Enhancing Telehealth in Singapore

Organised by

NUS National University of Singapore

Saw Swee Hock School of Public Health

In partnership with

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The "Enhancing Telehealth in Singapore" programme involved a series of seminars and workshops conducted between 2023 and 2024. Organised by the National University of Singapore Saw Swee Hock School of Public Health, in partnership with Temasek Foundation, the programme brought together healthcare policy leaders, researchers, hospital administrators and clinicians to:

1. **Enhance the applications of telehealth** by identifying gaps and challenges in telehealth, and develop solutions to better deliver telehealth services in Singapore
2. **Improve patient experiences** using telehealth services
3. Share and encourage developments in telehealth for **pandemic preparedness**

The following report provides insights on the issues, challenges, concerns and desired standards in telehealth for the Singapore population.

What is telehealth?

Telehealth may seem like a modern phenomenon, but in fact, early innovations in Singapore a few decades back laid the groundwork for what we now call telehealth. While many of us associate telehealth and telemedicine with virtual consultations with a medical doctor, telehealth encompasses a broad suite of digital platforms and services that enable healthcare to be delivered from a distance—be it through teleconsultations, remote monitoring devices, or virtual care teams collaborating online.

Today, telehealth in Singapore has diverse use cases such as tele-psychiatry, tele-geriatrics, tele-dermatology, and tele-cardiology. The telehealth platforms utilised today are also diverse, ranging from messaging applications (e.g. WhatsApp, Viber, LINE) for patient-reported outcomes to fully integrated platforms offering remote monitoring and virtual consultations. These technologies offer the promise of a more seamless and connected healthcare experience, especially for the elderly and those managing chronic diseases.

Local telehealth adoption lagged behind other leading countries, partly due to low-bandwidth constraints, resistance by providers and a conservative regulatory environment. However, the strong healthcare infrastructure and supportive policy direction—culminating in frameworks like the National Telemedicine Guidelines (2015) and, later, the Healthcare Services Act (HCSA)—have provided a solid foundation on which telehealth flourished in Singapore.

> ***DID YOU KNOW***
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> *The 2015 National Telemedicine Guidelines (NTG)[1] defines telemedicine (used interchangeably with telehealth) as the "systematic provision of healthcare services over physically separate environments via Information and Communications Technology (ICT)".*
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> *Telehealth is broadly categorised into the following four domains:*

Tele-collaboration *Refers to interactions between (facility-based or mobile) onsite and remote healthcare professionals for clinical purposes e.g. referral, co-diagnosis, supervision or case review.*	***Tele-treatment*** *Refers to interactions between remote healthcare professionals and patients or caregivers for direct clinical care from a remote location.*
Tele-monitoring *Refers to remote collection of biomedical and other data from patients or caregivers for disease monitoring and home nursing.*	***Tele-support*** *Use of online services for non-clinical purposes, such as health education and care administration to support patients and caregivers.*

Benefits of telehealth

The Singapore Integrated Diabetic Retinopathy Programme (SiDRP),[2] *launched in 2018, is an example of the utilisation of telehealth to improve the quality and efficiency of healthcare services. SiDRP relies on advanced IT infrastructure to transfer field images from diabetic patients to reading centres, allowing tele-ophthamology reports to be generated by accredited trained readers almost 'real-time' (within an hour). This is a significant improvement from traditional practice where screening for diabetic retinopathy was carried out without standardised protocols across GP clinics, with reports that took 2 to 3 weeks to be returned.*

Improve healthcare accessibility

One of telehealth's biggest advantages is its potential to increase access to healthcare, especially for the elderly or those with mobility issues. Homebound patients can connect with doctors via telephone or video call. For those juggling work and family responsibilities, teleconsultations are more convenient, reducing waiting times and travel expenses. Rural regions across the world have leveraged telehealth to reduce delays in care due to transferring patients or flying in doctors.

Improve healthcare affordability

Cost savings arise from multiple fronts. For patients, teleconsultations eliminate direct costs like transportation fares and indirect costs like time-off-work expenses. For healthcare systems, remote visits free up physical space and staff for the cases that truly require in-person care. When doctors are able to triage stable or routine follow-up cases virtually, clinical resources and physical spaces are freed up for more complex cases needing in-person consultations. This streamlining helps healthcare institutions allocate manpower more effectively. Additionally, as the user base grows, telehealth solutions become increasingly cost-effective due to economies of scale and improved resource utilisation.

