emergencies, including the COVID-19 pandemic.

With the public rollout of COVID-19 vaccines and global inoculation programs now underway,[61] governments and the private sector are preparing for the largest ever simultaneous public health initiative. Private sector support is imperative to successfully address the many challenges that lie ahead, including issues related to the massive scale of distribution, strict transportation requirements, transparency, equitable access, and patient adherence.[62] For example, Germany's Lower Saxony is the first state in the country to partner with private logistics supplies to address vaccine distribution challenges. DHL is tasked to manage the logistics, storage, and distribution of 2.2 million doses of the COVID-19 vaccine under 70-degree Celsius. [63] As of March 1, 2021, more than half a million residents in Lower Saxony had received at least one shot of the COVID-19 vaccine, accounting for 6.4% of the state's population, considerably higher than Germany's average vaccination rate of 3.14%.[64]

In the area of health financing, further policies to support the efforts of smaller private insurance providers can help drive down the cost of private health insurance and support the development of new products, providing the public with more options to find the most suitable insurance plan. When private health insurance providers are given

room to grow and innovate, they can establish and expand partnerships with other segments of the private sector to introduce new solutions in different areas of healthcare services. Ultimately, by catalyzing the growth and development of the private health insurance sector, the government can expect a significant decrease in public health spending and out-of-pocket expenditures, as well as an overall improvement in the population's general well-being.

Develop a Framework for Public-Private Partnership to Streamline Private Sector Participation in Government-led Programs

SII stakeholders collectively agree that public-private partnerships (PPPs) are a powerful mechanism to achieve socially beneficial outcomes. They are necessary in public health emergencies as governments alone are not equipped to provide the full range of services and expertise. Such situations also require innovative solutions and industry expertise to respond to a rapidly changing landscape.

In China, PPP is most often recognized as infrastructure development projects initiated by the government or state-owned enterprises (SOEs). The SII proposes that the government broaden the concept of PPPs and develop a framework that expands emphasis to include those delivering public health services, beyond just infrastructure development projects. This framework should define expectations of and benefits for all implementing parties. More importantly, it should leverage the expertise, network, and experience of the private sector to address the gap in the public sector's capability to address public health interests. The COVID-19 crisis has revealed that the PPP model brings real benefits in the healthcare sector – not only in the immediate context (e.g., hospital beds, healthcare professionals, equipment) but also as a long-term solution to drive innovation and improve efficiency.

For example, Merck and the China Women's Development Foundation jointly launched the "health education program for pregnant freshmen," aiming to improve the public's awareness of reproductive health knowledge through online health education and popular science; Johnson & Johnson's innovative treatment plans for Schizophrenia enables the hospital community integrated model, which has greatly eased the pressure of treatment due to its convenience and long-term effectiveness.

In public health emergency response and post-pandemic economic recovery, all sectors of society should vigorously promote public-private partnerships. Private sector investments have been observed to spearhead the development of digital health applications in the public health sector.[65] For instance, technology companies have developed numerous applications, including AI models that can detect the COVID-19 virus in patient CT scans with 90 percent accuracy, to detect, mitigate, monitor, and prevent the

spread of COVID-19. Technology companies are also currently developing AI-assisted tools that can scan body temperatures and identify surfaces potentially infected with COVID-19.

Deepen International Collaboration to Access New Trends and Strengthen Global Partnerships

Over the past two decades, infectious disease outbreaks of Ebola, Influenza A (H1N1), SARS, MERS, Zika virus, and most recently COVID-19, have had a major global impact. Emerging infectious diseases (EIDs) are increasing globally, with 75 percent of EIDs resulting from exposure to zoonotic pathogens.[66] Infectious diseases do not acknowledge national borders, making control inherently a global endeavor where international cooperation is a necessity. Each new infectious disease that surfaces challenge the landscape of global health security and emergency preparedness. This underscores the urgent need to build and maintain sustainable preparedness to prevent, detect, and respond to public health risks and threats, both as independent countries and globally.

As such, many discussions across the working sessions highlighted the importance of building global health partnerships to adequately respond to health emergencies. Effective collaboration requires three elements: (1) identification and declaration of emergency conditions; (2) investigation and analysis; and (3) execution of a successful response. The response should seek not only to contain or otherwise address the immediate threat, but also identify both medium-term and long-term solutions that enhance preparedness for the next emergency. Participants concurred with the idea that emergency response is a continuous process, subject to preparation, review, and adjustment as relevant.

Through the years, China has demonstrated its willingness to participate in international collaboration, not only in the area of health emergency response but also in disease prevention. As a member of the WHO, China is mandated by the International Health Regulations (IHR) to report and coordinate health emergency efforts with WHO's global response network.[67] China is also involved in bilateral and multilateral partnerships to accelerate disease prevention and control, promote disaster resilience, and provide global health security support, and is funding vaccine development and distribution efforts for AIDS, Tuberculosis, Malaria, and COVID-19.[68]

Further strengthening of China's participation in international initiatives around public health can augment its ability to meet the healthcare needs of its population. Doing so will ensure better access to international governmental and non-governmental organization support, such as technical support, internationally recognized standards, exchange of experiences and best practices, and shared use of resources. It would also

help China to ensure the efficiency of globally integrated domestic supply chains under its dual circulation system.

Develop an Ongoing, Comprehensive National Health Survey

To effectively develop relevant policies and enable patient-centric solutions for China's public health system, as well as to measure progress against national objectives, it is vital for policymakers to fully understand the public's varying lifestyles, needs, and preferences. Such understanding can be best informed by conducting an ongoing national health survey that sources input directly from the people. For example, the China Health and Nutrition Survey, an ongoing international project launched in 1989 by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health (NINH) at the Chinese Center for Disease Control and Prevention (CCDC), is one current source available to inform policy studies and develop-

SII Spotlight: Singapore's National Population Health Survey (NPHS)

Annual cross-sectional population survey that tracks health and risks factors, as well as lifestyle practices of the country's residents

Details

- Replaces three discrete population health surveys – National Health Survey, National Health Surveillance Survey, and National Behavior Surveillance of Singapore
- Conducted annually to provide timely data on prevalence and pervasiveness of non-communicable diseases
- Aims to be used as input for the Ministry of Health and Health Promotion Board's development and evaluation of policies to improve the health of Singapore residents
- Composed of two segments – Household interview and health examination, covering residents aged 18 to 74

Coverage

- Alcohol Consumption
- Cigarette Smoking
- Physical Activity
- Self-Reported Diabetes Mellitus
- Self-Reported Hypertension
- Self-Reported Hyperlipidemia
- Chronic Disease Screening
- Breast Cancer Screening
- Cervical Cancer Screening
- Colorectal Cancer Screening
- Vaccination Coverage

Source: "National Population Health Survey," *Ministry of Health, Singapore*

ment.[69] However, the project remains limited in scope, covering only nine provinces as of 2020. To ensure that the data collected in the national health survey more helpful for the policy-making processes, such ongoing surveys need to be expanded to cover not only densely populated and highly urbanized cities and regions, but also remote communities and rural areas, with differences in both needs and cultures taken into account.

For example, Singapore's National Population Health Survey, jointly conducted by the Ministry of Health and Health Promotion Board, tracks residents' health and risk factors, as well as lifestyle practices (see SII Spotlight: Singapore's National Population Health Survey for more details);[70]. Other examples of successful implementation of national health surveys include Japan's National Health and Nutrition Survey, conducted annually by the Ministry of Health, Labor and Welfare, is an important component of Health Japan 2021, the country's program for National Health Promotion;[71] and the US National Health Interview Monitor, implemented by the National Center for Health Statistics and Centers for Disease Control and Prevention since 1957, monitors the US populations' health as well as trends in illness and disability.[72]

Ultimately, by allowing greater general public participation in public health initiatives, their needs can be better served through more targeted and relevant healthcare services. Such participation can also slow the rise in healthcare expenditures, as the entire population becomes more focused on proactive and preventive health management.

