

DRAFT

**Regional Action Agenda on Harnessing
E-Health for Improved Health Service Delivery
in the Western Pacific**

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ABBREVIATIONS

AI	artificial intelligence
eHIS	electronic health information system
eHR	electronic health record
eMR	electronic medical record
GDHP	Global Digital Health Partnership
HIS	health information system
HMIS	health management information system
ICT	information and communications technology
ID	identifier
IDI	ICT Development Index
ITU	International Telecommunication Union
M&E	monitoring and evaluation
m-health	mobile health
mhGAP	Mental Health Gap Action Programme
NASSS	Non-adoption, Abandonment, Scale-up, Spread, Sustainability
NCD	noncommunicable disease
PICs	Pacific island countries and areas
SDG	Sustainable Development Goal
SOP	standard operating procedure
UHC	universal health coverage
UHI	unique health identifier
WHO	World Health Organization

EXECUTIVE SUMMARY

For progress towards universal health coverage (UHC), each country needs to ensure access to quality health services, especially for underserved groups. Information and communications technology (ICT), including e-health,¹ can strengthen preventive health care, improve quality of care, reduce costs both for health organizations and service users, and increase access to health services by the poor, the underserved, the vulnerable and those living in remote areas. This makes it an important facilitator of UHC.

Most countries in the Western Pacific Region are working to adopt or extend the use of essential e-health tools such as electronic medical and health records (eMRs/eHRs), telemedicine and m-health. However, the level of uptake of these tools, and of more advanced applications, varies with the different levels of ICT capability, funding, digital literacy, and strength of the institutional and regulatory environment. Potential e-health solutions may be constrained by weak ICT infrastructure and access, incompatible ICT and e-health architecture, and specifications and standards that limit scalability as well as community readiness and trust. Countries are challenged by the very rapid pace of change in both ICT and e-health. Many countries do not provide for steady investment to sustain progress in ICT and e-health.

All Member States in the Western Pacific Region should adopt those e-health applications most likely to improve service quality and access, such as eMRs/eHRs with a universal health identifier, m-health and telemedicine. The suitability of other applications will vary with the ICT environment, national priorities and service needs of each country. Member States can improve information sharing by developing and applying standards for e-health design and use, and privacy and security mechanisms. Each country should have an e-health policy and strategic plan, in line with national health priorities, to underpin strong leadership and governance for e-health and to guide and monitor progress. Engagement with regulators, service providers, communities and vendors, as well as with end users such as doctors and other health staff, and patients is critical, as is continuous monitoring and evaluation.

The *Regional Action Agenda on Harnessing E-Health for Improved Health Service Delivery in the Western Pacific* reviews the current use of e-health in the Region and recommends actions for four groups of Member States, depending on their size, capability, maturity and readiness to adopt e-health.

The immediate challenge and opportunity is for Member States to work effectively together without delay to accelerate progress and build on existing efforts.

Overview of the Action Agenda

Improvements in service delivery require the adoption of e-health at all levels, along with the conditions to ensure that the e-health tools and applications function as intended. These conditions include strong ICT infrastructure, systems for information sharing and levers for broader health

¹ Defined as the cost-effective and secure use of ICT in support of health and health-related fields, which include health-care services, health surveillance and health literature, education, knowledge and research (Resolution WHA58.28 on e-health (2005)).

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system adoption. Key actions are: (1) investment in tools; (2) providing an enabling environment; and (3) successful implementation, as summarized in Table E1.

Table E1. Key areas of action for e-health development

Key area	Action
Essential tools for improved health service delivery	Invest in e-health tools for better service delivery: <ul style="list-style-type: none"> • exchangeable eMR/eHR with continued focus on collecting and sharing information • telemedicine for service access • m-health to better engage with people in health service provision
Strategies and policies to harness e-health for improved health service delivery	Improve health information architecture, standards and interoperability to support sharing and exchange Support e-health adoption with engagement of end users, governance, leadership and other levers
Successful implementation of e-health	Introduce actions for health system level transformation: <ul style="list-style-type: none"> • link e-health with national health service priorities • manage the risks associated with introducing e-health applications for integrated service delivery • introduce a learning system for continued progress in e-health
	Introduce actions for operational-level transformation: <ul style="list-style-type: none"> • develop training and standard operating procedures for e-health implementation • align e-health with existing objectives and design work processes
	Engage with diverse stakeholders in the design and implementation process
	Embed the monitoring and evaluation of the e-health programme in the implementation process

Each country should select and apply e-health solutions that fit its own situation and health priorities. Countries in the initial stage of e-health adoption should focus on the basic foundations, such as digitizing existing information, applying common registries and unique identifiers, and introducing e-health applications that improve service access and coverage such as telemedicine and m-health.

Countries in the developing stage should maintain focus on national priorities for improving health services, and also develop and implement policy and regulations to support information sharing, interoperability and privacy protection between different systems.

Countries in the advanced stage should support innovation to improve service at all levels, and applications to link health information with other socioeconomic factors, while also improving interoperability using both top-down and bottom-up approaches.

The response to the special conditions in small population island countries requires investment in ICT infrastructure, along with the strengthening of basic information tools (unique identifiers and eMRs/eHRs), that could be applied in a hybrid manner, using paper and electronic formats.

All countries should identify ways to improve information sharing and create an enabling environment for e-health adoption to ensure health information is protected and securely transferred, as suggested in Table E2. They should plan for fundamental shifts in thinking and practice to ensure successful e-health implementation.

Table E2. Essential tools, policies and strategies for e-health adoption

	Initial	Developing	Advanced	Countries with small populations
Essential tools	<ul style="list-style-type: none"> • Unique ID • eMR/eHR (with minimum exchangeable data, including mobile based records) • Telemedicine and m-health for specific services • Network-based reporting system using mobile and computer that draws on eMR/eHR data for facility service management and facility-based reporting and for partially monitoring the incidence of public health threats for disease surveillance 	<ul style="list-style-type: none"> • Unique ID • Partially standardized, and exchangeable eMR/eHR linked with other hospital systems • Telemedicine (scaled up) and m-health (broader application) • Network-based reporting system using mobile and computer that draws on eMR/eHR data for service management, quality monitoring and reporting activities at facility and across facilities • National or subregional databases of eMR/eHR linked with health payment system to support facility-based reporting and individual information at subnational or national level and comprehensively monitor the incidence of public health threats 	<ul style="list-style-type: none"> • Unique ID (link with other sectors) • Fully standardized, and exchangeable eMR/eHR data linked with data from other e-health applications of hospitals such as clinical decision support, e-referrals; linked network-based reporting system with other e-health applications for support service provision and management • Big data, AI, robotics to support health system capacities and infrastructure • Telemedicine, m-health linked with other services • Network-based reporting system that draws on eMR/ eHR data across institutions and links data with other sectors; • National or subregional databases of eMR/eHR linked with health payment and quality management to support facility-based reporting and individual information at subnational or national level and comprehensively monitor the incidence of public health threats 	<ul style="list-style-type: none"> • Unique ID • eMR/eHR (with minimum exchangeable data) • Applications enabling use of records by health professionals • Telemedicine, m-health for information exchange • Network-based reporting system mobile and computer that draws on eMR/eHR data for facility service management • Network-based reporting system that has ability to partially monitor the incidence of public health threats, and support facility-based reporting m-health-based disease surveillance
Policies and strategies	<ul style="list-style-type: none"> • Establish digital health governance mechanism and develop key tools (architecture, standards) and identify minimum information exchange requests • Develop and apply legislation/policy on privacy protection and information security • Develop national e-health strategy • Set up management capacity on e-health and ICT and support institution development at national and facility level • Establish mechanism for better engagement with stakeholders on e-health policy and project design • Identify adequate funding to support acquisition, implementation and maintenance of hardware and software 	<ul style="list-style-type: none"> • Implement and enforce information exchange through architecture and standards • Apply and enforce legislation/policy on privacy protection and information security • Strengthen e-health management and governance at national and facility level • Introduce incentive mechanism (such as payment methods) for scaling up e-health applications based on identified priorities • Develop and promote learning and continue development on e-health • Identify adequate funding to support acquisition, implementation and maintenance of hardware and software 	<ul style="list-style-type: none"> • Identify, implement and enforce new requests for information sharing • Identify gaps and apply different methods to implement legislation/policy on privacy protection and information security • Apply evidence-informed approaches to select right e-health applications • Adopt system changes to allow innovative applications applied to benefit service and avoid possible harms • Involve broader engagement especially general public and service providers 	<ul style="list-style-type: none"> • Apply simple and service focused tools (architecture) that adopt common international standards • Develop legislation/policy on privacy protection and information security aligned with service operations • Focus on management and human resources capacity development • Apply cross-sectoral approaches with clear responsibility • Ensure country leadership and development partner involvement • Identify adequate funding to support acquisition, implementation and maintenance of hardware and software

1. INTRODUCTION

Key messages:

- The definition of **e-health** is the cost-effective and secure use of information and communications technology (ICT) in support of health and health-related fields, including health services, health surveillance and health-related literature, education, knowledge and research (Resolution WHA58.28 on e-health (2005)).
- Service delivery lies at the core of universal health coverage (UHC). Increasing equitable access to quality services is a key challenge in advancing UHC in Member States.
- In addition to its major role in improving health service delivery, e-health can be harnessed to prevent health problems, improve quality of care, reduce health costs to families and improve equitable access to health systems.

1.1 Potential to improve health service delivery and universal health coverage

Over the past decade, Member States in the Western Pacific Region have seen significant health gains and have shown their commitment to UHC – that is, for all individuals and communities to receive the health services they need without financial hardship. UHC underpins the United Nations Sustainable Development Goals (SDGs), to which Member States are also committed (WHO, 2017c).

In some countries in the Region, up to half the population still cannot access basic health services, because they cannot afford to pay, the service is too far from their homes, or there are shortages of qualified staff, equipment or medicine (WHO, 2017a). This lack of access for hard-to-reach populations is a major barrier to achieving the goal of UHC. In addition, many programmes still take a “silo” or vertical approach to specific health problems, overlooking the benefits of broader, people-centred, cross-sectoral collaboration for improved service delivery (WHO, 2017b). Furthermore, countries are grappling with increasing cost of care, demographic change and population ageing, the changing burden of disease, health workforce sustainability and growing community expectations.

Most countries in the Region are working to expand access to quality services while reducing or at least controlling costs, and addressing the increasing demand for coordinated care through the life course. ICT has great potential to improve health service delivery, as the visible face of UHC. The use of e-health can give people in rural and remote areas access to quality care, empower patients and communities to engage at all levels of the health system, and provide timely information for the prevention, diagnosis and management of illness.

At the Seventy-first World Health Assembly in 2018, Member States supported a resolution to advance global digital health (WHO, 2018b), but there has been uneven progress in adopting e-health and realizing its benefits. Digital health technology is evolving rapidly. Member States need to make the strategic decision to invest in e-health and build capacity to improve service access and quality while containing costs (WHO, 2016a).

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1.2 Purpose of the Action Agenda

The purpose of the *Regional Action Agenda on Harnessing E-Health for Improved Health Service Delivery in the Western Pacific* is to guide Member States in using e-health as a key enabler for strengthening health systems. Specifically, the Action Agenda sets out how to improve service delivery by using e-health to transform the way care is delivered and pave the way for sustainable health services.

The Action Agenda is not prescriptive. It does not encourage a single, linear path of development. In some countries, e-health development and implementation are already well advanced. In others, it has barely begun. Countries are planning to build on promising pilot initiatives to develop and scale up e-health projects, and to update national e-health strategies. The Action Agenda provides a stepwise approach to longer-term e-health development, indicating suitable strategic investments, based on local priorities and needs.