Improve healthcare empowerment

Telehealth also plays a part in enhancing patient engagement. Studies have shown that people managing chronic conditions become more proactive about their health when given user-friendly apps and devices. Older adults in Singapore have demonstrated a willingness to learn and use telehealth platforms—provided these tools are intuitive and genuinely make life easier. Education is another element worth incorporating telehealth solutions to. If educational materials such as disease specific knowledge can be incorporated into clinical workflows, patients will benefit from carefully curated information by health professionals and utilise precious in-person consultation time to address other questions and concerns.

Is telehealth safe?

As telehealth has grown, so too have the questions around patient safety, clinical quality, and data protection. The National Telemedicine Guidelines (NTG) released in 2015 set out essential standards, including the need for secure data storage and transmission, the importance of informed consent, and the expectation that teleconsultations meet the same standard of care as in-person visits. In practice, this can mean having clear protocols for when a teleconsultation should be escalated to a face-to-face examination, particularly for conditions that require more detailed physical assessments.

The License to Experiment and Adapt (LEAP) sandbox[3] *provided critical insights that informed the development of Healthcare Services Act (HCSA)*[4] *regulations. Launched in 2018 till 2021 with a focus on telemedicine, a comparative analysis of telemedicine episodes against a propensity-matched cohort demonstrated that telemedicine outcomes for emergency department attendance and hospitalisations were not worse than in-person care. The sandbox also highlighted distinct risks in telemedicine compared to face-to-face consultations, emphasising the necessity for additional provider training. This led to the start of Ministry of Health Telemedicine e-training programme*[5] *in March 2020 for providers to design and deliver telemedicine services. Furthermore, it facilitated the implementation of risk mitigation strategies, such as symptom-based patient selection during virtual queues to triage conditions unsuitable for remote management, ensuring patient safety and service appropriateness.*

The transition from the Private Hospitals and Medical Clinics (PHMC) Act to the Healthcare Services Act (HCSA)[4] has further formalised these safeguards. Under HCSA, telemedicine providers must complete the e-training and adhere to guidelines on conditions appropriate for remote management. The legislation also recommends two-way, real-time video communication to ensure doctors can visually assess the patient's condition, instead of relying on audio-only phone calls. An important requirement is having contingency plans for emergencies, such as protocols for sending an ambulance if a remote assessment raises red flags about a patient's condition.

The regulatory landscape for telehealth in Singapore has evolved to balance innovation, safety, and clinical quality, with HCSA providing a structured framework for oversight. While these guidelines offer a robust framework, there remain concerns from the public about the limitations of physical examination capabilities and cybersecurity risks with telehealth. Continuous refinements and developments in the technological and regulatory space will ensure that telehealth remains safe, effective, and adaptable to emerging healthcare needs.

Is telehealth only for a pandemic?

The global COVID-19 pandemic irrevocably changed how healthcare services are delivered. Lockdowns, social distancing requirements, and overburdened hospitals forced both patients and providers to look for new models of healthcare provision. Out of necessity, telehealth took centre stage. No longer just a convenience, telehealth was key to maintaining medical services while minimising infection risks. As society emerges from the pandemic's grip, one pressing question remains: Is telehealth only for a pandemic, or will it continue to shape healthcare in the years to come? The consensus, based on experiences from Singapore and beyond, is that telehealth is here to stay, evolving from a stopgap measure into a core component of modern healthcare.

A LITTLE BIT OF HISTORY

Telemedicine has roots in history, demonstrating its long and continuously innovative journey. For instance, the National Aeronautics and Space Administration relied on telemedicine to provide healthcare to astronauts since the 1960s,[6] while the US Military Health System has applied telemedicine as far back as the 1990s.[7] Singapore's interest in telemedicine started in the 1980s with maritime radio-medical services,[8] and the first article on telemedicine in the local newspaper, The Straits Times ("See a doc – via computer") was actually published on May 8, 2000.[9] Telehealth is thus by no means new, and our enduring interest in leveraging technology to enhance healthcare delivery, suggest the potential for telehealth to continually develop and grow.