Build Standardized Reporting Tools and Metrics for Monitoring Progress and Success of Healthcare Programs, as well as Management of Diseases

It is recommended for China to develop a strong monitoring and evaluation regime capable of independently assessing programs, systems, and practices, as well as policy impact and reforms.[73] At this time, China's monitoring and assessment framework is mostly project-based, having the advantage of being flexible and customizable to better fit the evaluation objectives. However, such evaluation cannot replace the role of systematic evaluation since customized programs are difficult to scale up and thus do not have access to system-wide data and lack systematic external oversight, making it difficult to influence the overall public health system environment.

Working session discussions established the need for such a standardized evaluation system developed within the context of China that aligns key performance metrics across all health institutions and public health programs with set objectives. These metrics should be easily tracked, deployed, and accessed at both national and local levels. Guiding principles can be developed to ensure consistency in tracking progress and evaluating program success, identifying improvement opportunities, and sharing best practices.

This evaluation framework should also be more deeply integrated into policy development and reforms. This would enable policymakers to make more informed decisions to improve the country's public health systems. By incorporating assessments into policy implementation, policymakers would be able to identify which stakeholders perform well in any given program, paving the way for stronger and expanded partnerships in the future.

The US CDC, for example, has introduced its own Evaluation for Public Health Programs, with the belief that program evaluation can help systematically improve and account for all health actions. The US CDC considers not only the impact and outcomes of the program, but also the actions of participating stakeholders. The CDC's framework includes six steps: 1) engaging stakeholders, 2) describing the program, 3) focusing evaluation design, 4) gathering credible evidence, 5) justifying conclusions, and 6) ensuring use of evaluation findings and sharing of lessons learned.[74]

[CASE STUDY]

R&D of Innovative Drugs to Promote Community Therapy Model for Schizophrenia

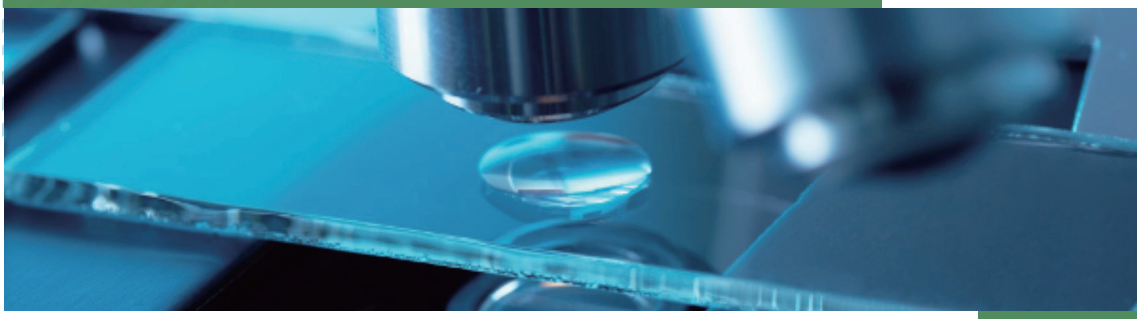
Schizophrenia is a chronic mental illness resulting in distortion and challenge in thinking, perception, and daily behavior. It damages patients' social and working capacity and brings tremendous disease and financial burden to them and their families. According to the statistics of the World Health Organization (WHO), there are over 21 million patients with schizophrenia around the world.

The public's limited understanding of mental illnesses has resulted in prejudice and discrimination against patients, which imposes heavy burden over the patients and their families. Research shows that over half of the schizophrenic patients worldwide have not been treated properly. Four out of ten schizophrenic patients have a relapse within a year after being discharged from hospitals, and almost eight out of ten patients who suspend medications have a relapse.

While continuing to introduce innovative treatment plans and promote community therapy models, Xian Janssen, the pharmaceutical subsidiary of Johnson & Johnson in China, is devoted to enhance public education on mental illnesses, so as to improve the public understanding of them and call on the whole society to accept and support patients with mental illnesses.

In terms of innovative drug R&D and the introduction of innovative treatment plans, on September 14, 2018, Xian Janssen Pharmaceutical Company officially launched Invega Trinza®, a long-acting injection to treat schizophrenia. This drug is applicable to schizophrenic patients who have been adequately treated with Invega Sustenna® for at least four months. Compared with oral drugs, the long-acting antipsychotic injection has multiple advantages, including improvement in patients' compliance, elimination of need to remind patients to take their medicines, easier and safer realization of minimum effective dose principle, no gastrointestinal absorption problem, no first-pass metabolism, and reduced risk of accidental or intentional overdose. At present, the long-acting antipsychotic drug that requires injection once a week has been included in the National Reimbursement Drug List (2017 Version), which has been executed in most provinces and cities in China since September 1, 2017, effectively reducing the economic burden on patients.

This R&D result also contributes to the promotion of community therapy. IN 2010, WHO released guidelines for inclusion of people with mental health problems in "community-based rehabilitation (CBR)" activities. The National Mental Health Work Plan (2015-2020) issued in 2015 by National Health and Family Planning Commission indicated that the service model of "treatment for serious illness in hospital and rehabilitation management in communities" should be actively promoted in China, encouraging social resources to provide community rehabilitation services for mental illnesses. The development of long-acting antipsychotic injections meets the urgent medical needs of China in the mental health sector, and supports the construction of

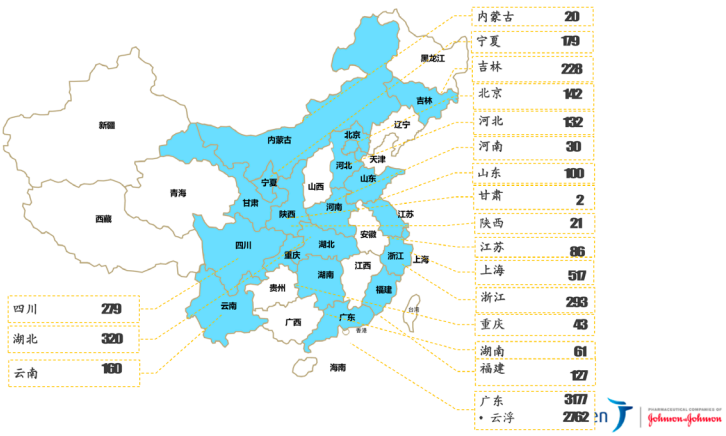


a Long-acting Hospital-Community Integrated Model. In this model, patients in acute stage will first be hospitalized and treated by an outpatient clinic of mental hospitals in the jurisdiction, and to be referred back to a community health center when in stable condition. The community health center will conduct assessment and screening with regular follow-up and long-acting injection treatments, helping them rehabilitate at home and eventually return to society.

Government departments have also introduced a co-payment model to provide free treatment for patients. In this model, the co-paid free treatment is realized with cross-department support from Health Insurance, Finance, Health, Political and Legal Affairs, Civil Affairs and other departments, aiming to realize low or zero self-payment for patients. By the end of January 2021, there were 129 pilot communities established in 20 provinces, benefiting 5918 patients in total. The model successfully improves the quality of life for patients and helps them return to society.