1.3 Structure of the Action Agenda

The Action Agenda first sets out the framework for the possible contributions of e-health to improved service delivery – at the level of the individual, the service provider, the health-care organization and the health system. This is followed by a situation analysis, which summarizes the current status of Member States in the use of e-health solutions at different service levels and highlights the main service delivery challenges. Areas for action are then described, with a focus on suitable e-health applications for all service levels. The action guidance responds to the findings of the situation analysis, suggesting practical e-health solutions to improve service delivery as well as ways to improve information sharing and system adoption. Case studies show how different countries have adopted a range of e-health solutions. The Action Agenda concludes with a proposed way forward, including recommendations for Member States and WHO.

2. FRAMEWORK OF POSSIBLE CONTRIBUTIONS OF E-HEALTH TO IMPROVE HEALTH SERVICE DELIVERY

Key messages:

- The use of e-health will play a critical role in achieving UHC. The rapid development of e-health applications and technologies is helping to transform services.
- To maximize the benefits of e-health for service delivery, countries should select appropriate e-health applications for the individual, service provider, health-care organization and health system level, to improve services and address national health priorities.
- Before scale-up of new or piloted e-health applications, their value should be assessed through a review of measurable outcomes at the different levels, with a focus on improvement in quality and access and reduced unit costs of health care.

This section sets out the framework for the possible contributions of e-health to improve service delivery – at the level of the individual, the service provider, the health-care organization and the health system.

2.1 The aspiration for UHC

At the core of UHC is good service delivery. UHC includes the full spectrum of essential, quality health services across the life course, from health promotion through prevention, treatment and rehabilitation, to palliative and end-of-life care. Increasing access to quality services at the individual and population level is a key challenge in achieving UHC. As populations age and noncommunicable diseases (NCDs) become more prevalent, there is greater need for primary and secondary prevention, continuity of care across service levels and a whole-person approach, with involvement of patients, families and communities in shared delivery of care. Using e-health will be integral to these improved service delivery models.

In 2015, Member States endorsed *Universal Health Coverage (UHC): Moving Towards Better Health – Action Framework for the Western Pacific Region* (WHO, 2016b). The UHC Framework identified actions to strengthen five interrelated attributes of a high-performing health system: quality, efficiency, equity, accountability, and sustainability and resilience. It also lists 15 action domains to advance UHC, all helping to improve service delivery. These are summarized in Table 1 (with the contributions of e-health shaded).

Specific contributions of e-health to each of the health system attributes are as follows:

- **Quality:** raise quality by improving diagnostic accuracy and treatment, ensuring care is appropriate and informed by evidence, better communication and information exchange between patients and service providers, for more people-centred care and adherence to treatment.
- **Efficiency:** optimize resource use, reduce fragmentation, duplication and unnecessary care, and improve institutional efficiency through access to real-time information.
- **Equity:** improve access to quality health-care services for people with multi-morbidity in rural, remote and deprived areas, and empower individuals to make more informed health decisions.
- **Accountability:** improve transparency and accountability through better information sharing and communication for greater engagement with the general public and local leaders.
- **Sustainability and resilience:** strengthen the monitoring of public health threats and improve overall system adaptability.

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Table 1. Health system attributes and action domains for UHC

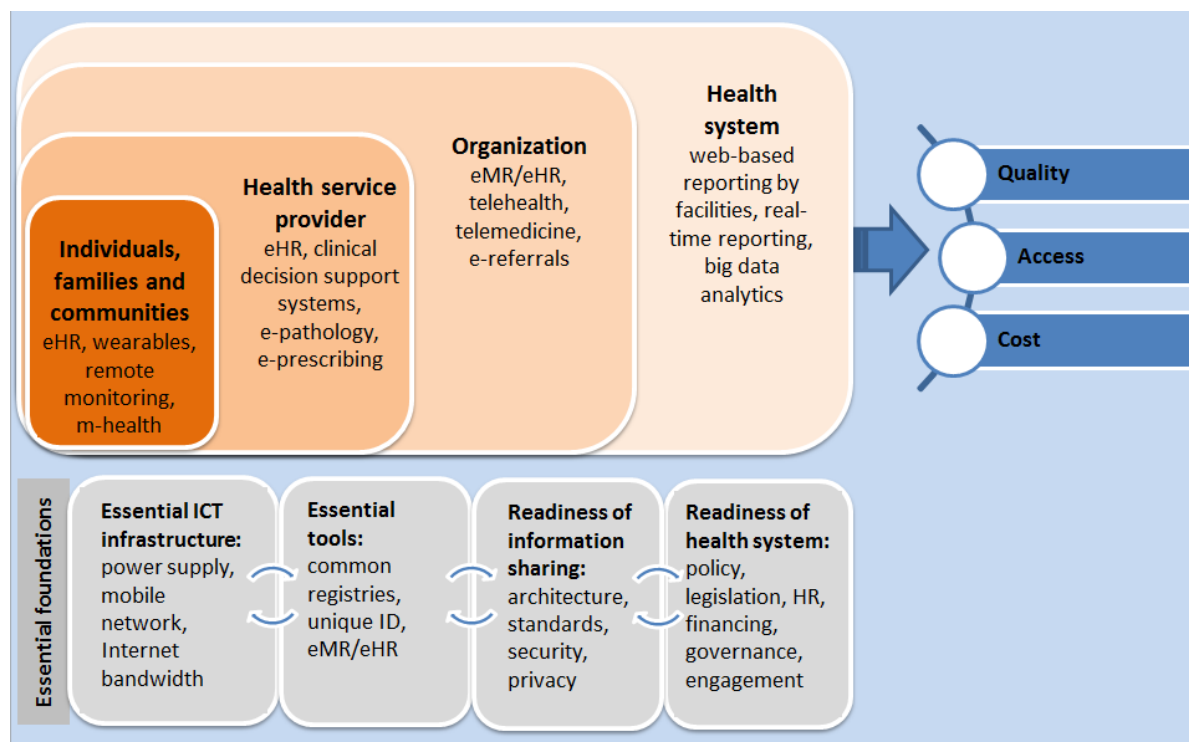
Health system attributes	Action domains for UHC
Quality	<ul style="list-style-type: none"> Regulations and regulatory environment Effective, responsive individual and population-based services Individual, family and community engagement
Efficiency	<ul style="list-style-type: none"> Health system architecture to meet population needs Incentives for appropriate provision and use of services Managerial efficiency and effectiveness
Equity	<ul style="list-style-type: none"> Financial protection Service coverage and access Non-discrimination
Accountability	<ul style="list-style-type: none"> Government leadership and rule of law for health Partnerships for public policy Transparent monitoring and evaluation (M&E)
Sustainability and resilience	<ul style="list-style-type: none"> Public health preparedness Community capacity Health system adaptability and sustainability

2.2 Framework of e-health for improved service delivery

Many e-health technologies are already widely used, including: electronic medical records (eMRs), electronic health records (eHRs), applications for health practice for mobile devices (m-health), remote service provision through telecommunications (telehealth and telemedicine), electronic health information systems (eHIS) and systems for medication, chronic disease and other clinical management, electronic learning and decision support. Social media and big data are also used for health service matters.

The Action Agenda focuses on e-health applications to improve service delivery and related work flows, such as eMR/eHR, telemedicine, mobile-facilitated services clinical decision support systems, and other information technologies that improve quick identification and response to disease (Fig. 1).³

³ Examples of out-of-scope applications are those for health literacy, health education, knowledge and research; as well as medical devices, environmental monitoring sensors, wearables for self-management but without a direct health service response and social networking platforms.

Fig. 1. Framework of e-health for improved health service delivery

The objective of the health system is to enable individuals, families and communities to maintain and improve their health through timely access to quality services delivered in a respectful and efficient manner. The application of e-health may bring improvements in service quality, efficiency and/or equity. The value of any change should be assessed through review of results at different levels – the individual, the service provider, the health-care organization and the overall health system (see summary of benefits at each level in Box 1). Monitoring and evaluation (M&E) should show better quality, improved access and/or lower cost of care. For lasting improvements in service delivery, investment in e-health is required at all service levels, in line with national health plans and priorities.

Box 1. Benefits of e-health at different levels of health service delivery

Individual service user

Good health outcomes are co-produced by providers along with individual service users and their families. Action is required to inform and empower individuals, families and communities so that they participate actively in their own health care and can also influence health system development. Benefits for the service user include:

- Greater access to health care, using telemedicine to overcome physical or distance barriers through remote consultation, diagnosis and management
- Targeted communication based on health or demographic status, for example the transmission of health event alerts to specific populations, or targeted advice and SMS reminders to individuals or groups.

Health service provider

For health providers, e-health enables effective management of chronic diseases through consultation with individuals with their data to hand, ensuring continuity of care and reducing fragmentation of the care pathway.

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Benefits for the provider include:

- Ability to provide patient-centred care, responsive to the individual's health status, needs and preferences, based on comprehensive and longitudinal data for that person
- Improved diagnostic accuracy and treatment, for example, through decision support systems that provide prompts and alerts, and screening of individuals by risk or health status
- Improved provision of quality care, for example through remote monitoring, consultation, diagnosis and treatment using telemedicine and telehealth.⁴

Health-care organization

At the level of the health-care organization, improved service delivery should meet the needs of all people, and services need to be better organized and coordinated, both horizontally and vertically. Benefits for the organization include:

- Improved transparency and accountability of care processes across institutional and geographic boundaries
- Improved cost-efficiency and resource allocation through streamlined processes, reduced waiting times, reduced unnecessary tests and treatment, and fewer errors
- Strengthened monitoring of referral system functions
- Improved patient retention (for private providers)
- Improved patient/consumer experience from e-health collaboration between health-care providers.

Health system

For the overall health system, e-health technologies can improve the functioning and relationships between different parts of the health system environment. A supportive health system will help ensure the effectiveness of e-health applications implemented at the level of health-care organization, service provider and service user. Benefits for the health system include:

- Strengthened monitoring of public health threats with more timely and effective response through notification of public health events
- Improved response to emergencies with quick access to clinical and service data
- Improved understanding of the health and service delivery needs of the population
- Improved dissemination of public health information and facilitation of public discussion and preparedness around major public health threats
- Improved ability to monitor health system performance and quality indicators and to identify relative variance and inequities
- Data-supported insights and priorities in health budget allocation.

The contribution of e-health depends on the preconditions being in place, including a conducive environment for ICT and readiness for information sharing and adoption.

The essential prerequisites for functioning ICT include electric power, mobile signal and Internet coverage. ICT conditions and user access to hardware will influence the adoption of e-health in different settings. For improved service delivery, information on individuals must be collected, recorded and exchanged safely and systematically across different service levels. The use of eMRs/eHRs facilitates the secure transfer of health information between different health providers and settings. A unique identifier for each individual, used by all health services – and potentially other services outside of health – can assist with data management. These essential ICT foundations underpin the smooth functioning of e-health at all levels.

⁴ The fields of telemedicine and telehealth are converging. For this document, reference to telemedicine covers both terms.

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Information standards, interoperability and enterprise architecture are important tools to improve information storage and exchange. Privacy, security and confidentiality are also critical in promoting the best use of information and in preventing harm from and misuse of information. Privacy legislation and regulations, as well as clear guidelines and training on data retention and management, and continued investment in cyber defence are required to support these.

The use of e-health tools and applications will inevitably bring changes to service delivery processes. Policies and strategies must be in place to support broader health system adoption. This includes national e-health policies and strategies, suitable governance arrangements, workforce capacity and partnerships and engagement with key stakeholders.

3. SITUATION ANALYSIS

Key messages:

- All countries in the Western Pacific Region have made rapid progress in adopting ICT.
- Different population groups pose different challenges in applying ICT; inequities in access and coverage can be reduced or exacerbated by emerging technologies.
- Member States can be classified as: initial, developing and advanced, with respect to e-health status, while countries with small populations are considered separately due to their unique circumstances.

Overall, countries in the Western Pacific Region have experienced rapid yet uneven growth in access to ICT and e-health. This situation also applies for different population groups within countries. Internet and mobile networks are the most widespread ICT applications, with eMR/eHR and m-health solutions increasingly used for interaction and information sharing between individuals and their health service providers as well as between different providers. Health informatics, big data, artificial intelligence (AI), blockchain and robotics are also spreading quickly.⁵ Those Member States that are beyond the initial stage of e-health adoption may consider these technologies for further service enhancements.