Telehealth's pivotal role during the pandemic

Remote monitoring and home recovery[10]

One of the most notable examples was the Home Recovery Program (HRP), where SARS-CoV-2-positive patients with mild symptoms recuperated at home under virtual supervision. This approach was made possible with support from General Practitioners who provided teleconsultations to patients. It alleviated pressure on hospitals, provided patients with the comfort of being in familiar surroundings, and allowed healthcare providers to manage more cases safely and efficiently.

Centralised vital signs monitoring platform

COVID-19's quarantine facilities uncovered a need for a centralised IT platform for remote monitoring, leading to the design of innovative platforms such as Health Discovery (HD) to collate patient's self-entered vital signs. This later evolved into Health Discovery Plus (HD+),[11] and provided scalable, cost-effective ways to track patients' conditions from home for programmes like Primary Tech-Enhanced Care (PTEC) for hypertension and diabetes.[12]

Mobile Inpatient Care @ Home[13]

The Mobile Inpatient Care @ Home (MIC@Home) model was swiftly adopted by all healthcare clusters in Singapore to expand their "virtual hospital" capacity. Initially starting with just a handful of virtual beds for non-COVID patients, the programme scaled up rapidly during the Delta and Omicron waves to handle a surge of COVID-19 patients at home. The MIC@Home enabled care of low-acuity patients outside traditional hospital settings. The patients received remote vital signs monitoring and consultations, helping to reduce unnecessary in-person visits that could put both staff and other patients at risk. MIC@Home had scalability and flexibility, particularly in managing patient capacity during the COVID-19 pandemic. However, manpower availability was more important than physical space for creating a flexible system. Early feasibility studies and findings from the COVID-19 response found no difference in clinical outcomes between hospital-at-home and traditional hospital care.

MIC@Home: A Continued Alternative to Inpatient Care

The Mobile Inpatient Care-at-Home (MIC@Home) programme[13] started as a pilot during the COVID-19 pandemic. This home hospitalisation service model provides patients the convenience and comfort of receiving acute clinical services and care typically provided at hospitals at home. While patients and caregivers generally accepted home treatment, clinicians had concerns and reservations about its safety and effectiveness. Building relationships and demonstrating the programme's effectiveness were deemed crucial. MIC@Home was mainstreamed on April 1, 2024. Today, patients can use their savings in their MediSave account, as well as insurance payouts from MediShield Life and Integrated Shield Plans to cover MIC@Home services.

Care for acute and chronic health conditions

Organisations such as SATA CommHealth stepped up to provide teleconsultations for migrant workers via the MWC Care application.[14] A telemedicine playbook with step-by-step instructions was developed. Tele-rehabilitation services were provided to older adults as an alternative to their "Doctors on Wheels" programme that delivered subsidised or free community medical services to disadvantaged residents.[15]

Psychiatric and mental wellness services

In-person consultations during the pandemic were often compromised by masks, which obscured facial expressions that can be crucial for diagnosis and rapport-building. Psychiatrists and mental health professionals found that virtual consultations offered face-to-face interactions without the physical barrier of a mask, leading to more open communication.

Doctors historically expressed resistance to telehealth due to concerns about patient safety, professional liability without in-person examinations, care financing, care pathways and cybersecurity issues. Over the course of the COVID-19 pandemic, doctors became far more receptive when they recognised the ability of telehealth to reduce infection risks, protect staff, and still maintain a high quality of care. There was also increased acceptance of home care and remote monitoring among patients, facilitated by government support. The pandemic effectively broke down long-standing resistance and changed mindsets, setting the stage for a new era in healthcare.

Investing in telehealth for pandemic preparedness

Investing in telehealth during "peacetime" is crucial for pandemic preparedness as it ensures that technology and infrastructure, clinical workflows and public trust are in place and ready to be scaled rapidly in times of crisis. While the nature and transmission pattern of infectious diseases in the next pandemic may be unpredictable, the development of a robust telehealth ecosystem allows us to quickly adapt to changes, ensuring a resilient health care system.