During the COVID-19 pandemic in 2020, countless mental disorder patients across the country faced difficulties in seeing a doctor, getting medicines, and hospitalization. The hospital community integrated model of long-acting injections has greatly eased the pressure of treatment due to its convenience and long-term effectiveness. Furthermore, it provides new ideas and references for new mental illness treatment models in the post-epidemic era. We believe that the construction of an innovative model of hospital-community integrated model for schizophrenia patients will continue to promote the sustainable development of China's mental health sector, benefit more patients with schizophrenia, and help realize the strategic goals of Healthy China 2030.

截至2021年1月底，11个城市为基础的社区试点（83个）+46个社区试点——合计129个社区试点，累计惠及5918名精分患者



[CASE STUDY]

Joining Hands with Foundations to Promote Awareness and Improve Patients' Experience

Currently there are over 30 million people suffering from infertility in China.1 One out of seven couples seeks help in trying for a child. Some of them are facing hardships, including financial difficulties, lack of awareness for infertility, and lack of access to appropriate medication, among others.

However, China lacks professional health education organizations to raise public awareness on infertility and relevant standardized treatment. As a result, many patients continue to suffer from lack of sufficient knowledge about infertility.

Promote Awareness of Reproduction Technology

To better raise public awareness and knowledge of reproductive health and assisted reproduction technology (ART), promote formation of adequate medical conception, and emphasize the importance of continuity of treatment, Merck joined hands with China Women's Development Foundation to launch the Zhiyunxinsheng Health Education Program for infertility patients in 2019.

This program aims to enhance public awareness and knowledge of reproductive health through online health education and popularization of science, increasing education efficiency for the patients. As of 2020:

- 16 innovative educational materials were released online and read 570,000 times in total, including cartoons, articles and videos to help infertile couples better understand ART and relevant treatment processes
- Eight live educational broadcasts were conducted through People's Daily and We-doctor, reaching over six million viewers, including 300,000 patients

Improve Patients' Experience

During ART treatment, luteal phase support is a crucial step for pregnancy. At this phase, due to lack of acknowledgement and limited time with doctors, patients' needs have often been ignored, which adds to the psychological burden of patients, thus affecting the progress and effect of treatment.

To better serve patients and improve their experience during ART treatment, Merck joined hands with Beijing Hongyi Medical Development Foundation to initiate the Patient Management Program.

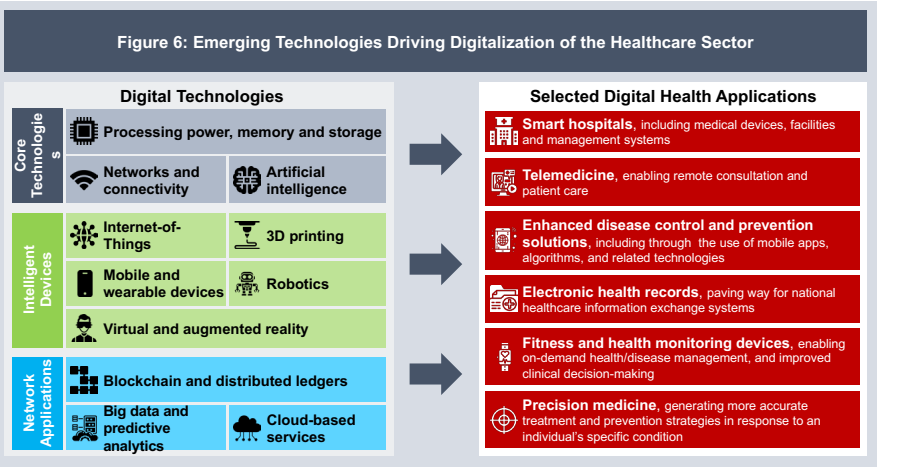
The Program uses a WeChat public account platform to provide multiple services to ART patients including course management, disease education and patient follow-up. This program plans to cover 30 IVF centers nationwide, with 6,000 ART patients joining for patient management and follow-up. As of October 2020, the target number of IVF centers have been reached, while over 4,500 patients have already been enrolled.

Recommendation #3: Accelerate Adoption of Digital Health Technologies

Digital health is the use of Information and Communications Technologies (ICT) to improve the quality, accessibility, and delivery of healthcare services. It covers a broader scope beyond clinical and medical intervention to include the promotion of healthy lifestyles and improvement of one's well-being.

Digitalization of the healthcare sector is enabled by a whole host of technologies, including artificial intelligence, increased processing power, Internet-of-Things, cloud computing, and Big Data (see Figure 6). These technologies have led to the development of health applications such as smart hospitals, telemedicine, and precision medicine. Widespread utilization of these innovative technologies can be used to accelerate the advancement of China's health programs, enabling healthcare institutions to serve the entire population with cutting edge and cost-efficient solutions.

Figure 6: Emerging Technologies Driving Digitalization of the Healthcare Sector



Smart hospitals leverage emerging and existing ICT technologies to improve and make the process of medical treatment and care more patient-centerd. As identified in a McKinsey & Company report, smart hospitals can improve patient experience before, during, and after a hospital stay by: 1) tracking the patient's condition through wearable devices, in addition to recommending and setting-up appointments; 2) providing information on procedures performed and delivering results; and 3) storing patient's data on the cloud to support development of treatment programs.

Smart hospitals also feature a repository for many type of innovative digital health technologies, including: 1) artificial intelligence, to support diagnostic and clinical analysis,

drug discovery, and development of care plans; 2) electronic health records, to improve patient health management and storage of medical history and clinical data; 3) robotics, to improve precision of surgical procedures, support healthcare professionals, and asset maintenance; and 4) real-time location services, used for patient-flow management, asset tracking, and space management.

Globally, smart hospitals are increasing in scope and number.[75] The Mayo Clinic in Rochester, New York, which is consistently the best ranked hospital in the US, has begun processing and storing data on the cloud, and in June 2020 announced the launch of a technology-enabled "Hospital-at-Home" program. Singapore General Hospital, the largest state-owned tertiary hospital in Singapore, uses RFID for its bed management system and robotics for its surgical and biopsy procedures. Fortis Memorial Research Institute in India has a mobile app to process hospital admissions and schedule doctor appointments, and also provides remote patient care with e-consultations and e-ICU using telehealth solutions.

In China, Honeywell enabled the incorporation of IoT technologies in Qingdao East Hospital, a medical facility located in Shandong province that was also used for the 2008 Olympic Games. The hospital is now equipped with HVAC, air filtering, lighting, security, and analysis features centralized in one system, enabling it to provide 24/7 comfort, energy, safety, cleaner air, and automated responses to the needs of its patients throughout the facility.[76]

Other smart hospitals in the country include Guangdong Provincial People's Hospital in Guangzhou, New Tiantan Hospital in Beijing, Huoshenshan Hospital and Wuhan Union Hospital in Wuhan, Sheng Jing Hospital in Shenyang, and Ruijin Hospital in Shanghai. For example, on February 22, 2021, the world's first "Artificial Intelligence Research Center for Neural Diseases" was established in Beijing's New Tiantan Hospital. The Center is the world's first integrated application product of artificial intelligence diagnosis of head diseases, such as brain tumors, small vessel diseases, large vessel diseases and stroke. Its establishment makes data collection, identification and diagnosis can be completely in the hospital in a timely manner without the need of uploading medical data, which prevents the leakage of patient privacy and eliminates the risk of medical data loss.[77]

By placing a Pad at the bedside, Tiantan Hospital has created a "personalized intelligent housekeeper" for each patient. This intelligent interactive system not only provides patients with entertainment functions such as digital TV, but also enables patients to check their medical records, make appointments for examinations, order nutritional meals, etc. At the same time, in order to facilitate patients' travel, Tiantan Hospital has also established an intelligent navigation system covering the whole hospital. Patients only need to "shake" their cell phones, the system will automatically plan a suitable

route, and the accuracy is within meters.