3.1 ICT development

The status of a country's ICT infrastructure, including Internet bandwidth, the level and spread of mobile broadband and access to mobile-cellular networks, affects its ability to make use of e-health applications. The ICT Development Index (IDI) of the International Telecommunication Union (ITU) combines 11 indicators of ICT access, use and skills into one measure (ITU, 2018a). Table 2 provides IDI values and rankings for 19 countries in the Western Pacific Region, along with the regional and global averages. It shows the wide range of ICT development in the Region (ITU, 2017). In general, each country's IDI is in line with its economic development. High-income countries in the Region have a high IDI (average 8.18), well above the regional and global averages. By comparison, the IDI averages of upper-middle-income (4.82) and lower-middle-income countries (3.42) are below the broader averages. The status of all available countries in the Region for core IDI indicators is in Appendix 1.

Overall, ICT environments are developing rapidly, bringing accelerated growth in digital connectivity. The percentage of individuals using the Internet grew exponentially between 2000 and 2016 (ITU, 2018b) (see Appendix 2). Among high-income countries, the average percentage of individuals using the Internet increased from 34.5% in 2000 to 88.7% in 2016. Among upper- and lower-middle-income countries, the average percentage of individuals using the Internet increased from 3.8% in 2000 to 44.4% in 2016. Among Pacific island countries and areas (PICs), the average percentage of individuals using the Internet increased from 5.3% to 30.4%. Mobile phone subscriptions also greatly increased in countries in the Western Pacific Region, from 15.1 per 100 inhabitants in 2000 to 101.3 per 100 inhabitants in 2016 (see Appendix 3).

⁵ Please refer to the glossary for the meaning of these terms.

Table 2. Countries in Western Pacific Region by IDI rank and value and World Bank income group, 2017

Country	IDI 2017 rank (global, out of 176 countries)	IDI 2017	Income group *
Republic of Korea	2	8.85	High
Japan	10	8.43	High
New Zealand	13	8.33	High
Australia	14	8.24	High
Singapore	18	8.05	High
Brunei Darussalam	53	6.75	High
Malaysia	63	6.38	Upper-middle
China	80	5.60	Upper-middle
Mongolia	91	4.96	Lower-middle
Philippines	101	4.67	Lower-middle
Fiji	107	4.49	Upper-middle
Viet Nam	108	4.43	Lower-middle
Tonga	110	4.34	Upper-middle
Samoa	127	3.30	Upper-middle
Cambodia	128	3.28	Lower-middle
Lao People's Democratic Republic	139	2.91	Lower-middle
Vanuatu	141	2.81	Lower-middle
Kiribati	154	2.17	Lower-middle
Solomon Islands	157	2.11	Lower-middle
Regional average		5.44	
Global average		5.11	

* World Bank (2017).

3.2 Digital divide

The term “digital divide” refers to the gap between population groups and regions with good access to modern ICT, and those with no access or only restricted access. This includes phones, televisions, personal computers and the Internet (WhatIs.com, 2018b). While the benefits of m-health technologies can reach many, it is important to address access barriers to prevent creation of a new kind of health inequity due to uneven spread of e-health technologies, arising from global, social and personal factors. Global factors include ICT infrastructure, language and levels of literacy and education; social factors cover income, age and place of residence; privacy and security are examples of personal factors.

Based on ITU data for 2016–17 for seven countries in the Western Pacific Region, more men than women use the Internet (Table 3). Data for 2015 show an urban/rural divide for male and female Internet use (see Appendix 4). For high-income countries, the gender gap is up to 12% in rural areas, and only up to 5% in urban areas. Again, data are available only for a few countries (and fewer low- and middle-income countries). Globally, the digital gender gap increases with age, especially in low- and middle-income countries (ITU, 2018b). There are no separate data for the Western Pacific Region.

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Table 3. Individuals using the Internet (from any location) by gender (%), 2016–2017

Country	Year	All Individuals	Male	Female
Australia	2015	84.6	84.2	84.9
Brunei Darussalam	2016	90.0	90.0	90.0
Cambodia	2016	32.4	32.4	32.4
Japan	2016	93.2	94.7	91.8
Malaysia	2016	78.8	80.0	76.7
Republic of Korea	2016	92.8	94.7	90.9
Singapore	2017	84.4	85.4	83.6

Note: Age scope of population for which data are available varies across countries.

Source: ITU (2018b).

The impact of new investments in e-health and ICT infrastructure on the quality and cost of health care must be considered, especially for those affected by the disparities discussed above. A proactive, whole-of-government and well-targeted approach can help to minimize the access or knowledge gap arising from the introduction of e-health applications.

3.3 Regional progress in e-health and service delivery

Successful implementation of e-health requires strong ICT infrastructure and an enabling environment. The e-health situation in the Western Pacific Region has been surveyed by the Global Observatory for eHealth, most recently in 2016 (WHO, 2016a), and also in the Draft Electronic Health Information Systems Assessment for the Pacific (Gevity, 2018). An overview of the ICT and e-health situation in individual countries in the Region, based on these sources, is in Appendices 4 and 5.

Member States in the Western Pacific Region can be classified into four groups according to their ICT and e-health progress with regard to service delivery:

- **Initial stage:** experimentation and early adoption, with both ICT infrastructure and the enabling environment for e-health at an early stage. These countries do not yet have a national e-health strategy or a health sector development plan with an e-health component. Key e-health applications are not yet institutionalized. Local e-health initiatives may be present, and may be scaled up where they get traction. There is limited access to quality health services for all groups.
- **Developing stage:** development of ICT and e-health has commenced, with ICT infrastructure established to provide an enabling environment for e-health. These countries either have clear national e-health strategies with an implementation plan, or e-health is integrated into the health sector development plan. There is variable e-health implementation, with some applications becoming institutionalized. These countries may have poor service delivery for some groups; they are experiencing increasing demand, while taking steps to improve service quality and efficiency.
- **Advanced stage:** scaling up and mainstreaming of e-health. As the environment matures to support broader adoption of ICT, there may be formal national e-health strategies with an implementation plan, or e-health is integrated into the health sector development plan. There are local groups and agencies in academia, the public sector and the private sector, for developing and implementing e-health applications, with innovation (WHO and ITU, 2012). These countries aim for integrated, patient-centred care, through tailored services and clinical pathways.

- **Countries with small populations:** Small island countries (population less than 250 000) share some characteristics with respect to ICT and e-health development, but their unique challenges require different e-health responses from other groups, so they are placed in a special group. These countries include Cook Islands, Kiribati, the Marshall Islands, the Federated States of Micronesia, Nauru, Niue, Palau, Samoa, Tonga and Tuvalu. Many countries in this group have very small populations, few human resources and flat health service structures.

Member States in the Western Pacific Region have each been placed in one of the four groups based on their IDI, World Bank-defined income category, e-health status and service delivery needs, as shown in Table 4. The table shows a strong relationship between a country's World Bank income group category and its e-health status.

Table 4. Countries in the Western Pacific Region grouped by stage of e-health development

Stage of e-health development	Criteria	Countries
Initial	<ul style="list-style-type: none"> • Low IDI (< 4) or unknown • Low-income or middle-income • No/unclear national e-health strategy • e-health applications not institutionalized 	<ul style="list-style-type: none"> • Cambodia • Lao People's Democratic Republic • Papua New Guinea • Solomon Islands • Vanuatu
Developing	<ul style="list-style-type: none"> • Medium IDI (4–8) • Upper-middle-income • Clear national e-health strategy • e-health applications becoming institutionalized 	<ul style="list-style-type: none"> • Brunei Darussalam • China • Fiji • Malaysia • Mongolia • Philippines • Viet Nam
Advanced	<ul style="list-style-type: none"> • High IDI (8+) • High-income/Upper-middle-income • Clear national e-health strategy and implementation • e-health applications institutionalized 	<ul style="list-style-type: none"> • Australia • Japan • New Zealand • Republic of Korea • Singapore
Countries with small populations	<ul style="list-style-type: none"> • Small island country (population < 250 000) • Low IDI (< 4) or unknown • Low-income or middle-income • No/unclear national e-health strategy • e-health applications not institutionalized 	<ul style="list-style-type: none"> • Cook Islands • Kiribati • Marshall Islands • Micronesia (Federated States of) • Nauru • Niue • Palau • Samoa • Tonga • Tuvalu

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4. ESSENTIAL TOOLS FOR IMPROVED HEALTH SERVICE DELIVERY

Key messages:

- Telemedicine and eMR/eHR, preferably with a national unique health identifier, are the initial e-health applications most likely to benefit service delivery.
- Ongoing development of e-health technology has potential for further service improvement.

Service improvements depend on the rapid, comprehensive sharing of information between and within health-care organizations. Two basic e-health tools, eMR/eHR and telemedicine, have been widely adopted by vastly different countries to reduce access barriers and improve quality of care. This section first discusses these better known tools and then identifies emerging trends of relevance to service improvement in the Western Pacific Region.

4.1 Electronic records, unique health identifiers, telemedicine and m-health

The basic tool to harness ICT for improved quality and continuity of health care is the eMR or eHR, which allows compilation, sharing and monitoring of health and related information of each individual service user, including every contact the user has with the health system over time. Combined with a unique health identifier (UHI), which is a single identifying number or code for each person, these electronic records hold information about an individual, which can be shared in different health service settings over the person's lifespan. The information in the eMR/eHR helps service providers make better decisions; it allows managers to monitor and audit service quality and cost as well as to monitor system performance. For effective information sharing and exchange, interoperability of the eMR/eHR must be assured. Introducing and strengthening the use of eMR/eHR with UHIs is important for all countries (see Box 2).

Box 2. Use of UHIs in the Marshall Islands, the Federated States of Micronesia and New Zealand

Marshall Islands

In 2016, the Ministry of Health implemented a new client registration scheme as the first phase of the tuberculosis (TB)/leprosy and NCD mass screening programme in Ebeye, the second most populous island in the country. For this, the Ministry of Health, with the United States Centers for Disease Control and Prevention (US CDC) and the WHO Regional Office, developed an electronic registration form. Using this form as well as machines installed in the community health centre and a dispensary, people in Ebeye registered their fingerprints, address and other personal information, which were linked to their unique hospital number. This enhanced client registration scheme resolved duplicate patient records in the database and facilitated the disease screening, the second phase of the mass screening programme. Cognizant of the value of this initiative, the Ebeye health team has committed to integrating client registration data into their TB/leprosy and NCD screening software programme and deleting duplicate records. In 2018, the Ministry of Health started expanding this e-health initiative to cover the capital and most populous island, Majuro. The Ministry of Health, US CDC and WHO agreed upon specific measures to ensure the confidentiality of the information collected.

Federated States of Micronesia

The Department of Health and Social Affairs has been working to set up an eMR system with a unique hospital number for each patient. In 2017, Pohnpei State and Chuuk State health departments, in collaboration with WHO, developed an electronic data collection form with fingerprint registration to facilitate their integrated outreach service programmes for NCD, TB/leprosy, maternal and child health immunization, sexually transmitted infection/HIV, oral health, and other services at designated village outreach posts. The health team enters the individual's unique hospital number into the system after returning from the outreach service. This new registration scheme has already accelerated outreach programme operations, facilitating continuity of care for registered villagers and aiding in monitoring programme achievements. The programme currently covers Madolenihmw Municipality in Pohnpei State and Toleisom Island in Chuuk State. WHO continues to support the Department of Health and Social Affairs to implement the same registration scheme in the hospitals and remove duplicate records inherited from the old database. To maintain confidentiality of information, WHO shared the measures used in the Marshall Islands with both participating states.

New Zealand

The National Health Index (NHI) number is a unique identifier assigned to every person who uses health and disability support services in New Zealand. Each person's number is stored on the NHI along with that person's demographic details. The NHI is used to link information and get a better understanding of each person's needs, and to help with planning, coordination and provision of health and disability support services across the country. With the NHI, authorized users can uniquely identify information in the Medical Warning System, which is designed to warn health-care providers of any known risk factors that may be important when making clinical decisions about individual patient care. The NHI is also used to access information in the National Immunisation Register to help vaccinators increase New Zealand's immunization coverage through timely access to immunization histories.