Key Areas for Investment	Rationale
Interoperable Data Standards	• Ongoing discussions between the Ministry of Health, Synapxe, regional healthcare clusters, and private healthcare providers on data harmonisation help to ensure continuity of care for patients across care settings and care modalities
Technology Infrastructure	• Continued investment in telehealth platforms and capabilities by providers and health tech agencies ensures that systems remain up-to-date, secure, seamless, and scalable. The sharing of expertise and solutions allows for rapid innovation and improved outcomes
Patient and Provider Training (including for vulnerable populations)	• Patient and provider willingness and ability to embrace telehealth is crucial during pandemics. Facilitated discussions across care providers, and between care providers and patient representatives enable the enhancement and integration of telehealth services across primary, secondary, tertiary and intermediate to long-term care settings
Financial Support	• Effective financing mechanisms ensure the affordability and sustainability of telehealth services
Regulatory Enhancement	• Strengthening regulatory frameworks to enhance compliance with standards of care helps build patient trust in telehealth

Designing telehealth for long-term relevance

Ensuring that telehealth remains a core healthcare modality rather than a temporary fix requires deliberate design and sustained support. Although the pandemic highlighted telehealth's potential, translating that success into permanent practice depends on multiple factors.

Incorporating Financial Levers in Promoting Telehealth Adoption

Sustainability for providers with high start-up costs for devices and IT systems can be a challenge. Financial incentives, such as enabling the use of insurance or MediSave for telehealth, can help build a user base to achieve economies of scale.

Iterative Development and Minimum Viable Products (MVP) Approach

MVPs allow providers to test if telehealth solutions address immediate needs. Providers should be prepared for iterations and refinement through continuous feedback. Iterative improvements ensure telehealth remains user-friendly, adaptable, and clinically relevant over time.

Targeted Patient Populations and Environment

Patients with chronic health issues and supportive home set-ups often excel with remote monitoring, thanks to greater motivation. Those with fewer health concerns may be less inclined to engage, hence strategic incentives and outreach to the right user segments are essential for broader impact.

Streamlining and Simplifying Regulations

Complex or inconsistent regulations can slow telehealth's growth. Simplifying regulations while safeguarding patient data and clinical standards is key to ensuring telehealth's relevance in healthcare for the long run.

Looking ahead

The pandemic served as a catalyst, propelling telehealth from a niche service into a cornerstone of contemporary healthcare delivery. Telehealth is not a panacea; it is an enabler that fits into a broader healthcare ecosystem. As telehealth becomes more deeply embedded in everyday healthcare, the focus shifts to refining the technology, training practitioners, and developing robust governance frameworks.

While telehealth continues to play a vital role in pandemic preparedness, it has transcended its pandemic origins. Supported by evolving technology, changing patient expectations, and ongoing initiatives like HealthierSG,[16] it stands poised to remain a vital component of healthcare for decades to come. The challenge now is to harness its full potential responsibly, i.e. in balancing convenience with quality, and innovation with patient safety, so that telehealth truly becomes an integral, sustainable aspect of modern medicine.

Patient-centred telehealth design

Patient-centred design is not just a good practice but a core principle for telehealth. Improving patient experience drives the adoption of telehealth services, and encourages patient empowerment. It is important to develop a product that people want, and to consider their preferences in terms of design and costs. Patient experience should be monitored throughout their telehealth journey, using tools such as a recently validated telemedicine Patient Experience Index (diagram).

User-experience in design

Prioritising user experience in telehealth design is key. Outcomes such as usability and usefulness should be measured alongside clinical effectiveness. Measures related to user experience include software stability and usability, perceived usefulness, user experience and context fit.

Based on a study conducted in 2023 by the Institute of Service Excellence, Singapore Management University, perceived care quality has the greatest impact on patient satisfaction for teleconsultations. In turn, the factor that had the greatest impact on the quality score for teleconsultations was the time to get an appointment. Other factors that affected patients' perceived care quality included platform simplicity, care provider sensitivity and empathy and waiting experience before appointments. While teleconsultations increased convenience for patients and reduced their risk of exposure to communicable diseases, potential pain points include a more transactional doctor-patient relationship, lack of empathy from healthcare providers and difficulties in rescheduling appointments.