Telemedicine enables remote delivery of healthcare needs to patients using telecommunication technologies, such as mobile phones, mobile apps, email, and live videos, in addition to wearable technologies, like smartwatches and wearable monitors. These tools are used to gather important health data that can provide doctors and patients with a comprehensive view of patient health even without face-to-face engagement, improving accessibility of healthcare services, as well as continuity and accuracy of treatment programs.

COVID-19 has accelerated the use of digital health technologies in China, driving adoption that is likely to remain for the long-term. The demand for public health services, coupled with social distancing requirements and stay-at-home orders, have caused demand for telemedicine services to spike. Ping An's "Good Doctor," China's largest healthcare platform, saw the number of users registered on its platform grow ten-fold from early January to mid-February 2020.[78] Enabled by digital therapeutics and data analytics, as well as its innovative drug R&D, Johnson & Johnson[79] was able to introduce the Long-Acting Injection Hospital Integrated Model as part of its digital mental health strategy in China, allowing patients with acute phase schizophrenia to be treated in psychiatric hospitals and referred back to community health centers (CHC) once in stable condition. During the pandemic, countless patients across the country faced difficulties in seeing a doctor, obtaining medicines, and hospitalization. The hospital community-integrated model of long-acting injections has greatly eased the pressure of treatment due to its convenience and long-term effectiveness.

Emerging technologies are also being adopted for disease prevention and control, especially during the pandemic. NVIDIA's "Clara Parabricks"[80] uses graphical processing units (GPUs) to dramatically reduce the amount of time required for complete analysis of an entire human genome DNA sequence to 20 minutes. This enables a better understanding of a patient's disease susceptibility, disease progression and treatment response, and subsequent diagnosis and treatment, providing powerful support for the fight against COVID-19. Another NVIDIA-developed technology is the Clara Discovery Advanced Tool Suite,[81] which addresses the exponentially increasing demand for R&D as an integral part of the scientific effort against emerging diseases. GPU and AI technologies play an extremely significant role in determining possible new disease outbreaks, research and application of existing diseases, diagnostic imaging, and new development in pharmaceuticals.

Other examples of emerging technologies adoption during the height of COVID-19 include: (1) Terra's drones used to fly medical samples and quarantine materials in Xinchang, China;[82] (2) Health kits, mobile apps used for contact tracing and determining

clinical risks of COVID-19;[83] (3) Robots that are being routinely deployed in quarantine facilities, clinics, and hospitals to disinfect the premises and provide basic assistance to patients;[84] (4) VivaLNK's wearable temperature sensor used to continuously record health data, which enables remote monitoring and reduces person-to-person contact;[85] and (5) Flashforge's 3D printer, used for mass production of safety goggles that were delivered to COVID-19 healthcare professionals and frontline workers.[86]

To maximize the adoption of these digital technologies for healthcare, SII recommends the Chinese government to: (1) develop a national digital health strategy; (2) create a national healthcare data system to facilitate the collection, management, and exchange of healthcare data; (3) strengthen the data policy framework; and (4) make additional investments in underlying infrastructure.

Develop a National Digital Health Strategy

Successful national-level adoption of digital health solutions will greatly contribute to the transformation of China's public health system, elevating it among the top globally. Such adoption will lead to: (1) creation of more patient-centric health solutions and overall better patient experience; (2) improvement of outcomes with respect to delivery of health services, such as greater speed, accuracy, and quality of diagnosis and treatment; (3) streamlined workflow and processes in healthcare institutions, particularly in data and asset management; (4) decline in disparities in healthcare access across the country; and (5) dramatic reduction in healthcare costs

The national healthcare strategy "Healthy China 2030" has already paved the way for the promotion of digital technology in the public healthcare system. The NHC actively encouraged the use of internet-based services to minimize the spread of COVID-19. In 2019, the National Healthcare Security Administration (NHSA) also launched an insurance system that would allow internet-based services to be covered by the country's medical insurance system. [87] As of August 2020, the NHC committed to introduce a notice that will permit the use of electronic licenses and certificates for healthcare professionals. [88]

However, a detailed framework and certain level of interoperability between health institutions must exist to realize the full benefit of digital health. To this end, SII recommends the development of a national level strategy that is specific to the promotion and oversight of digital health applications across the country. This can be achieved through identifying objectives and desired outcomes for the digitalization of the entire public health ecosystem and developing a playbook that standardizes the approach and protocols for adopting a broad range of digital health applications. After the deployment of these technologies, guidelines should be established to help healthcare

SII Spotlight: New Zealand's Digital Health Strategic Framework

Evolving aspirational goals and enabling priorities, guidelines, and resources that will guide the use of digital technologies and data to support a strong and equitable public health system in New Zealand

Digital Objectives

- People are in control of their own health information
- Access to digital services and health information improving health outcomes and equity
- Digital services enabling health providers to deliver better services
- Digital services increasing performance of the public health system
- Data insights provide evidence to make and support informed decisions

Principles

- Person-centered
- Customer-led
- Accessibility
- Privacy and security by design
- Cloud-first
- Maximize value

Capabilities – Each stakeholder will formulate plans that set digital capabilities, or disciplines and considerations that underpin the use of digital health technologies

Enablers – Resources, frameworks and guidelines that create focus and alignment to achieve goals and objectives set

Source: "Digital Health," *New Zealand Ministry of Health*

professionals, supporting staff, and the general public meaningfully, diligently, and consistently utilize them. A feedback loop should also be created to continuously engage all ecosystem participants, as well as jointly identify challenges in implementation, opportunities for improvement, and potential solutions.

It is important for China to create an environment that provides solutions providers, adopters, and the public access to resources to achieve common objectives. Government can put in place incentives to further encourage the private sector to contribute to the development of more relevant digital health applications, such as tax breaks and capital grants. Existing healthcare regulations should also be revisited and updated to enable patients to safely, easily, and legally access digital health applications, such as prescription medicines via telemedicine consultations, particularly in remote or rural areas where access to healthcare facilities is very limited.

Sandboxes and tech parks can be built where stakeholders can freely innovate, testing tools and technologies that can further advance digital health in a controlled environment with minimum regulatory risks. And these spaces, there should also be a government-led platform for different government organizations, the private sector, and

research institutions to share data and other resources, exchange experiences and best practices, and foster innovative developments.

New Zealand's Digital Health Strategic Framework is one example of such thinking, using a person-centered (i.e., consumers, healthcare professionals, researchers, and service providers) approach that guides the use of digital technologies and health data to strengthen its public health system (see SII Spotlight: New Zealand's Digital Health Strategic Framework for more details).[89]

Establish a National Healthcare Data System to Facilitate the Collection, Management, and Exchange of Health Data

The growing adoption of digital health applications has led to a dramatic increase in the volume of healthcare data that include details such as patients' personal information and medical history, health institutions' operational key performance indicators, medical images, and clinical outcomes. Healthcare data can be used for patient medical history monitoring, hospital performance management, patient health risk forecasting, disease causes and outcomes prediction, medical and pharmacological research application, and population health analytics.[90] Furthering the use of data in healthcare has the potential to reduce costs of treatment, reduce overall healthcare expenditures, optimize treatment for diseases affecting multiple organ systems, predict outbreaks of epidemics, support disease prevention, and improve general quality of life.[91]

In the early 2000s, China's "11th Five-Year Plan"[92] and "Guidelines for Health Information Technologies Development"[93] directed the development of electronic health records (EHR). The national government invested more than US$3.5 billion as of 2015 to build a National Electronic Health Information System. [94]

Yet, despite the supporting policies, large public investment, and actual development of IT systems, implementation of EHR in China still faces challenges, largely due to disparities in the accessibility and quality of technology between urban and rural areas. Even with a forecasted EHR adoption rate of 91.4 percent by 2020,[95] interoperability, quality, and ease of use of EHR data remain lacking. With 300 EHR system providers, data used in different hospitals are incompatible with each other. Moreover, a considerable number of hospitals still use many paper forms, which may raise concerns about the quality and integrity of EHR data.