Source: Ministry of Health, New Zealand (2017).

Two additional widely adopted and cost-effective e-health applications are telemedicine or telehealth (the use of ICT to provide clinical care and health prevention from a distance) and m-health (the use of mobile communication devices to support or provide health care). Many countries now use both to improve service access and coverage, and there is a shift from stand-alone usage to combining with other service arrangements to improve access and patient engagement (see Boxes 3–5). Before adding these to the core work flow of the health system, certain preparation is needed – to review and update the service processes, and also to adapt risk management and governance strategies to ensure accuracy, privacy and security of the data. In this area, it is wise to review and incorporate best practices from countries with established e-health knowledge, capacity and infrastructure.

Box 3. Telemedicine in Mongolia

Telemedicine has received substantial attention in Mongolia with the support from the Minister of Health. Projects include telemedicine for the Cardiovascular Center and telehealth for maternal and newborn health services in 2007, funded by the Government of Luxembourg funded and United Nations Population Fund. In 2012, an evaluation of the tele-health project found improved efficiency and effectiveness in health-care delivery brought about by remote decision support for rural physicians, and strengthened capacity of the Maternal and Child Health Research Center. Obstetricians received training in computer literacy and clinical skills to improve their communication with urban physicians and their ability to deliver rural care independently. Of all cases, 86% were managed locally, while 14% were referred for specialized care in the capital city, Ulaanbaatar. Referrals decreased over the course of the project. Overall, pregnancy complications decreased from 19.1% in 2005 to 15.4% in 2009, and childbirth complications decreased from 25.7% in 2007 to 9% in 2009. In 2009, the rate of pregnancy complications in project areas was less than half the national average, suggesting that this project successfully built rural delivery capacity, enhanced access to specialized care and improved patient outcomes.

Sources: Baatar et al. (2012); LuxDev (2016)

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Box 4: Integrated health care in Xiamen, China

The Xiamen Regional Health Information Platform (Citizen Health Information System) has improved service efficiency and quality across the city's health-care delivery system by facilitating information sharing and exchange across facilities and health programmes including the Expanded Programme on Immunization, maternal and child health, NCDs and aged care, as well as by providing integrated health information to patients, families and service providers. All population groups in Xiamen city can use the mobile app to get real-time information on waiting times at emergency rooms, make appointments, get prescriptions dispensed, access their eHR and make payments. Each patient is given a unique identifier, which is the same as the health insurance number. The system can monitor all interactions between the provider and patient, as well as relevant health data. For health care involving both general practitioners and specialists, there is increased confidence in primary care, with more patients going to community health and fewer going to outpatient facilities.

Source: confirmed by Xiamen Municipal Health and Family Planning Committee

Box 5. Mental Health Gap Action Programme app

The Mental Health Gap Action Programme (mhGAP) app, launched in 2017, is the e-version of the WHO's mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized settings. In the Western Pacific Region, 14 countries and areas have implemented mhGAP: Cook Islands, Fiji, Kiribati, the Federated States of Micronesia, Nauru, Niue, Palau, the Philippines, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. The app can provide decision support to health workers at the time and location of care. For example, a clinician could follow the algorithms of mhGAP to arrive at a diagnosis or to help decide on treatment and related action. mhGAP enables a comprehensive response, especially in places with weak peripheral care and lack of resources. The app also facilitates scale-up of services for people with mental, neurological and substance abuse disorders, as well as their families. Its use is still at an early stage and it has not yet been extensively tested or evaluated.

Source: WHO (2017d).

Each country should decide its priorities for e-health investment, based on the service needs, national priorities and stage of e-health development. Countries in the initial stage of e-health development and island countries with small populations should first introduce the basic e-health tools, eMR/eHR (with UHI), telemedicine/telehealth and suitable m-health applications. As the e-health system matures, tools should become more standardized for information sharing, and be progressively more broadly applied, institutionalized and scaled up. Countries in advanced stages may plan to link data from different e-health tools within the health sector and across sectors for evidence-based planning and policy. They may also pilot innovative e-health applications as outlined in section 4.2. Table 5 lists priority e-health applications for the individual, service provider, health-care organization and health system level.

Table 5. Priority e-health investments according to a country's stage of e-health development

Domain (Level which will benefit)	Recommended e-health actions			
	Initial	Developing	Advanced	Countries with small populations
Individual	<ul style="list-style-type: none"> • UHI • eMR/eHR (with minimum exchangeable data, including mobile-based records) 	<ul style="list-style-type: none"> • UHI • Partially standardized and exchangeable eMR/eHR 	<ul style="list-style-type: none"> • UHI (link with other sectors) • Fully standardized, and exchangeable eMR/eHR • eMR/eHR data linked with data from other devices, e.g. remote individual monitoring 	<ul style="list-style-type: none"> • UHI • eMR/eHR (with minimum exchangeable data)
Health service provider	<ul style="list-style-type: none"> • eMR/eHR with layered design • Telemedicine • m-health 	<ul style="list-style-type: none"> • eMR/eHR • eMR/eHR linked with other hospital systems, e.g. for clinical decision support, e-referrals • Telemedicine (scaled up) • m-health (broader application) 	<ul style="list-style-type: none"> • Comprehensive eMR/eHR linked with other hospital systems, e.g. clinical decision support, e-referrals • AI, robotics • Telemedicine and m-health, combined with other services 	<ul style="list-style-type: none"> • Use of electronic records by health professionals • Telemedicine and m-health for information exchange • Information exchange applied with a less layered structure
Health-care organization	<ul style="list-style-type: none"> • Network-based reporting system that uses eMR/eHR data • Mobile and computer-facilitated service management system for reservation, e.g. scheduling, activity monitoring 	<ul style="list-style-type: none"> • Network-based reporting system that uses eMR/eHR data (across institutions) • Mobile or computer-facilitated service management system for quality monitoring and reporting activities 	<ul style="list-style-type: none"> • Network-based reporting system that uses eMR/eHR data (across institutions, and links with data from other sectors) • Linked network-based reporting system with other e-health applications • to support service provision and management, e.g. m-health for call centre, communication 	<ul style="list-style-type: none"> • Simplified network-based reporting system that draws on eMR/eHR data • Mobile and computer-facilitated service management system reservation, e.g. scheduling, activity monitoring

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Domain (Level which will benefit)	Recommended e-health actions			
	Initial	Developing	Advanced	Countries with small populations
Health system	<ul style="list-style-type: none"> • Network-based reporting system that has ability to partially monitor the incidence of public health threats and support facility-based reporting • m-health-based disease surveillance system 	<ul style="list-style-type: none"> • National or subregional databases and data warehouse to support facility-based reporting and individual information at subnational or national level • National or subregional databases and data warehouse linked with system for health payment • Network-based reporting system that has ability to comprehensively monitor the incidence of public health threats 	<ul style="list-style-type: none"> • National or subregional databases and data warehouse to support facility-based reporting and individual information at subnational or national level • National or subregional databases and data warehouse linked with system for health payment and quality management • Big data, AI to support health system capacities and infrastructure 	<ul style="list-style-type: none"> • Simplified network-based reporting system with ability to partially monitor the incidence of public health threats, and support facility-based reporting • m-health-based disease surveillance system • Engagement with clinicians for maintenance and implementation of e-health solutions

4.2 Future trends

Both ICT and e-health applications are developing very rapidly, with transformative advances in the fields of ICT infrastructure, big data, AI and robotics. The Region and all Member States must plan ahead and be ready to test and adopt suitable future e-health advances to improve service delivery.

Faster Internet. Faster Internet connections in most parts of the Region are mainly due to national fibre-optic networks and the way they are routed. By mid-2015, 14 of the 27 PIC clusters were connected to a submarine cable system, compared with fewer than nine clusters connected in 2005 (ITU, 2016). The dramatic change is evident in countries like Tonga, where Internet use increased fivefold within six months of its first submarine cable becoming operational in 2013. Further rapid progress in e-health is expected. The World Bank and the Asian Development Bank have current projects to improve ICT access in several PICs, including rural areas and outer islands.

Cloud data storage. There has been rapid uptake of cloud technology for storage for patient records, with reduced cost of maintenance and increased access. Cloud storage is flexible and scalable, with lower costs than on-site data storage (Barthelus, 2016). Cloud storage of health data is now preferred for health system back-office applications, backup and disaster recovery. It reduces reliance on servers and dependence on revenue cycle management and patient engagement. However, data ownership, privacy and confidentiality concerns must be considered.

Big data. “Big data” is an approach to data management that enables large volumes of data to be analysed and understood in real time. It is characterized by the four Vs: volume (the quantity of data), velocity (speedy analysis of data in real time or near-real time), variety (dealing with different forms of data, often from disparate sources) and veracity (quality assurance for verification of the data and the analytic results) (Kruse et al., 2016). Big data provides many opportunities for improving health service quality, including reduction of medication errors, by analysing all medications prescribed in patient records and flagging anomalies or unusual findings; identification of high-risk patients; and reduction in hospital costs and waiting times. To optimize big data applications, countries need to compile data and develop methods and capability for advanced data processing, analytics and visualization.

Blockchain. Blockchain functions as a decentralized database, managed by computers in a peer-to-peer network. Each computer in the network maintains a copy of the transactional data, to prevent a single point of failure (WhatIs.com, 2018a). Since health care deals with confidential patient data and requires quick access, blockchain has the potential to benefit service delivery, through managing longitudinal patient records, compiling care episodes, master patient indices and interoperability (Deloitte, 2018).

Artificial intelligence (AI). AI in health represents the coordination of multiple technologies, enabling machines to sense, comprehend, act and learn. With this capability, they can perform administrative functions and optimize the clinical care process (Jiang et al., 2017). AI “assistants” can perform a large proportion of the common services, freeing up the service provider’s time. AI can also assist with diagnosis, treatment and prevention of rare diseases. AI algorithms can quickly process data to identify patterns to help with early diagnosis and appropriate management. Harvard University research indicates that the AI-powered approach achieves 85–90% agreement with primary care physicians, with the expectation of reaching almost complete agreement within two years, and the

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potential to exceed the diagnostic accuracy of doctors, nurses and other health staff (MIT Sloan Management Review, 2018).

Robotics. Robots can also enhance human efforts to improve service quality and availability. Robots are taking on health-care tasks, such as: assisting at surgical procedures; medicine dispensing; nursing, including drawing blood, checking a patient's condition and vital signs, and managing hygiene; and robot-assisted rehabilitation therapy. They can improve productivity by enabling health practitioners to perform more complex tasks, improving patient comfort and reducing costs for the health system and for the patients. See Box 6 for a case study on the use of AI and robotics in China.

Box 6. Use of AI solutions at Anhui Provincial Hospital, China

The southern district campus of Anhui Provincial Hospital in China is using a range of AI solutions to provide an “intelligent medical service”. Driving this effort are government support for innovation, increased convenience for patients and the need to contain labour costs. The hospital is piloting a voice dictation eMR and clinical decision support system (an AI general practitioner system, in Chinese called “AI doctor assistant”). Robots located at the outpatient entrance of the hospital respond to voice recognition and touch, advising patients where to seek clinical service in the hospital and how to get there. The AI doctor assistant can quickly review patient case histories, suggest prescriptions, and improve primary care in remote areas where there is a shortage of health personnel.

The hospital is also working with Anhui University of Science and Technology to develop a range of applications in its radiology department, including using telemedicine (with cloud technology) to transmit scans from all over the province for review and analysis. Diagnostic accuracy of sarcoidosis from CT imaging has reached 94.6%. Such better diagnosis has improved respiratory specificity and therefore led to better targeted and earlier treatment. The applications also allow doctors who are off-site to check hospital inpatients on their smartphones and adjust treatment using voice recognition, with all prescription and diagnostic information accessible. The hospitals' pathology department also has automated kiosks where patients can make appointments, receive their medications and make payments. This automation creates efficiency and reduces human error.