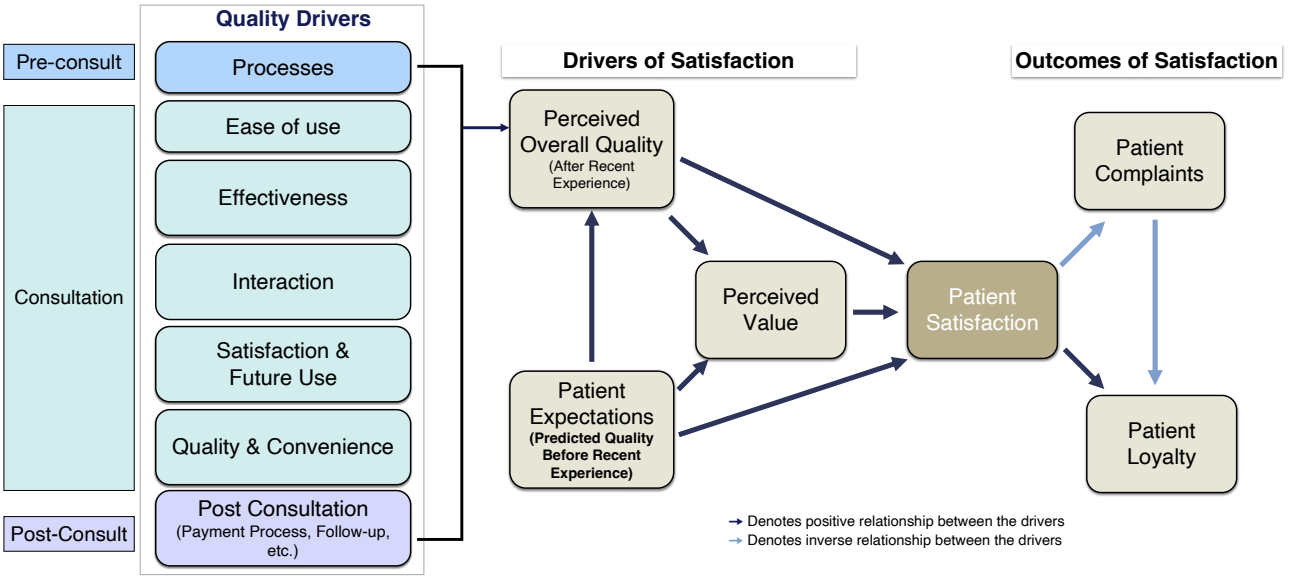

Diagram: Drivers Of Overall Quality For Telemedicine

Findings from the study identified factors pertaining to service quality, digital experience and healthcare-related information that requires change to improve the patient experience.

Service Quality	Digital Experience	Information-related
• Assurance - Ensure that consultations are not rushed • Comfort - Make patients feel comfortable to share concerns • Concern - Make patients feel that providers are concerned about their condition • Empathy - Improve empathy during virtual consults	• Video call options - Provide consultations over websites • Ability to make changes online - Allow patients to change timing and modality of appointment on app* • Add family members - Provide an option to add more profiles for one account • Make the process seamless - Improve continuity between virtual providers & physical clinics	• Instruction guide - Provide an instructional guide on what to expect from telemedicine consultations • Info about doctors - Provide more information about the doctors when booking a consultation

Table: Areas For Improvement in Telehealth Services

The human interaction and reassurance from doctors through telehealth consultations is critical to patients' care experience. It is important for telehealth providers to address patient concerns such as anxiety caused by delayed or unplanned calls either via the mobile phone or Zoom.

In telehealth design, besides targeting the most enthusiastic users, UX designers should also engage those who may not be as technologically savvy and design a telehealth product that is simple and easy to use. It is also important to assess the use cases for the telehealth service. Not every telehealth solution needs to be designed for full adoption by the population, and heterogeneous needs should be taken into account when developing healthcare services.

Health and healthcare delivered through telehealth should be weaved into everyday life in a seamless way, using technology to support patients without requiring them to make significant changes to their daily routines. Technological systems that work in the background and collect health data without extra effort from patients (i.e. ambient monitoring) can help avoid burdening patients with additional health-related tasks (e.g. manual tracking in traditional monitoring methods).