There is, therefore, a need to introduce interoperable reporting standards and protocols for EHR that aggregate, consolidate, and present a unified view of patient health and medical information. Effective implementation of EHR systems must: (1) provide healthcare professionals with a holistic perspective on patients' history and current condition; (2) be accessible to patients any time they need it; (3) eliminate the need for repetitive

medical processes; and (4) enable data analysts to uncover trends and insights on diseases, useful in developing drugs and advancing technologies for treatment and care.

Research shows that fifteen common factors grouped into three major categories needed to ensure a successful EHR program. The first category covers organizational factors, such as governance, leadership and organizational culture, stakeholder participation, resources, support, and workflows. The second category concerns human factors, including skills and capabilities, perceived benefits to end users, and perceived changes to the healthcare ecosystem. The third category focuses on technological factors, with usability, interoperability, adaptability, and availability of infrastructure, comprehensive testing, and existing regulations in scope.[96]

As one of the more advanced implementations of EHR, Iceland's HealthNet Hekla is a centralized storage and information exchange portal for health data. EHR systems of all public and most private health institutions are connected to Hekla. Patients use its public-facing portal, Heilsuvera (Vera), to view their records and access other information that can help them better manage their health (see SII Spotlight: Iceland's Electronic Health Records System for more details).[97] Another successful adoption of EHR on a national level is Singapore's National Electronic Health Record, launched in 2011 across

SII Spotlight: Iceland's Electronic Health Records System

As mandated by the Health Records Act, No. 55/2009, Iceland's HCPs are required to enter health records in an interconnected system to support coordination, collaboration and continuity of care

HealthNet Hekla

- Centralized channel used for storing and exchanging health information in Iceland
- All public and many private healthcare institutions are required to connect to Hekla for seamless exchange of information
- Compliance to directives on quality and security of health records is required for institutions to be connected to the Hekla platform

Vera

- Country's citizen health portal that must be implemented across all health institutions
- Can be accessed using individual eCards
- Used by citizens to access their health records, including history, lab results, and who accessed their data
- Working to integrate various patient health measurements, reminders, and access to information about waiting lists

Source: "National eHealth Strategy," Iceland Directorate for Health

public and private health institutions to support the vision of its "One Patient, One Record" program. Since its launch, NEHR has expanded to improve usability and introduce new clinical capabilities, ultimately creating a holistic, patient-centric, and longitudinal care record.[98]

Strengthen the Data Policy Framework

The risk and potential magnitude of cyberattacks on health infrastructure and data highlights the need for an integrated national healthcare data framework that not only regulates and facilitates the generation, acquisition, exchange, and use of healthcare data, but also incorporates comprehensive data protection guidelines.

The Chinese government has already demonstrated a growing focus on data protection policies with a range of legislative efforts in recent years. In 2020, the National People's Congress published the "Draft Data Security Law"[99] and the "Draft Personal Information Protection Law (PIPL)"[100] for public consultation. The draft legislation is China's first comprehensive legal framework for data security, protection of personal information, and cross-border data processing and transfer. The legislation is expected to complement China's existing "Cybersecurity Law",[101] which requires specific data to be stored within the country, and for organizations and network operators to be subjected to government security checks.

During SII working sessions, corporate representatives homed in on the issue of data protection, particularly with respect to the need for more comprehensive guidelines for patients and healthcare organizations. Prior to the publication of the draft "Data Security Law" and "Draft Personal Information Protection Law", there was no specific national law on data protection. This development is a step towards addressing the need for an improved and updated regulatory framework that supports an environment where data is both protected but also able to be leveraged for innovation. Furthermore, these laws are timely as they integrate stipulations that support pandemic prevention and control, introducing the legal basis of "necessity for coping with public health emergencies." It is essential for proposed data protection laws to clearly identify the roles and responsibilities of relevant government organizations, as well as the other participants of the ecosystem, in protecting healthcare data.

The emergence of the use of mobile apps and wearable devices as digital health applications has also given birth to new security risks, as existing laws lack coverage and will eventually become outdated. This highlights the need to reinforce data protection guidelines for patients and healthcare organizations that can provide flexibility to encourage innovations and maintain relevance. Similarly, data security policies should be standardized to promote and secure international cooperation for the development of

innovative digital health technologies.

Overall, data protection legislation must ensure that healthcare institutions and other relevant organizations have the right data-use governance model that includes: (1) a philosophy on how data will add value in delivering better healthcare services to the public while enabling new initiatives; (2) data use policies that determine how data can be used and what actions must be taken to protect its use; and (3) partner guidelines that specify how data will be protected as it is transmitted to and used by partner institutions.

The Health Insurance Portability and Accountability Act (HIPAA) of the United States is one of the most well-known examples of data security legislation with specific jurisdiction over health information. HIPAA was enacted in 1996 and remains relevant with vital modifications. Notably, the HIPAA applies to health-related mobile apps and wearable technologies[102] that allow users to share personal data with healthcare professionals (see SII Spotlight: The US Health Insurance Portability and Accountability Act for more details).

Invest in Infrastructure Development

To accelerate the adoption of these technologies, China is making significant investments in infrastructure development. During the height of COVID-19, the government announced a "New Infrastructure Initiative" designed to invest trillions of RMB into

SII Spotlight: The U.S. Health Insurance Portability and Accountability Act (HIPAA)

National standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge

Protected Information - Individually identifiable health information that is transmitted or maintained in any form or medium; excluding certain educational and employment records

HIPAA Security Rule – A stipulation with the HIPAA Privacy Rules the specifically covers all individually identifiable health information created, received, stored and transmitted in electronic form

Covered Entities
- Healthcare providers using electronic transmission of health information
- Health plans
- Healthcare clearinghouses
- Business associates that act on behalf of a covered entity, ex. claims processing

Permitted Uses and Disclosures
- Disclosure to the individual
- Treatment, payment, and healthcare operations
- Opportunity to agree or object to the disclosure of PHI
- Incident to an otherwise permitted use and disclosure
- Public interest and benefit activities

Source: "Health Insurance Portability and Accountability Act of 1996 (HIPAA)," U.S. CDC

emerging technologies around China.[103] "Healthy China 2020"[104] reiterated and reemphasized health information technologies as an important technical support point. Policymakers are also updating the legal and regulatory environment to support the provision of telemedicine services. However, it is imperative to ensure that the broad range of digital technologies being adopted to improve healthcare institutions help facilitate equitable access for all and not further exacerbate the gap between different segments of the population.

Data from 2017, showed that 97.25 percent of China's hospitals have a specialized information and technology department,[105] while a separate survey claimed that 69.21 percent[106] of sampled hospitals already had a wireless network infrastructure. However, the Chinese Hospital Association found that 56.29 percent of hospitals lack thorough digitalization development planning.[107] And without teams capable of spearheading digital transformation among healthcare institutions, the process will be slow and arduous, especially as the infrastructure for many of the advanced digital technologies being adopted for public health require significant experience and expertise to be built.