Source: Anhui Provincial Health and Family Planning Commission

Internet of things. The Internet of things is a system of interlinked computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (Techtarget, 2018). The system enables the transfer of data within a network without human-to-human or human-to-computer interaction. Various Internet-connected devices have been introduced to patients, including fetal monitors, electrocardiograms, temperature or blood glucose monitors. Many of these measures still require follow-up interaction with a health professional, but there is an opportunity for smarter devices to deliver more valuable data, reducing the need for direct patient–physician interaction.

Increasing privacy, confidentiality and security concerns. Digitization of health and patient data and intensified focus on integrated and high-quality care have lent themselves to increased information sharing between health-care providers and organizations. However, digital technology is not perfect; it has vulnerabilities. Hackers are increasingly targeting electronic health-care data, with data breaches occurring globally, including the National Health Service in England (Donnelly, 2017) and SingHealth in Singapore (Ministry of Communications and Information & Ministry of Health, 2018). In all countries, there is increasing tension between balancing privacy, confidentiality and

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security, on the one hand, and availability of data, on the other. While all data should be available to be shared and monitored to deliver health care, some data may not be shared for security or confidentiality reasons. Countries must ensure that privacy, confidentiality and security legislation, guidelines and institutional arrangements are developed, that their systems are updated, and that security measures are in place to protect health information.

The concurrent emergence of new forms of ICT, big data, blockchain, AI and robotics is driving a fundamental revolution in health care and health systems. “Horizon scanning” is critical to allow countries to monitor and learn about new technologies and select those that are suitable for local use, and can assist cost-effectively with service improvement. Countries should consider the related requirements for technical and financial investment, including governance, information security and privacy protection, and training and capacity-building of those interfacing with the new technology. Decisions should be taken in light of the ethical issues raised by these new technologies.

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5. STRATEGIES AND POLICIES TO HARNESS E-HEALTH FOR IMPROVED HEALTH SERVICE DELIVERY

Key messages:

- For information to be valuable, it must be recorded, exchanged and used. Countries can improve information sharing by developing and applying enterprise architecture, information standards, and privacy and security mechanisms.
- Strengthened governance and management of e-health, and increased capacity of the workforce and the general public, can improve information sharing, privacy and security.

An enabling environment is critical for successful implementation of e-health and benefits for service delivery. This section introduces the key tools that could assist countries to improve information sharing and governance and management of e-health.

5.1. Strategies for health information sharing

Countries should consider the following actions to prepare for health information sharing:

- Develop the enterprise architecture for e-health.⁶
- Develop or adapt and apply information standards.
- Develop or adapt and apply legislation and regulations to support privacy and security.

5.2. Policies for strategic e-health development

Countries should consider the following actions to prepare for governance and management:

- Assess the e-health maturity, and service provision models, such as who provides services and how they are financed to identify strategic directions on e-health.
- Develop a clear national e-health policy, strategic plan and legislative framework through a multisectoral approach.
- Introduce suitable e-health governance mechanisms, including privacy protection and information confidentiality and security measures (ADB, 2018).
- Improve workforce capacity for e-health development, adaptation and management.
- Establish partnerships with key stakeholders, including the private sector to gain their buy-in and harmonize interests for sustainable operation and the usefulness of e-health solutions.

These actions are outlined in more detail in Table 6. The health sector should collaborate within government, leveraging other ministries investing in digital technology and putting the economic case for infrastructure development to central agencies.

⁶ Enterprise architecture covers: the elements of the e-health system, the relationships between these elements, and the alignment of the e-health system with the mission and objectives of the health sector.

Table 6. Actions to support health information sharing and system adoption for e-health

Stage of e-health development	Information sharing and exchange	System adoption
Initial	<ul style="list-style-type: none"> Establish digital health governance mechanism Develop key tools (architecture, standards) Identify minimum information needs for sharing and exchange Develop and apply legislation/policy on privacy protection and information safety 	<ul style="list-style-type: none"> Develop national e-health strategy Set up management capacity on e-health and ICT Support institutional development at national and facility level Establish mechanism to engage with stakeholders on e-health policy development and project design Identify adequate funding to support the cost of acquisition, implementation and maintenance of necessary hardware infrastructure and software licensing
Developing	<ul style="list-style-type: none"> Implement and enforce information sharing and exchange through architecture and standards Apply and enforce legislation/policy on privacy protection and information safety 	<ul style="list-style-type: none"> Strengthen e-health management and governance at national and facility level Introduce incentive mechanism (such as payment methods) for scaling up e-health applications based on identified priorities Develop and promote learning and continued e-health development Identify adequate funding for acquisition, implementation and maintenance of hardware infrastructure and for software licensing
Advanced	<ul style="list-style-type: none"> Identify, implement and regulate new changes for information sharing and exchange Identify gaps and apply different ways to implement legislation/policy on privacy protection and information safety 	<ul style="list-style-type: none"> Apply evidence-based approaches to select suitable e-health applications Make system changes to allow use of innovative applications, to benefit services and avoid possible harm Create ways to increase the engagement of the general public and service providers (see Box 7)
Countries with small populations	<ul style="list-style-type: none"> Apply simple and service-focused tools (architecture) that adopt common international standards Develop legislation/policy on privacy protection and information safety, aligned with service operations 	<ul style="list-style-type: none"> Identify health priorities to benefit from a stepwise approach on e-health application development Focus on management and human resources capacity development Apply cross-sectoral approaches, with clear responsibility Ensure country leadership and development partner involvement Identify adequate funding to support the acquisition, implementation and maintenance of essential hardware infrastructure, and software licensing

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Box 7. Adoption of e-health in the Republic of Korea

Recent adoption rates of eMR systems in the Republic of Korea were reported to be “100% in tertiary hospitals, 99% in general hospitals, 95.4% at local hospitals and 91.9% at local primary care clinics” (Oh et al. 2015). This wide eMR coverage is associated with nearly universal digitization of patient data, digital storage of clinical images, electronic hospital administration databases and the expanding use of remote sensor technology. In addition to international collaboration, successful eMR implementation in the country can be attributed to: standardization; law and policy, particularly on patient information protection; human resources development, including academic offerings on e-health; and innovation, strengthened by investments in research and development for e-health as well as international collaboration. While eMR systems allow medical professionals to access various types of clinical data for individual patients electronically within each organization, access is not available to data from outside of each organization. The vast majority of hospitals still do not allow external access to their electronic patient records.

Video telemedicine services have been provided on a trial basis to patients living on islands and in remote rural areas and prisons. Telehealth services are restricted to certain pilot programmes. Barriers to adoption include the lack of coverage of telehealth services by health insurance, an aggravating burden on consumers and medical professionals that prevents active telehealth utilization. In addition, the medical law related to telehealth is being reorganized. Further, Internet privacy is quite vulnerable, making it difficult for patients to trust telehealth services as responsibilities remain ambiguous in cases of personal information leaks or medical malpractice. Moreover, the matter of who takes responsibility for accidents during telemedicine service (equipment or communication failure) has not been settled. Such matters should be clarified by law to encourage the active participation of medical professionals. In addition, low health-care incentives and environment changes to improve confidence between medical staff and patients should be resolved. For this, experiences should be documented. At the same time, a cost analysis of actual health care should be completed.

Sources: Herh (2015); International Trade Administration (2016); Kim et al. (2015); Lee et al. (2009); Lee & Chang (2012); Oh et al. (2015); Park & Han (2017).

6. SUCCESSFUL IMPLEMENTATION OF E-HEALTH

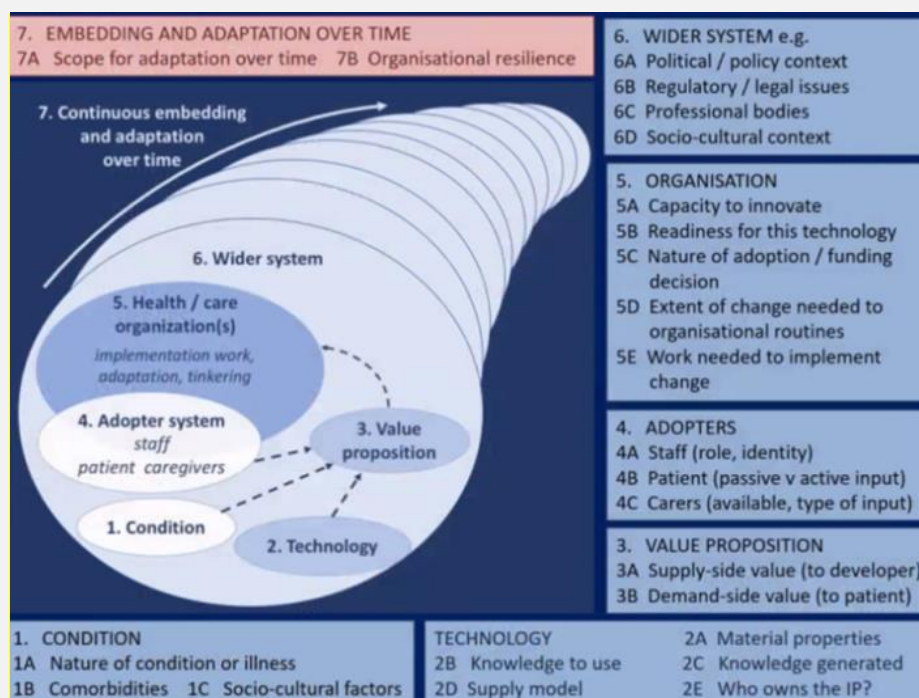
Key messages:

- Successful implementation of e-health across the health system requires end user engagement, and an e-health policy and strategic plan in line with national health priorities, to strengthen leadership and governance, and to guide and monitor e-health developments.
- The process of e-health implementation must fit with the existing working environment, align with the needs of different groups, and reassure both users and beneficiaries. Continuous learning and development can enhance the success and underpin sustained e-health implementation.
- Good monitoring and evaluation systems for e-health at the national and regional level will support continued and sustained progress in e-health for all countries.

After identifying appropriate e-health tools for different service levels, attention must move to implementation. Successful implementation requires planning for a fundamental shift in thinking and practice, with specific actions to support system transformation and to reduce mistakes, delays or failure. This section provides practices for better implementing e-health at the system and operational levels (see Box 8 for an example of an overall e-health implementation model).

Box 8. The Nonadoption, Abandonment, Scale-Up, Spread, and Sustainability framework

The framework of “Nonadoption, Abandonment, Scale-Up, Spread, and Sustainability” (NASSS) identifies seven critical elements linked to avoiding failure of an e-health project (see figure below).



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In the context of the Regional Action Agenda, these can be summarized as follows:

- Identify suitable e-health applications in line with the national health strategic plan, to ensure appropriate conditions and define the expected benefit and the value proposition.
- Engage stakeholders in order to identify and set up suitable initial adopters.
- Align e-health with existing objectives and design processes, including additional training for better technology use and for acceptance by the organization.
- Establish mechanisms to support interoperability.
- Monitor and evaluate the implementation, to understand its impact and the return on investment.

These actions should be embedded in the implementation plan and adapted as needed over time.

Source: Greenhalgh et al. (2017)

6.1 Actions for system-level transformation

Strategic priorities for health services are identified in the national health strategic plan. Each country should select appropriate e-health applications, according to its stage of e-health development. Countries should also be proactive in early dialogue with donors to ensure that any institution-based e-health projects fit with national objectives and priorities, and that the donors themselves harmonize their efforts.

6.1.1 Set up links between e-health applications for large-scale improvement of service delivery

Possible measures to improve links between e-health applications include the following:

- Set up strong governance and institutional arrangements at all levels of the health system to guide, support and monitor e-health development.
- Develop leadership and commitment at the system and organization level to promote the governance measures and ensure the goals and objectives are accepted by different stakeholders.
- Assign clear roles and responsibilities for different stakeholders to ensure their involvement.
- Build capacity for e-health project/programme management, including writing specifications, managing the tender process and ensuring that senior health staff are ICT-literate to deal with IT providers.
- Introduce incentives, such as tax policy or government-led investment, to encourage uptake of appropriate applications, with a clear path to the value proposition and implementation milestones.
- Set up a legislative framework dealing with data privacy and confidentiality.