Caregiver-centred design

Besides patients, the perspectives of families, and caregivers are also important. A strong support system for families and caregivers, with clear communication from healthcare professionals to keep them updated during the care journey, is important. Patient and caregiver engagement in the co-creation of telehealth solutions can help to address potential blind spots. Patient and caregiver engagement, interaction and learning should be continuous throughout the implementation process, as telehealth services require adaptation and improvement along the way. It is also good to integrate patient support groups into the telehealth design and implementation process, as they comprise motivated individuals who can support new patients and partners in the telehealth and healthcare journey.

Given the recent introduction of newer models of telehealth, such as MIC@Home, it is important to provide patients and their caregivers with clear explanations, resources and training on the telehealth service in advance, and address their concerns regarding the quality of care, trust in the system, privacy, availability of services and alternatives, and costs. Studies on digital caregiving in Singapore and abroad underscored the need for more support for caregivers, addressing challenges such as usability barriers and the necessity for secure digital delegations.[17] Staff should be familiar with the tools and applications that patients will be using, and regardless of the technology, it is critical to maintain a good doctor (or healthcare professional)-patient relationship.

Finally, it is imperative to recognise that caregivers are a heterogeneous group, ranging from family members, paid caregivers, unpaid caregivers, social workers to volunteers; telehealth solutions should thus be catered to different caregiver demographics and needs. Given the diverse backgrounds of caregivers and domestic helpers, it is also important to address language barriers by translating complex concepts in telehealth into various native languages (e.g. dialects, Burmese). As circumstances can change over time (older caregivers can become patients themselves over time, and as caregiver stress increases with increased durations of caregiving), caregivers' suitability to facilitate telehealth services for their care recipients should be reassessed periodically. Caregiver support, such as through tele-support, should be in place.

Telehealth for vulnerable and disadvantaged groups

For telehealth services involving young children and people with disabilities, caregiver engagement and social support are crucial to success. As telehealth shifts even more responsibility onto caregivers—such as monitoring and reporting vital signs—it is essential that healthcare professionals, family members, and the wider community refrain from blaming them if adverse outcomes occur. Blame only increases caregiver burden and stress; instead, the community should focus on offering support. Developing objective diagnostic criteria can reduce reliance on subjective judgment, and automating tele-monitoring systems can give caregivers greater assurance.

Home Ventilation and Respiratory Support Service (HVRSS)

Home ventilation is a form of telehealth service that provides mechanical ventilation to children and adults who have breathing insufficiency. Home ventilation is a life-sustaining procedure that enhances the quality of life of patients, "by allowing them to live at home and pursue a lifestyle and activities with as much autonomy and dignity as possible". Multidisciplinary teams have been set up in KKH (est. 2001), TTSH (est. 2009) and NUH Paediatrics (Est. 2014). The HVRSS[18] at TTSH supports patients such as those who suffer from degenerative neuromuscular diseases, spinal cord injuries, skeletal, cardiovascular and respiratory disorders. Continued investments in resources and funding for manpower and telehealth services are crucial to ensure high-quality care for such patients given growing patient loads with an ageing population.

Telehealth holds particular promise for the care of older adults, who often face mobility challenges. Although older people are commonly assumed to be digitally illiterate, patient-centred designs that accommodate larger text and screens, simplify interfaces, and account for varying levels of digital literacy can make telehealth more appealing. Remote check-ups and reviews can improve healthcare access while reducing travel time and transport costs. However, it is important to remain sensitive to factors that may cause resistance to telehealth, such as fears that a digital-first approach will reduce contact time with family members and limit social interaction compared with in-person appointments.

For patients who opt for home ventilation and end-of-life care (hospice care) delivered remotely, a high touch relationship between nurses, doctors, patients and their caregivers needs to be maintained. Informal investments in patient care and the coordination of care, such as time spent by healthcare workers advising and supporting patients and their families, including after office hours, are often difficult to quantify and fully account for. Continual investments in resources and funding for manpower and telehealth services are crucial to ensure high-quality care for such patients given growing patient loads with an ageing population.