Building a robust infrastructure that can support digital health applications is where the private sector can provide the highest value. Healthcare institutions can leverage solutions providers' expertise in transitioning to more advanced technologies, particularly in the areas of artificial intelligence, data storage systems, big data and analysis, and development of mobile apps. A broad range of options are available, many of which can be tailored to institutions' specific needs.

For example, Dell Technologies built a new generation of IT infrastructure that processes medical data, provides intelligent storage, and administers data management in the healthcare industry to cater to Suzhou Municipal Hospital's need to reinforce the data security of its EHR system. The hospital's integrated storage system is now also enabled with emergency and remote disaster recovery, improving business service continuity, and remote dual-active mechanisms to ensure real-time data synchronization and continuous data protection.[108]

On a national level, utilization of digital health technologies should be inclusive and accessible to all. As such, network infrastructure should also be continuously upgraded, particularly in remote locations to serve as a foundation for wide scale adoption of digital health. This will reduce the digital divide, meaning residents living in rural areas will have the same level of access as those who live in more urbanized communities. Furthermore, ease of use should also be considered when investing in infrastructure and applications, to cater to the needs of a broader range of the population. Specifically, members of China's aging population who are not technologically adept should still be able to utilize public-facing technology interfaces with zero to very minimal training required.

Combating Covid-19 with GPU-Based Computing Platform

To date, COVID-19 is not yet under effective control in most parts of the world, especially with the mutation of the virus. The global ravages of COVID-19 have created a need for new approaches in the healthcare industry to enhance the ability to rapidly respond to large-scale medical situations, accelerate the tracking of pathogens, improve point-of-detection capabilities, and enable the rapid development of effective drugs.

To address this need, large-scale application of measures enabled by big data, such as tracing the source of infection through gene sequencing and locating the close contact person were adopted, have dramatically increased computing power requirements in a short period of time. Facing the future development of healthcare, as well as dealing with the next possible outbreak of a pandemic, it is necessary to make a reserve of computing power to deal with new challenges such as computing for larger-scale environmental genetic safety.

Graphics Processing Unit (GPU)-based gene sequencing technology has accelerated the progress of industries such as pathogen detection and tumor therapy. In the context of pathogen detection after the COVID-19 outbreak, the CDC was able to quickly confirm and release the sequence of the COVID-19 virus to the world by using the Oxford Nanopore third-generation sequencing system based on GPU computing. It laid the foundation for large-scale nucleic acid PCR testing and the development of mRNA vaccines. A huge quantity of genetic analyses and gene sequences comparisons are needed to detect and track pathogens and test the environment more quickly, more accurately, and on a larger scale. The amount of computation required is beyond what traditional CPU computing can provide, making GPUs the optimal option for such needs. In oncology, extensive genome-wide analysis to compare the differences between genes of cancerous cells and those of normal cells is required. The analysis of a column that would take days to complete using traditional CPU computing can be reduced to less than a few hours using GPUs. This significantly decreases the waiting time required for R&D and clinical purposes.

In the molecular field, cryoelectron microscopy has become a powerful tool for researching the structure and function of molecules. In the process of drug development against Covid-19, discovering and mapping the precise 3D structure of the virus is critical. With the NVIDIA DGX-1 computing platform, the complete structure of the virus can be examined from the inside out in 100TB tomographic images, and a typical complete 3D structure of the virus can be reconstructed with a resolution of up to 7.8Å. The successful examination of the complete molecular

structure of the virus has helped scientists around the world to gain a deeper understanding of its molecular structure, thus breaking the barrier of the "invisible enemy," which is of great significance for vaccine development and drug R&D. The disclosure of its structure will accelerate the R&D of vaccines and antibodies, supporting pandemic prevention and control, science education, and molecular dynamics simulation.

Meanwhile, by applying GPU acceleration in the field of drug development, high-precision screening of existing drug databases can be completed within a week to predict drugs with higher affinity, significantly improving the prediction accuracy of drug/target affinity. It can also improve the prediction speed, shortening the originally required 30-60 days to less than a day, and improving the efficiency by 30-60 times.

In the response to the pandemic, the efficiency of pathogen discovery and research on cure can be dramatically improved by using GPUs for massive data computation. Bringing together medical imaging, radiology and genomics functions, The NVIDIA Clara Discovery Advanced Tool Suite has been used to develop AI applications for some of the largest computing tasks in healthcare. The adoption of GPU-accelerated solutions by NVIDIA in the healthcare industry addresses the exponentially increasing demand for R&D as an integral part of the combat against the virus. In the post-pandemic era, GPU and AI technologies will continue to play a significant role, whether in the face of possible future pandemic outbreaks, research and application of cancer treatments, imaging diagnosis, or drug development and new use of existing drugs. Therefore, planning and build-up of GPU computing power will be imperative.

Planning and reserving GPU computing power for the healthcare industry will unlock the tremendous potential that big data can bring to the healthcare industry. It will accelerate the process of genetic analysis and drug development for the benefit of the people. In the battle against COVID-19, GPU-based supercomputing has played an irreplaceable role in pathogen identification, virus origin tracking, virus structure research, drug screening, AI intelligent diagnosis, and many other areas. With the accumulation of more medical data and the wider application of gene analysis in cancer treatment, disease control, and other fields, GPU-based computing power will become an indispensable infrastructure in the intellectualization and modernization of the healthcare industry.

NVIDIA CLARA

Intelligent Computing for Healthcare

Combating COVID-19 with AI-Empowered Medical Imaging and Genetic Analysis

With the approval of several AI medical products by the NMPA (National Medical Products Administration), diagnostic applications through AI are entering the practical stage. Meanwhile, genetic analysis is gradually gaining popularity in areas such as pathogen detection and cancer treatment.

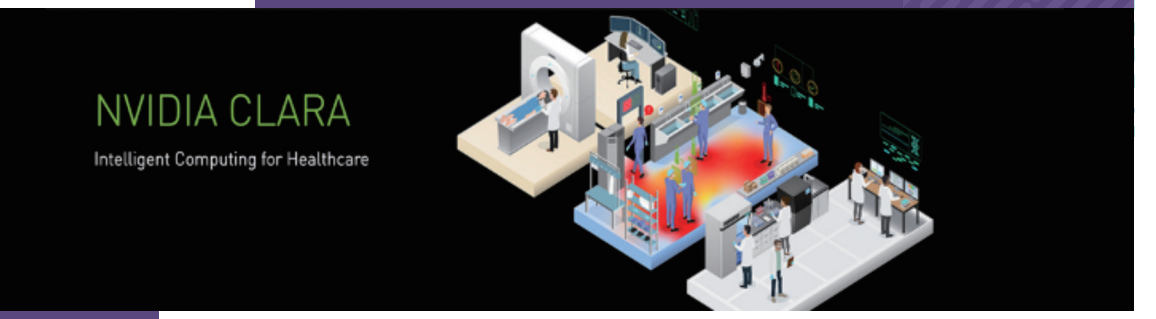
Taking medical imaging as an example, medical imaging today, including CT images and pathology slides, still takes a long time for doctors to diagnose, and the process is complicated and repetitive. Doctors often need to go through dozens or even hundreds of pathology images to determine the condition. And in the context of the global pandemic, where the shortage of doctors and medical resources has been magnified, deployment of efficient technical aids, such as AI platforms, has become a priority.

The NVIDIA Clara Imaging can accelerate the development and deployment of AI in medical imaging. For radiologists who are highly overloaded, GPUs can dramatically reduce the time for image reconstruction and analysis, as well as subsequent diagnosis to seconds. With the latest version of NVIDIA Clara's AI-assisted annotation tools and the new DeepGrow 3D feature, complex 3D CT data can be labeled with only one-tenth of the original number of clicks. The AI quantifies infected areas and visualizes CT report results, making it easy for doctors to analyze and review medical data.