See Boxes 9 and 10 for examples of a “smart city” or e-government or initiative, and Box 11 for a national e-health initiative that is suitable for a particular local context.

Box 9. Smart Nation initiative in Singapore

The Smart Nation initiative, launched in 2014, is a whole-of-nation movement to harness digital technology in Singapore. Through strategic deployment of technology across the nation, leveraging on investments in digital infrastructure, a tech-savvy population and a single-layer of government that can work quickly to coordinate policies and synergize efforts, Smart Nation aims to develop people-centric solutions to address global urban challenges. Its strategy includes the following seven targets to be achieved by 2030: intelligent energy, smart technology, intelligent building, smart health, public transport system, smart power and intelligent mobility. This “smart city” initiative takes an integrated approach: connecting communities, including individuals, government, businesses and organizations, and formulating specific, targeted services to address the city’s objectives, and advancing the skills and capacities of the community collectively.

Specifically, under Smart Health, Singapore has rolled out national platforms for video consultation and tele-rehabilitation solutions. The platforms enable patients to receive care in convenient locations of their choice, and improve the productivity of the country’s health-care professionals and providers. The Vital Signs Monitoring (VSM) system will also be introduced to bring care beyond the health-care institution into the community and the home. The system will enable the remote monitoring of vital signs such as the blood pressure, blood glucose, or weight of patients with conditions such as hypertension, diabetes, and heart or pulmonary diseases. Patients can in turn receive more timely advice and intervention to manage their conditions without having to schedule an appointment to visit the hospital. A number of other initiatives are also in the pipeline, such as: HealthHub, a one-stop portal and mobile app for citizens to access health-related content, programmes, and services; robotics innovations; sensors; and the Internet of things.

Sources: Chourabi et al. (2012); Giffinger et al. (2007); Shichiyakh et al. (2016); Singapore Ministry of Health (2017); Singapore Ministry of Health (2018); Smart Nation Singapore (2018).

Box 10. Cambodia’s IDPoor programme

Broader social security/citizenship systems can also interface with health-initiated schemes. Since 2005, Cambodia’s Ministry of Planning has used a standardized questionnaire and procedure to identify poor households in rural areas, with support from GIZ and other development partners such as the Australian Government, the European Commission and the United Nations Children’s Fund. This standardized process is now known as the IDPoor Programme. Since 2014, GIZ has been supporting the Ministry of Planning to develop a complementary tool to identify poor households in urban areas. IDPoor is a critical entry point to efficient targeting of social services, social assistance and other services that need to ensure inclusion of all poor population groups. Cambodia’s IDPoor programme with nationwide coverage can be used to improve health service delivery to the poor population. The unique ID scheme assigned to poor populations and families can be expanded or further developed to function as a unique health identifier for the country’s whole population.

Source: Malli & Doetinchem (2016)

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Box 11: Pacific e-health systems fit for the local context

Fiji analysed various applications to determine feasible options for developing the core hospital patient administration system (PAS/EMR). The following options were considered:

- Adopt a modification of the PATISPlus (Patient Information System) used in Fiji, which was developed and funded under Australian Aid.
- Purchase a modified full commercial system.
- Contract a suitable IT company to modify and implement a system based on OpenSource software.

Fiji chose to implement PATISPlus, funded by the Australian Department of Foreign Affairs and Trade. This system captures information from health services to support clinical decision-making, allows information sharing between clinical settings to support continuity of patient care, and provides timely data for management, monitoring and planning. With this system, the registered client is issued a card with a unique common national health number and demographic details. The number can be used at later visits to quickly retrieve their information and prevent creation of duplicate records, for example in case of misspellings.

The customization of PATISPlus according to local needs and the availability of in-country IT vendor support are key factors of its successful adoption and sustainability. The existing and planned further implementation of e-health in Fiji includes a small number of commercial applications, interfaced with PATISPlus.

In contrast, in 2004, Cook Islands introduced Medtech32, a primary care software package designed in and supported from New Zealand. The introduction of the system was driven by the need for a centralized system as well as administration and financial modules. It is now used at health centres and the main referral hospitals. The cost for customization and licences, inability to conduct statistical analyses, poor Internet connection, outdated hardware, and the burden of maintaining both paper and electronic forms have impacted its successful adoption and sustainability for local use.

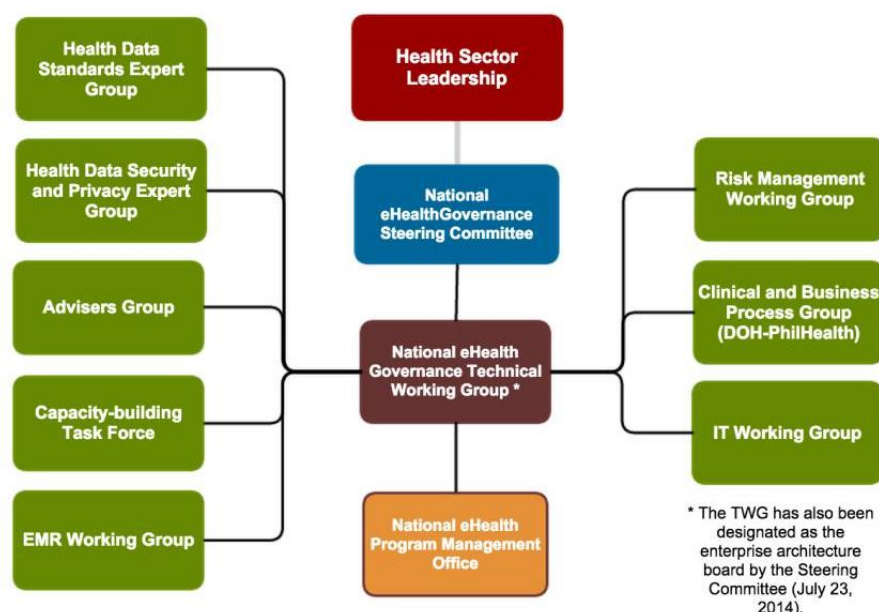
Source: Pacific Health Information Network. Meeting on Health Information System Strengthening, 27–29 June 2018, Suva, Fiji.

6.1.2 Ensure alignment and interoperability of e-health applications

It is important to be able to share information collected from different systems across geographic and health sector boundaries, as well as between different levels of the health system. Key measures for improved interoperability include the following:

- Develop appropriate enterprise architecture, and make sure it is updated and used to guide the development of e-health.
- Apply both top-down and bottom-up approaches to implement the information standards; use national information standards if available, adapt international standards or prepare a national data dictionary for sharing essential information (Box 12).
- Disseminate the national e-health enterprise architecture and related information standards to stakeholders, including service providers, IT software vendors and subnational policy-makers, to ensure they understand the importance and benefit (see Philippine example in Fig. 2).
- Identify a suitable field and opportunities to begin the use of e-health, for example for enforced financial claims or other information requests that already use defined information standards.
- Explore the testing and licencing for interoperability of different systems applied to health.

Fig. 2. Philippine e-health Governance Framework



Box 12. Top-down and middle-out approaches to implementation of eHR in New Zealand and Australia

A top-down approach is directed by the government, with central procurement of standardized health-care IT systems to replace existing diverse systems and with the aim of centrally stored and shared eHRs. New Zealand has adopted this approach with the Ministry of Health leading the business case development for a proposed health information platform to give consumers, health-care providers and planners integrated access to health information from sector eHR systems. A paper will be presented to the Government for a decision to go to the next stage – the business case. In contrast, in the bottom-up model, local health-care organizations take responsibility for making their existing and any new health-care ICT systems compliant with interoperability standards. Multiple eHRs are held locally, but the intention is that, over time, data from all settings will be accessible as the diverse local systems become integrated.

The middle-out approach has elements of both the top-down and bottom-up strategies. It combines local consultation, systems choice and investment with central government support and nationally agreed interoperability standards and goals. Local health-care providers retain responsibility for choosing their eHR systems and for complying with national standards, in order to exchange information with other health providers. Australia's strategy, focusing on standards rather than government implementation of ICT, is an example of the middle-out approach.

Sources: Coiera (2009); Ministry of Health, New Zealand (2017); National E-Health Transition Authority (2009); Morrison et al. (2011)

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6.1.3 Introduce a learning system for continued progress in e-health

The objectives of e-health for health service improvement should focus on the whole system, rather than on single projects. A “learning system” will allow the cumulative experience (what worked and what did not) to contribute to adaptation of the health system over time and ensure resilience for future development. Key steps in this learning system include the following:

- Build a “review and adjust” learning process into both the strategic plan and the implementation plan. Countries need to generate capacity and knowledge from their own experience, the experience of others and projections for the future, to ensure continued development.
- Allocate adequate time and financial investment for continuing development; budget for maintenance and sustainable development during initial planning.
- Build the learning process into each implementation stage, to generate knowledge from success and failure as well as to modify procedures as required.
- Arrange for collection and sharing of best practice and lessons learnt, through regular forums and/or a database, and publish in the academic literature so others can benefit from the learning.
- Build capacity, through peer learning and practical coaching, to continue using development approaches. Countries should identify moving targets for ongoing e-health development (see Boxes 13 and 14).

Box 13. Vanuatu e-health developments to improve service planning

Vanuatu, located in the South Pacific Ocean, is made up of 83 islands, with an estimated population of 270 402 in 2016, most (73.6%) in small rural villages. The country is in the early stages of implementing a new Hospital Information System in order to provide improved information for evidence-based decisions by clinicians at the point of care, as well as for planning, M&E and for hospital management. Its implementation is guided by a strategy that includes a project plan and an investment strategy to inform the decisions of the Vanuatu Government and donor partners.

The investment strategy is governed by the Hospital Information Management System (HIMS) working group. Key to its success is the engagement and leadership of clinicians and other end users (of a potential new system) who have been appointed to key positions in the working group, including a clinician as chairperson. This helps to ensure that the outcomes of the project will meet the needs of potential users of the system and the population it serves and is also an important component of the change management approach of the strategy. The HIMS working group has recently been expanded to an e-health steering committee. The committee will continue providing oversight of the HIMS investment strategy implementation, and incorporate broader health information system developments including development and implementation of a national e-health strategy.

Source: Vanuatu Ministry of Health (2017). Hospital Information System Investment Strategy. Port Vila: Vanuatu Ministry of Health

Box 14. China Tuberculosis Information Management System

The outbreak of severe acute respiratory syndrome in 2002 revealed the limitations in China's disease surveillance system. A sophisticated addition since then has been the Tuberculosis Information Management System (TBIMS), which builds on the data from the Infectious Disease Reporting Information Management System (IDRIMS) to track TB care from suspected cases to outcomes with substantial information on testing and treatment. The initial version of TBIMS, introduced in 2005, was revised in 2009. Around 3200 health facilities used the system at that time. They reported confirmed cases to the TBIMS within 48 hours and presumptive cases to the IDRIMS within 24 hours. Over the first three years of the system, the number of referred patients obtaining a diagnosis increased by more than 150%, mainly due to improved tracing of referred patients. There were some challenges with remote facilities lacking adequate computer facilities or Internet connection. In 2007, it was estimated that about 5% of rural and 29% of township facilities had to submit reports by phone to another institution with Internet access.

Source: Huang, Blaschke & Lucas (2017)

6.1.4 Manage the risks of introducing e-health applications for integrated service delivery

While e-health applications can be transformative, they may also introduce risks into the system. These risks should be identified and addressed through a risk management plan, with the following measures:

- Introduce response arrangements to mitigate the risk of information leaks that can compromise privacy. The arrangements should include national privacy legislation and local privacy and security procedures (see Box 15).
- Introduce technical arrangements to avoid business disruption from events such as a computer virus or a hacker attack.
- Take action to minimize and mitigate the risk of disruption from natural disasters and other unpredictable events on e-health programmes and system operations. Action might include setting up system backup for important information in different physical locations, or some duplication of systems to prevent interruption in operations.
- Monitor the use of e-health applications in different population groups, to manage the risk of e-health increasing inequity and expanding the "digital divide".