Abuse of telehealth services

As telehealth services become more widely adopted, instances of misuse have been reported. Examples include unusually short teleconsultations, repeated issuance of medical certificates without valid clinical justification, and inadequate medical record keeping. Some issues arise from ethical breaches by healthcare professionals, but may also be driven by patients feigning illness to avoid work. Such patients may seek telehealth without clinical need. While improving patient education may help, previous efforts to provide health information have shown limited success.

These strategies could be adopted to improve the safety, quality, and effectiveness of telehealth services:

Enhancement of triaging systems
Create more effective chatbots, and triaging systems that can manage patients who may be less familiar with their health conditions.

Enhance training, standards and governance for healthcare providers
Strengthen provider training and accreditation, with a focus on communication and assessment of visual or body language cues across diverse patient groups. In addition to guidance on compliance with regulations and professional standards for telemedicine services, regular audits of clinical notes and processes could help raise the standard of clinical documentation and ensure that telehealth outcomes are comparable to, or better than, in-person care.

Strengthening online-to-offline capabilities
Integrate telehealth services with clinical support services (e.g. imaging support, mobile phlebotomy, allied health services), to reduce healthcare providers' reliance on patients' self-reported information for clinical diagnosis

Ensuring continuity of care
Enhance post-consult services and arrange follow-ups with familiar doctors via teleconsultations, enabling ongoing monitoring of patient outcomes and health status changes.

Knowledge exchange on adverse outcomes
Sharing insights from telehealth-related adverse events, near-misses, and errors helps other providers prevent similar incidents.

Professional telehealth environments
Deliver telehealth services from traditional healthcare settings or dedicated telemedicine pods equipped with up-to-date technology can enhance care quality, patient confidentiality, and provider accountability.

Sharing of medical history across providers
Enable the secure sharing of medical histories among healthcare providers enables comprehensive monitoring of patient's health conditions and their history of healthcare utilisation. Clinical rationale for each prescribed medication is included. Secure verification of patient identities facilitated by government technologies - such as Singpass.

Systems integration in telehealth

Integration and interoperability

For broad telehealth adoption, seamless systems integration is essential. Individual providers across different hospitals, polyclinics and private medical clinics may develop their own telehealth applications. However, this approach can lead to care fragmentation and user frustration. A fragmented telehealth system makes it harder for patients to coordinate their care, share information, and access the services they need. There is thus a need for a more streamlined and connected system. This integration may be across GP clinics, as well as across primary and tertiary care levels. In addition, given that the provision of public healthcare services is currently segregated into 3 independently managed integrated healthcare clusters (National Healthcare Group, National University Health System, and Singhealth), it is important to ensure a seamless user experience for patients who may move across clusters and healthcare systems in Singapore. A centralised system, such as Health Hub could help with coordination and management of services, across telehealth and in-person modalities. Another proposed option is to utilise hyperlinks to connect different medical leaflets and apps, making it easier for patients to access information.

Besides the telehealth interface, integration across systems should also be sought in the aspects of data capture, data storage, patient contact and transport standards. However, the level of integration and standardisation required is still under debate, given the heterogeneity in preferences and risk appetites among doctors and patients. A national GSM platform run by a single telehealth provider may not be effective and cost-effective and may also discourage innovation. Passive telemonitoring solutions that are low-cost, low-tech, and easy to use can be as effective for specific use cases.

Health Discovery+ (HD+)

HD+ is a centralized telemedicine platform,[14] allowing patient captured data (both remotely recorded and manually entered) to flow the HD+ backend system, which can then be viewed by healthcare professionals on the HD+ dashboard alongside clinical protocols. It is a single repository that provides Application Programming Interfaces (APIs) for different applications and systems to plug into, allowing for a more flexible and accessible healthcare system. The goal is to create a system where a patient's telemonitoring record will still be available if they switch healthcare providers.

The amount of patient data to be stored for telehealth should not be excessive relative to the data required for medical decision making. Only relevant telehealth data should be extracted in the integration of national Electronic Health Records (EHR) with Electronic Medical Records (EMR).

Future of telehealth

Can telehealth replace face-to-face interactions?