The NVIDIA Clara application framework also integrates with NVIDIA's Federated Learning Program, which enables researchers and data scientists to collaborate on AI algorithms while ensuring data privacy and security, paving the way for closer collaboration between data scientists and clinicians.

Digitization of medical imaging is the starting point for the transformation of healthcare intelligence. Faster model training, coupled with the privacy-preserving multiple data sources provided by Federated Learning, can help organizations that have adopted the NVIDIA Clara Imaging platform to quickly complete model training for COVID-19 CT images and achieve higher accuracy rates in real-world applications, reducing the burden on doctors and speeding up the diagnosis of COVID-19 conditions.

Medical imaging will evolve into a model where human physicians and AI co-exist. NVIDIA uses AI to perform data processing work and provide structured reports that physicians can review on top of. This can greatly save physicians' time, so they can focus on judgment and patient communication.



In genetic analysis, analyzing genomic sequences often takes a lot of time and computing power, which can easily lead to missing the best time to control the outbreak. With NVIDIA Clara Parabricks running on NVIDIA A100 GPU, the complete analysis of the entire human genome DNA sequence can be done in less than 20 minutes. Meanwhile, the GPU-accelerated RNA sequencing solution can output results in less than 2 hours, so as to understand the patient's disease susceptibility, disease progression and treatment response, facilitating subsequent diagnosis and treatment, and providing powerful support for the fight against COVID-19. Besides, genetic analysis will also be widely used in cancer treatment, pathogen detection, rare disease diagnosis and treatment, and many other fields.

However, the penetration of AI genetic analysis in healthcare requires a large amount of computing power as support. The infrastructure of the medical system requires forward-looking planning and construction to facilitate the application of medical big data and AI technology in the healthcare industry. The planning and construction of GPU-based high computing power platforms for the medical and health care industry will boost the application of cutting-edge technologies such as AI and genetic analysis in the medical industry and provide a strong guarantee for maintaining people's health.

[CASE STUDY]

Enabling Hospitals with an Intelligent Medical Information Platform

With the rapid development of the healthcare sector and the continuous adoption of new technologies, the volume of data of healthcare organizations continues to grow at an accelerating pace. However, the resources required to store massive medical data is relatively high, and the data is scattered across various fragmented sources, making it difficult to share and interconnect. Due to this fragmentation, its overall value to healthcare services is still far from being effectively utilized. Moreover, new business needs continue to emerge, and the traditional hospital IT architecture cannot meet the challenges of these new scenarios. Healthcare organizations face the pressure of digital transformation.

To enable the healthcare industry's evolution, Dell Technologies has built a new generation of IT infrastructure around processing medical data, intelligent storage, and converged data management. Based on this system, Dell provides diverse computing and hierarchical data processing capabilities that help hospitals quickly analyze and highlight valuable information from massive amounts of data. The system establishes a Middle Platform for the healthcare information system to accelerate the digital transformation of healthcare.

In China, Dell Technologies provided Suzhou Municipal Hospital with an integrated solution based on the combination of all-flash memory, dual-active capabilities, and high-performance servers. Dell's solution accelerates the hospital's end-to-end information system, improves the overall operating speed of the business process, and builds an intelligent information platform for digital transformation.

Suzhou Municipal Hospital purchased 4 Dell EMC PowerEdge rack-mounted servers, with the original virtualized servers forming an integrated virtualized computing resource platform. All businesses are run on the platform in the form of virtual machines. The system also provides N+1 or N+M redundancy to improve business service continuity. At the same time, this digital platform also undertakes the tasks of local server emergency and remote disaster recovery, and serves as the back-end platform for client virtualization.

For the core storage facility, Dell EMC provided a remote dual-active mechanism for real-time data synchronization and replication. When one of the storages fails, it will automatically switch to the other storage, which has no impact on the entire hospital operation, to ensure the normal hospital operation. Through the capability of continuous data protection (CDP) function, the stored data can be automatically recorded twice in seconds to avoid data loss due to logic errors.

Dell Technologies' business is not only reflected in the data center solution. In

terms of end-client, the hospital has also introduced Dell OptiPlex high-efficiency desktops as clinical service workstations to provide high-efficiency services for all business lines, such as patient registration, waiting, diagnosis, payment, medicine collection, inspection, and laboratory test.

After adopting Dell Technologies' end-to-end IT solutions, Suzhou Municipal Hospital has improved both at the business and IT levels:

- According to the response of various clinical departments of the hospital, the processing efficiency of its clinical business has significantly improved, with response speed at two to three seconds, enhancing patient's clinical service experience
- Helped users achieve the best balance between performance, capacity and cost, as well as reduced storage costs by 50% under the premise of guaranteed performance
- Provided an integrated backup appliance to provide a highly reliable physical security mechanism for the entire system's data, reducing risks from intended or unintended errors such as data file damage or loss, database table misoperation or deletion, and database instance damage, with the hospital's IT staff able to quickly restore backups within minutes

[CASE STUDY]

Enabling Smart Hospitals and Connected Healthcare

Driven by aging demographics, chronic diseases, limited resources, and more stringent policies and regulations, the healthcare sector has been facing significant increase in demand, as well as tighter cost controls. These place significant stress on existing infrastructure and old processes.

To alleviate this problem, Honeywell has been active in establishing partnerships with hospitals around the world to improve a broad range of medical environments and facilities. Leveraging its extensive experience, Honeywell designs Internet-of-Things-enabled solutions for connecting facilities, healthcare professionals and patients to improve the quality of care and improve operational efficiencies.

Hospitals digitalized using Honeywell's solutions automate and integrate infrastructure systems to ensure rapid information flow, comprehensive monitoring and more agile operations. It holistically improves hospitals' operational performance to ultimately deliver better patient experience. Some of the features of a Honeywell-powered digital hospitals include:

Security Systems – Site-wide monitoring with cameras and video analytics that provides alerts on suspicious activity, restricts access to certain areas, and notifies rapid-response providers of potential security breaches

Smart Navigation – Smart system that guides around the hospital via their smartphone or separate kiosk through real-time location and integration with building monitoring systems

Patient Notifications – Patients can pre-register from home and be informed of expected wait times, while visitors to the hospital are notified via their mobile device when their physician is ready

Patient Care and Coordination – Paperless electronic health records, scanners and mobile computers or "clinical smartphones" help track patient samples and documents, while workflow automation technologies and smart alarm systems free up nurses for critical tasks

In China, Honeywell enabled the incorporation of IoT technologies in in East Branch of Qingdao Municipal Hospital, a medical facility located in Shandong province and one of the designated hospitals of 2008 Olympic Games. The hospital is now equipped with HVAC, air filtering, lighting, security and analysis features centralized in one system. This allows Qingdao East Hospital to provide 24/7 comfort, energy, safety, cleaner air, and automated responses to the needs of its patients throughout the facility.

Recommendation #4: Develop Alternative Health Financing Options

According to the World Health Organization, the goal of universal health coverage is, "to ensure that all people obtain the health services they need without suffering financial hardship when paying for them."[109] Furthermore, the organization believes that a well-established health financing system is essential in achieving the objectives of universal health coverage. Securing universal health coverage and addressing health inequity are not limited to providing individual health insurance coverage, but include provision of a resilient environment able to withstand times of crisis. Provision of health coverage is best understood through three dimensions: 1) depth (proportion of services covered), 2) breadth (extent of the population covered), and 3) height (extent of financial protection) of health coverage. In this light, SII's health financing recommendations focus on enhancing the capabilities of BMI, advancing the status of the PHI industry and emphasizing the contributions of both public and private health financing in securing universal health coverage and addressing health inequity.