Box 15. Risk management for e-health in Australia

The Office of the Australian Information Commissioner (OAIC) has prepared a guide to help entities understand their legislative requirements for reporting and responding to a data breach involving the My Health Record, Australia's national eHR system.

The guide describes some steps an entity must take in the event of a data breach:

- Contain the breach and undertake a preliminary assessment.
- Evaluate any risks that may be related to or arise from the breach.
- Notify the authorities of the breach.
- Take steps to prevent or mitigate the effects of further breaches.

The guide also stresses that notification in the case of a data breach involving personal information should be consistent with good privacy practice. This is important because notification allows affected health-care recipients to take any necessary action to protect their information and to ensure the ongoing security and integrity of, and confidence in, the My Health Record system. The issue often comes down to who owns a patient's records (providers usually are the custodians on behalf of patients), who pays for the integration (usually there has to be a governmental monetary push) and who benefits from e-health integration.

Source: OAIC (2017)

Annex

6.2. Actions for operational-level transformation

6.2.1 Align e-health with existing objectives, review and redesign work processes

The benefits of e-health for service delivery depend on successful integration of the applications into existing practice. The integration must occur at both system (strategic) level and at institutional or project (operational) level. The following measures are recommended for success at system level:

- Conduct institutional and workflow analysis to learn how current processes may be affected by proposed new approaches and technologies.
- Ensure that new institutional arrangements and workflows for e-health applications are included in development and implementation plans.
- Undertake review of any needed redesign of work processes.
- Conduct education and training so that the workforce can adopt the e-health applications at system and institutional levels.
- Identify a team of early adopters throughout the organization. Use them to champion the use of the new technology and provide peer-to-peer training on the job.
- Conduct training on data quality at entry.
- Ensure good communication within teams and with stakeholders to build and maintain trust and transparency.

6.2.2 Develop training and standard operating procedures for e-health implementation

The use of e-health applications will bring new ways of working, which may disrupt established organizational arrangements. Affected staff will need to adapt to using the new procedures in their work. Training programmes for e-health adopters, with related standard operating procedures (SOPs), are essential to ensure the changes are introduced and maintained in the health system and relevant facilities. Measures include the following:

- Identify key changes and the people involved, to define the training and SOPs needed.
- Develop and test training materials and SOPs closely linked with actual real task performance, operational requirements, and common barriers and mistakes.
- Conduct the training, including use of SOPs and attention to actual performance.
- Continue monitoring and auditing the e-health implementation to ensure that the new methods and SOPs are applied appropriately to reach identified objectives.
- Ensure ongoing support and maintenance, for example help desk and other change management steps.

6.3 Engagement with stakeholders

Stakeholder engagement⁷ is important to ensure that the e-health implementation plan is understood, is feasible, and that the e-health projects will really improve services. Stakeholder groups must be identified and engaged, in order to understand their needs and to build trust. In the context of e-health and health services, stakeholders include the service users (patients), the service providers (health professionals) and managers who will use the e-health applications (see Box 16). Stakeholder engagement measures include the following:

- Identify different stakeholder groups, analyse the contributions and influences of each group, and identify suitable actions to engage each group. This process is referred to as stakeholder analysis. For example, regular engagement with health professionals, as the primary users of many e-health applications, promotes adoption of e-health tools, and helps build an informed and motivated workforce. Inclusion of patients, their carers and advocacy groups promotes patient awareness of, and participation in, their health care.
- Involve stakeholders at the strategic level in developing the national e-health plan and those at the implementation level in preparing project plans (see Box 17).
- Engage with stakeholders as early as possible, to build interest and support and to facilitate the planning process.

Box 16. Stakeholder engagement for adoption of a health information system

The Ministry of Health of the Lao People's Democratic Republic moved from an Excel to a web-based health management information system (HMIS) using DHIS2 open source software and developing the first e-health strategy based on the 2012 WHO–ITU guidelines in 2015. The online HMIS captured routine programme data from public health facilities nationwide, with the district health office as the connecting and reporting point between primary health services and higher-level service reporting. All submitted data from paper forms are entered in the system at the district offices. The paper forms are still in use, for reference and for data quality verification.

With support from the Global Fund to Fight AIDS, Tuberculosis and Malaria in 2017, the three disease programmes integrated their reporting systems with HMIS, using DHIS2 as the common reporting platform. Other programmes also started to use the common platform or exchanged their data using the platform for cross-sectoral analysis and reporting. The Ministry issued a directive in December 2017, formally endorsing the common platform as the national information system and requesting all programmes to report to it. The Ministry also launched the National UHC/SDG monitoring framework in May 2018, using the same platform for data analysis. A monitoring dashboard (www.hmis.gov.la/lao) has been developed and will be updated annually. A similar effort is now ongoing to monitor the progress at the subnational level.

The e-health strategy was developed in consultation with all stakeholders: the health sector at all administrative levels, Ministry of Planning and Investment, Ministry of Finance, Ministry of Tele-communication and Technology, and all concerned development partners (United Nations agencies, World Bank, Asian Development Bank, bilateral agencies). Engagement of stakeholders conveyed the importance of working together and sharing resources as well as developing a master plan for interoperability and data exchange across reporting systems. This strategy was then incorporated into the National Health Information Strategy 2018–2025.

⁷ For this Action Agenda, stakeholder engagement means involvement of those who can affect e-health projects, as a beneficiary or user of e-health technology (sometimes both), or as someone responsible for providing health services or for developing and implementing changes to health services and to e-health applications.

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Box 17. Global Digital Health Partnership

The Global Digital Health Partnership (GDHP) is an international collaboration of governments and territories, government agencies and WHO, formed in 2018 to support the effective implementation of digital health services. It facilitates global collaboration and cooperation to support the best use of digital technology.

Participating countries engage in international dialogue to share lessons on effective policy design and practical delivery implementation of digital health services. The GDHP will collaborate, develop and share resources on interoperability, cyber security, policy environments, clinical and consumer engagement, and evidence and evaluation.

Sources: Australian Digital Health Agency (2018); Global Digital Health Partnership (2018)

6.4 Monitoring and evaluation of e-health applications

Monitoring and evaluation (M&E) is essential to ensure that e-health develops in line with national priorities. M&E can also guide the adjustment of implementation to reach specified objectives and end goals. The following points should be considered when planning M&E for e-health development:

- Keep in mind the value of system-level success for improved health service delivery. Apply M&E at both system (strategic) level and project (implementation) level. Note that different e-health projects may target different parts of the service process.
- Identify indicators for national progress on e-health for services at different levels (WHO, 2018a). The table in Box 18 shows possible indicators of the successful use of e-health for improved health service delivery.
- Include M&E in the national e-health development plan and in implementation plans to confirm that all e-health projects are in line with national priorities.
- Adopt appropriate M&E methods, including multilevel processes, for e-health development.
- Work with independent bodies and academic institutes to improve e-health evaluation as well as for knowledge translation and exchange.

Box 18. Possible indicators to assess e-health for improved health service delivery

The overall objective of e-health for improved health service delivery is to have better access to quality service with lower cost for the whole population. UHC indicators should be used to assess the impact of e-health on health service delivery. These should be used in addition to the possible indicators of e-health for improved health service delivery in the table below.

Domain	Possible indicators
System	<ul style="list-style-type: none">• % population with improved service access due to different e-health applications• % population affected by improved communication with health providers through different e-health applications
Organization	<ul style="list-style-type: none">• % hospitals with improved communication with patients, through different e-health applications• % health facilities that provide transparent information through electronic records and other e-health applications
Service provider	<ul style="list-style-type: none">• % health facilities that have applied eMR/eHR, across different types of facilities• % primary health care facilities using applied telemedicine or other e-health applications to improve service capacity and quality
Individual	<ul style="list-style-type: none">• % of population with improved access to quality health services by population groups through different e-health applications• % persons with exchangeable eMR/eHR by different population groups.

7. WAY FORWARD AND RECOMMENDATIONS

The final section of this Action Agenda for e-health summarizes recommended actions for Member States and for WHO in the Western Pacific Region. A general list of actions recommended for the Member States is followed by particular points of emphasis for countries with the four groups, based on stage of e-health development: initial, developing, advanced and countries with small populations. A list of actions recommended for WHO concludes this section. Readers should refer back to the main text for the detailed context of each recommendation.

7.1 Recommended actions for Member States

Member States are recommended to take the following actions:

- **Strategic planning.** Develop and implement a national e-health strategy, which identifies the timeline and priorities for e-health, in line with the national health development strategic plan, and aims to support improvements in service quality and in access for disadvantaged populations.
- **Use of essential e-health tools.** Adopt and disseminate or expand the use of basic, proven e-health tools, based on international standards and best practice. The tools will include UHI, eMR/eHR and telemedicine.
- **Capacity-building.** Take steps to build human and institutional capacity in e-health, including (1) access to professional and refresher training in required skills and competencies for e-health, (2) institutional arrangements at national and facility level for e-health development, and (3) channels and events to exchange experiences and lessons, across service levels, across sectors and in other countries.
- **Cross-sectoral involvement.** Develop multisectoral mechanisms to advance e-health initiatives, including working with the treasury, ICT development, education, social services and the private sector.
- **Engagement of different stakeholders.** Involve stakeholders in e-health planning and implementation, including professional associations and patient and family organizations. Promote engagement with communities, service providers and those in other sectors by identifying (1) champions to help leverage and promote digital initiatives, and (2) central and cross-sectoral governance mechanisms for health-related innovations.
- **Ensuring privacy and security.** Develop legislation and policies to protect privacy and to strengthen information security at different levels.
- **Sharing of information, expertise and experience.** Improve information sharing by introducing enterprise architecture and information standards.
- **Monitoring and evaluation.** Conduct M&E of the strategy and implementation of e-health development, share the findings with relevant stakeholders, and promote exchange of experience and lessons within and across countries.

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7.2 Recommended priority actions for countries according to their stage of e-health development

Member States in the Region at different stages of e-health development should select actions from the list above to improve service delivery and coverage, according to their immediate needs and capacity and the opportunities available, as outlined here.

Initial stage

Countries in initial stage of e-health development, facing challenges of health service access, should focus on the basic foundations of e-health and include the following priority actions:

- Develop and apply UHIs for the population using a stepwise approach.
- Digitize relevant existing databases (e.g. workforce, facilities).
- Introduce eMRs/eHRs at facility level (start in selected facilities and expand to all).
- Introduce m-health and telemedicine to improve service access and coverage.
- Select e-health applications that which can function with limited coverage/speed of Internet and mobile phones. However, basic infrastructure may improve quickly at low cost, so be ready to respond.
- Identify “leapfrog” opportunities based on national priorities and experience from other countries.

Developing stage

Countries in the developing stage, facing challenges of health service quality and equity, should focus on national priorities for improving health services and include the following priority actions:

- Regularly review and update national e-health enterprise architecture and information standards.
- Organize and fund e-health capacity development for the health professionals, managers and ICT staff.
- Adopt processes to monitor and control costs and promote sustainable development.
- Conduct M&E and participative reviews before scaling up existing pilots.

Advanced stage

Countries in the advanced stage, aiming to improve people-centred quality of care and assist other countries, should include the following priority actions:

- Foster innovative e-health applications to improve services at all levels and to link health with other socioeconomic factors (for example, integrate health and community services for older people).
- Improve interoperability using both a top-down and a bottom-up approach.
- Strengthen privacy and accountability legislation, regulation and enforcement.
- Mentor other countries that are in the initial and developing stages.