Key Digital Growth Areas in Telehealth

Several key areas of growth in telehealth include:

- *For healthcare providers: enhanced workflows, data-driven insights, improved diagnostic accuracy*
- *For patients: improved healthcare access, self-monitoring, AI diagnostics, wearable health devices, electronic health records,, telemedicine, health apps, virtual and augmented reality (VR/AR)*

While some healthcare providers support a digital-first approach, most believe telehealth services should not operate in isolation from traditional care systems. Rather, they should be integrated within existing healthcare systems to be sustainable. Physical healthcare facilities are likely to remain a key feature in our healthcare system. Integrating telehealth with traditional healthcare enables more effective scaling of initiatives.

Telehealth today exists in many forms and for many purposes, ranging from teleconsults to telemonitoring and beyond. The future of telehealth will likely involve human augmentation. The saying goes "machines will not replace men, but men with machines will replace men without machines". Embracing cost-effective telehealth solutions to enhance productivity and efficiency is important, particularly in high-cost environments like Singapore. While Singapore prides itself as a "smart nation", we need continuous innovation and technological advancement to remain ahead of the curve. The country benefits from intrinsic strengths, such as a well-developed technological infrastructure and a digitally literate population, which together provide a strong foundation for future growth.

Systems thinking and futures thinking for telehealth

Traditional reductionist approaches are insufficient for managing the complexity of health-related issues. Instead, a holistic understanding of relationships, patterns, and dynamics within the healthcare system is crucial. Reimagining the future of telehealth requires strategic foresight and illustration of future scenarios. One effective tool for such analysis is the PESTEL framework, which identifies and evaluates the external factors influencing telehealth.

Political	Government policies, funding streams, political will
Economic	Healthcare financing, cost of living
Sociocultural	Patient expectations, education, health challenges
Technological	Technological adoption, interoperability
Environmental	Climate-smart infrastructure, adaptive strategies
Legal	Regulatory changes, data protection

Optimal telehealth scenarios enhance the well-being of both patients and healthcare professionals, contributing to a healthier, more resilient society. These futures are characterised by affordable care, universal access to digital tools, equitable healthcare delivery, a strong emphasis on preventive medicine, and a motivated workforce capable of addressing the majority of health needs through seamless telehealth integration.

Ideal	• Low-cost and universally accessible telehealth technologies • Strong focus on healthcare equity and preventive care • Seamless integration of telehealth into existing healthcare systems • Highly motivated healthcare workforce meeting the majority of population health needs
Drivers and Trends	• Emphasis on healthcare equity and social justice • Movement toward universal healthcare coverage • Growing recognition of mental health as a public health priority
Challenges	• High costs that threaten long-term sustainability • Questions around cost-effectiveness and return on investment • Data privacy and cybersecurity concerns • Loss of human connection in virtual care settings • Innovation driven by top-down approaches lacking grassroots input
Opportunities	• Redesigning healthcare roles and workflows • Upskilling healthcare professionals for digital competencies

Telehealth is but one of many technological tools with great potential to transform healthcare delivery. Telehealth services should function to achieve the aim of optimising health outcomes and should not be imposed solely to reduce costs. The long-term success of telehealth services hinges on securing funding for cost-effective telehealth services, and balancing stakeholder interests in the community and technology spaces. The future success of telehealth in Singapore depends on how the local population embraces the technology and uses it to its full potential.

Contributions

The organising team would like to acknowledge and thank all speakers who greatly contributed to our seminar and workshops. We would also like to express our gratitude to all participants for their active contributions and input.

List of speakers

Name	Organisation
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Mr Adrian Tan	Co-Founder & Chief Empathy Officer, SG Assist
Mr Alfred Chua	Senior Manager, Synapxe
Dr Chan Yeow	Director, Home Ventilation and Respiratory Support Service, Tan Tock Seng Hospital
Dr Cheryl Glenn	Medical Advisor, Whitecoat Global
Mr Chew Kim Soon	Co-chair, SingHealth Patient Advocacy Network
Ms Chitra Nair	Former Lead Research Manager, Institute of Service Excellence, Singapore Management University
Dr Eric Chan	Associate Consultant, Sengkang Polyclinic
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