Boost Basic Medical Insurance Coverage and Accessibility

China's Basic Medical Insurance Schemes can greatly benefit from leveraging online channels, expanding coverage to private healthcare services, revisiting the National Reimbursement Drug List to include medically necessary over-the-counter drugs, and redefining solutions for claims, reimbursements, and payment processes.

The transition of BMI processes and procedures to a single online channel would benefit both China's government and its population. Doing so would decrease paperwork, eliminate complicated bureaucratic processes, and promote access for remote communities. Another recommendation that could address ease and convenience of insurance processes is to allow reimbursed funds to be wired directly to personal bank accounts.

Taking cue from the NHSA's inclusion of some internet-based medical services to BMI and the rise of internet hospitals in public health facilities, it is recommended that the government expand coverage to include a greater number of online and digital health offerings existing and emerging in China. Expanding coverage could also include some private services and drugs procured at private hospitals, particularly those that are not currently available in public health facilities. These two recommendations are complementary as private health facilities lead innovation in digital health.

A next step to further integrate the private health sector would be to fully integrate BMI and PHI and develop new incentives for the private health sector in general, PHI providers included. One example would be to grant private healthcare service providers

greater independence and the ability to operate with market-driven flexible pricing. This would aid the development of public health financing, reduce health expenditures, and encourage innovation in the healthcare sector.

In fact, some Chinese cities have already experimented with this. In the past two years, cities have launched their own versions of "Huimin Insurance". As a supplemental health insurance, it has established a new business model, in which the government is responsible for publicity, the insurance company is responsible for underwriting and claims, and the third-party platform is responsible for promotion and customer acquisition. The "Zibo Qihui insurance" launched by Zibo government, for example, was led by the local Healthcare Security Administration, Banking and Insurance Regulatory Commission and other departments in cooperation, joint by twelve joint life insurance companies include Pacific Life Insurance and China Life and utilized Tencent "micro insurance" platform. Zibo citizens only need to pay 99 yuan a year to enjoy 80% insurance coverage of any out-of-pocket money that's more than 20,000 yuan during hospitalization, making up for the gap in basic medical insurance coverage of large medical expenses. Similar Huiminbao programs have landed in more than 100 cities in China, gradually replacing "online mutual aid" as the first choice for most people to supplement their medical insurance.[110]

Although this model is facing multiple challenges in its development, such as sustainability issue due to low payments and excessive benefits, the inconsistency and ambiguity of government role[111], and the fact that reimbursement is still largely limited to the coverage list of basic medicare insurance[112]; Huiminbao, as a currently successful public-private partnership program model, is still a major direction worth exploring for future health insurance financing option in China.

Singapore's health care system is based on the country's social and commercial insurance system. Singapore's Medishield Life is the basic government-backed insurance scheme. Under this scheme, all Singaporean citizens and permanent residents, regardless of age or health status, are entitled to insurance coverage for life including medical expenses incurred by critical diseases. In addition to lifetime health insurance, most people will also get Integrated Shield Plan, which are partly covered by commercial insurance. The Integrated Shield Plan gives more options for insurees and covers the high medical costs of private hospitals. Singapore combines the two types of insurance and simplifies the process of settlement of claims.

Establish Policy Reforms to Aid Development of the Private Health Insurance Industry

The government has a key role to play in raising the awareness of the benefits offered

by private health financing options. As mentioned in challenge 2, development of PHI in China faces policy obstacles. Policy reforms starting with an enhanced regulatory framework are essential to aid the anticipated growth of China's private health insurance sector. Specifically, health insurance regulators should refine policies for data use and security governing digital tools of insurance and digital health applications potentially to be covered by insurance.

Health financing can also reinforce emergency response efforts. For instance, during public health emergencies, the government takes the leading role and covers the associated expenses. The private health sector, including private health insurance, should focus on covering preventive healthcare and encourage individuals to protect their own health to build up general resilience among the population, and enable more effective responses.

In Australia, private health insurance policy reforms were introduced in 2019 to expand insurance coverage, improve accessibility, promote consumer awareness, and protect consumer interest.[113] These reforms included simplified classification of coverage inclusions, discounts for specific demographics, expanded coverage for mental health treatment, and a refined regulatory framework. These reforms also determined a minimum standard for private health insurance providers to protect consumers and encourage product differentiation to facilitate market growth. The Australian government also facilitates PHI penetration by providing rebates to qualified health insurance holders to help cover the cost of premiums.[114]

Promote Digital Health Adoption in the Health Financing Industry

The rise of Insurtech[115] in China gave birth to the digitalization of healthcare financing. The pandemic's social distancing rules made it a vital disease control strategy. Private health insurance can catalyze this digital transformation by recognizing the benefits of emerging technologies and innovative solutions in promoting PHI accessibility and market growth.

Specifically, SII working session participants recommend the use of blockchain solutions as a foundation for financial processes. Blockchain has been widely adopted in the financial services sector and increases social trust in commerce. Its adoption in the healthcare sector could help in providing secure payment and reimbursement capabilities that gives patients greater confidence in their healthcare transactions and a greater degree of control over their personal information.

Insurance providers can also leverage big data and AI technologies to develop new products and improve general operations. Specifically, big data can be used for underwriting, to estimate the cost of insurance products, forecast profit margins, and predict diagnostic outcomes more accurately.

Furthermore, PHI providers can expand coverage to digital health applications as they become more widely used and essential in healthcare and disease management. Including payments of digital health applications in insurance will also promote patient access to innovative treatment and management solutions, allowing for the development of medically necessary digital technologies.

A 2019 law allows doctors in Germany to prescribe digital health apps to patients, with fees incurred on purchases through the apps reimbursable by health insurance. Apps are covered by a regulatory framework that requires them to prove efficiency of the app in improving patient care. This "Digital Supply Law"[116] promotes digitalization of Germany's health services by incentivizing online consultations, electronic medical letters, and e-prescriptions. It also allows the use of anonymized patient data to be used for medical research.

Improve the accessibility, affordability, and coverage of PHI

China has already achieved notable success in providing Universal Health Care that is able to support a majority of its population.[117] The private health insurance industry could help fill in the unaddressed gaps in the state-mandated BMI. For instance, PHI could offer demographic-specific products that will cater to special (at-risk) population segments and disadvantaged groups (e.g., elderly, disabled, minority), as a means of actively ensuring socially impactful solutions to address health inequity. They could also expand coverage to include a greater number of healthcare products and services to increase their attractiveness for potential consumers. Specifically, coverage should include medical consumables to increase its attractiveness for consumers as these are often costly for patients to obtain and rarely covered by typical health insurance policies. Long-term care should have the flexibility to be integrated into private health insurance offerings and could supplement the state-managed long term care system. This is forecast to be of greater demand with China's aging population. Lastly, PHI can consider offering custom-made insurance and provide a window of opportunity for special medical cases.

In Canada, the Non-Insured Health Benefits[118] program provides qualified members of First Nations and Inuit communities with coverage for a range of health benefits that are not covered through other health financing options. First Nations and Inuit communities are a minority in Canada and enjoy a range of state-mandated subsidies and benefits. This program recognizes the financial vulnerability of indigenous peoples and provides expanded coverage of health insurance to medically necessary goods and services including OTC drugs, transportation, mental health counselling, medical consumables, and equipment.

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