Countries with small populations

Small population island countries, generally with limited service capacity and access, limited and few resources for e-health development, should include the following priority actions:

- Assess coverage of electric power, Internet and mobile phones to identify which e-health application can be used to improve services and access.
- Establish and improve basic e-health tools, such as UHI and eMR/eHRs that can be applied as paper/electronic hybrids.
- Make arrangements to share technical and managerial expertise and funds across different sectors.
- Establish institutional arrangements to link providers of both the same and different service levels.
- Adopt a stepwise approach for investing in e-health, based on a longer-term strategy; accumulate and use funds for identified priorities.
- Introduce e-health system elements according to local context and opportunities.

7.3 Key actions for WHO

WHO in the Western Pacific Region will focus on the following actions:

- Advocate to raise awareness and recognition of e-health as an important way to strengthen health services in achieving UHC, and support countries in developing e-health strategies and actionable plans for e-health development.
- Strengthen country capacity to analyse and decide on future e-health initiatives, within their national e-health strategies
- Support e-health development in resource-constrained settings and small island developing states in the Western Pacific Region.
- Work with other partners and liaise with government ministries of different sectors to establish unique identifiers for Member States.
- Work with Member States to improve donor alignment and demand donor coordination for e-health.
- Support multisectoral coordination, including working with the private sector to improve implementation, learning and scaling up of cost-effective e-health solutions.
- Develop and introduce prototypes of guidelines, tools and information standards, to assist Member States to select, manage and evaluate e-health solutions.
- Work with countries and partners to generate and share evidence on e-health development, including cost-effectiveness; improve knowledge sharing and peer-learning on e-health.
- Continue to monitor and report on trends in digital innovation for health service delivery to inform policy and practice in Member States as well as report regularly on the use of e-health in the Western Pacific Region.

WHO actions will be applied according to the context of the countries in the Region, taking account of the diversity of ICT and e-health development and varying levels of resources.

Annex

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GLOSSARY

Term	Definition	Source
Artificial intelligence	Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans.	Techopedia. Artificial Intelligence (https://www.techopedia.com/definition/190/artificial-intelligence-ai , 3 August 2018)
Big data	The term big data refers to the emerging use of rapidly collected, complex data in such unprecedented quantities that terabytes (10^{12} bytes), petabytes (10^{15} bytes) or even zettabytes (10^{21} bytes) of storage may be required. The unique properties of big data are defined by four dimensions: volume, velocity, variety and veracity. As more information is accruing at an accelerating pace, both volume and velocity are increasing.	World Health Organization. Big data in global health: improving health in low-and middle-income countries (http://www.who.int/bulletin/volumes/93/3/14-139022/en/ , accessed 23 July 2018)
Blockchain	Blockchain is a type of distributed ledger for maintaining a permanent and tamper-proof record of transactional data. A blockchain functions as a decentralized database that is managed by computers belonging to a peer-to-peer (P2P) network. Each of the computers in the distributed network maintains a copy of the ledger to prevent a single point of failure (SPOF) and all copies are updated and validated simultaneously.	Techtarget. Blockchain. (https://searchcio.techtarget.com/definition/blockchain , accessed 23 July 2018)
Confidentiality	Confidentiality safeguards information that is gathered in the context of an intimate relationship. It addresses the issue of how to keep information exchanged in that relationship from being disclosed to third parties (Westin, 1976). Confidentiality, for example, prevents physicians from disclosing information shared with them by a patient in the course of a physician–patient relationship. Unauthorized or inadvertent disclosures of data gained as part of an intimate relationship are breaches of confidentiality (Gostin and Hodge, 2002; NBAC, 2001).	Beyond the HIPAA Privacy Rule: Enhancing Privacy, Improving Health Through Research. The Value and Importance of Health Information Privacy. (https://www.ncbi.nlm.nih.gov/books/NBK9579/ , accessed 23 July 2018)
Digital divide	Digital divide is a term that refers to the gap between demographics and regions that have access to modern information and communications technology, and those that don't or have restricted access. This technology can include the telephone, television, personal computers and the Internet.	WhatIs.com. Digital Divide (https://whatIs.techtarget.com/definition/digital-divide , accessed 23 July 2018)
Digital health	Digital health and e-health are used as umbrella terms to encompass all concepts and activities at the intersection of health and ICTs, including mobile health (m-health), health information technology, electronic health records and telehealth	Broadband Commission for Sustainable Development (2017). Digital health: a call for government leadership and cooperation between ICT and health

E-health	E-health is the cost-effective and secure use of ICT in support of health and health-related fields, including health care services, health surveillance, health literature, health education, and knowledge and research.	Fifty-eighth World Health Assembly (2005) Resolution WHA58.28 (http://www.who.int/iris/handle/10665/20378) This Framework uses the WHA definition; there are over 50 different definitions of the term (Oh, 2005).
Enterprise architecture	Enterprise architecture is a comprehensive operational framework that explores all of an organization's functional areas while defining how technology benefits and serves the organization's overall mission. The technological aspect of EA defines the hardware, operating systems, programming and networking solutions a business employs and how those may be used to achieve its current and future objectives.	Technopedia. Enterprise Architecture (https://www.techopedia.com/definition/24746/enterprise-architecture-ea , accessed 23 July 2018)
Health informatics	As defined by the United States National Library of Medicine, health informatics is the interdisciplinary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management, and planning.	Health Information and Management Systems Society. Health Informatics Defined. (https://www.himss.org/health-informatics-defined , accessed 23 July 2018)
Integrated health services	Health services that are managed and delivered so that people receive a continuum of health promotion, disease prevention, diagnosis, treatment, disease-management, rehabilitation, and palliative care services, coordinated across the different levels and sites of care within and beyond the health sector, and according to their needs throughout the life course.	Sixty-ninth World Health Assembly (2016) Framework on integrated, people-centered health services (A69/39; http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf)
Internet of things	The Internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.	Techtarget. Internet of Things. (https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT , accessed 23 July 2018)
Interoperability	<p>In health care, interoperability is the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged. Data exchange schema and standards should permit data to be shared across clinician, lab, hospital, pharmacy, and patient regardless of the application or application vendor.</p> <p>Interoperability means the ability of health information systems to work together within and across organizational boundaries in order to advance the effective delivery of healthcare for individuals and communities.</p>	Health Information and Management Systems Society. What is interoperability? (https://www.himss.org/library/interoperability-standards/what-is-interoperability , accessed 23 July 2018)

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M-health	M-health or mobile health is a component of e-health. It refers to medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices.	World Health Organization. mHealth. New horizons for health through mobile technologies. 2011 http://www.who.int/goe/publications/goe_mhealth_web.pdf
People-centred care	An approach to care that consciously adopts perspectives of individuals, carers, families and communities as participants in, and beneficiaries of, trusted health systems that are organized around the comprehensive needs of people rather than individual diseases, and respects social preferences. People-centred care also requires that patients have the education and support they need to make decisions and participate in their own care, and that carers are able to attain maximal function within a supportive working environment. People-centred care is broader than patient and person-centred care, encompassing not only clinical encounters, but also including attention to the health of people in their communities and their crucial role in shaping health policy and health services.	Sixty-ninth World Health Assembly (2016) Framework on integrated, people-centered health services (A69/39; http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf)
Privacy	Privacy addresses the question of who has access to personal information and under what conditions. Privacy is concerned with the collection, storage, and use of personal information, and examines whether data can be collected in the first place, as well as the justifications, if any, under which data collected for one purpose can be used for another purpose. An important issue in privacy analysis is whether the individual has authorized particular uses of his or her personal information.	Beyond the HIPAA Privacy Rule: Enhancing Privacy, Improving Health Through Research. The Value and Importance of Health Information Privacy (https://www.ncbi.nlm.nih.gov/books/NBK9579/ , accessed 23 July 2018)
Robotics	Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering.	WhatIs.com. Robotics. (https://whatis.techtarget.com/definition/robotics , accessed 23 July 2018)
Security	Security can be defined as “the procedural and technical measures required (a) to prevent unauthorized access, modification, use, and dissemination of data stored or processed in a computer system, (b) to prevent any deliberate denial of service, and (c) to protect the system in its entirety from physical harm” (Turn and Ware, 1976). Security helps keep health records safe from unauthorized use. When someone hacks into a computer system, there is a breach of security (and also potentially, a breach of confidentiality). No security measure, however, can prevent invasion of privacy by those who have authority to access the record (Gostin, 1995).	Beyond the HIPAA Privacy Rule: Enhancing Privacy, Improving Health Through Research. The Value and Importance of Health Information Privacy. (https://www.ncbi.nlm.nih.gov/books/NBK9579/ , accessed 23 July 2018)
Telehealth	Telehealth involves the use of telecommunications and virtual technology to deliver health care outside of traditional health-care facilities. Telehealth, which	World Health Organization. Telehealth (http://www.who.int/sustainabl)

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	requires access only to telecommunications, is the most basic element of “e-health”, which uses a wider range of information and communications technologies (ICTs).	e-development/health-sector/strategies/telehealth/en/, accessed 23 July 2018)
Telemedicine	The delivery of health-care services, where distance is a critical factor, by all health-care professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health-care providers, all in the interests of advancing the health of individuals and their communities.	World Health Organization. Telemedicine: Opportunities and Developments in Member States. Global Observatory for eHealth series – Volume 2 (http://www.who.int/goe/publications/goe_telemedicine_2010.pdf , accessed 23 July 2018)

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APPENDICES

Appendix 1. Core household indicators on access to and use of ICT by households and individuals

	Proportion of households with												Percentage of individuals using a					
	(HH1)	Year	(HH2)	Year	(HH3f)	Year	(HH3m)	Year	(HH4)	Year	(HH6)	Year	(HH5)	Year	(HH7)	Year	(HH10)	Year
	Radio		TV		Fixed line telephone		Mobile-cellular telephone		Computer		Internet access at home		Computer		Internet		Mobile	
Australia	...		...		...		...		83.0	2015	85.9	2015	...		84.6	² 2015	...	
Brunei Darussalam	75.0	2016	64.0	2016	33.3	2016	63.8	2016	93.0	2016	75.0	2016	58.0	2016	90.0	2016	...	
Cambodia	41.6	2016	65.0	2016	12.7	2015	81.7	2015	12.0	2016	20.0	2016	27.4	2016	32.4	2016	...	
China	...		...		...		...		...		...		...		53.2	2016	...	
Fiji	...		...		...		...		...		...		...		...		...
Japan	...		...		75.6	2015	95.8	2015	76.7	2016	96.2	2016	76.4	2016	93.2	2016	76.4	2016
Kiribati	...		...		...		...		...		...		...		...		...
Republic of Korea	...		96.7	2016	50.0	2016	99.2	2016	75.3	2016	99.2	2016	77.2	2016	92.8	2016	99.6	2016
Lao People's Democratic Republic	55.0	²² 2012	53.0	²² 2012	...		...		...		...		...		...		...
Malaysia	92.1	2015	98.4	2015	...		...		72.2	2016	76.9	2016	68.7	2015	78.8	2016	97.5	2015
Marshall Islands	...		...		...		...		...		...		...		...		...
Micronesia (Federated States of)	...		...		...		...		...		...		...		...		...
Mongolia	13.6	2015	96.6	2015	4.6	2015	96.0	2015	23.6	2016	23.6	2016	...		22.3	2016	...	
Nauru	...		...		...		...		...		...		...		...		...
New Zealand	...		...		...		...		77.8	2012	76.8	2013	...		81.6	2012	...	
Papua New Guinea	...		...		...		...		...		...		...		...		...
Philippines	29.6	2016	73.8	2016	6.7	2016	84.8	2016	23.4	2016	...		...		48.1	²⁹ 2013	...	
Singapore	...		...		84.2	2015	97.3	2015	87.0	2015	88.2	2015	73.6	2014	79.0	2015	83.9	2014
Solomon Islands	...		...		...		...		...		...		...		...		...
Tonga	...		...		...		...		...		...		...		...		...
Tuvalu	...		...		...		...		...		...		...		...		...
Vanuatu	...		...		...		...		...		...		...		...		...
Viet Nam	...		...		...		...		...		...		...		...		...

Note: Figures in italics are ITU estimates.

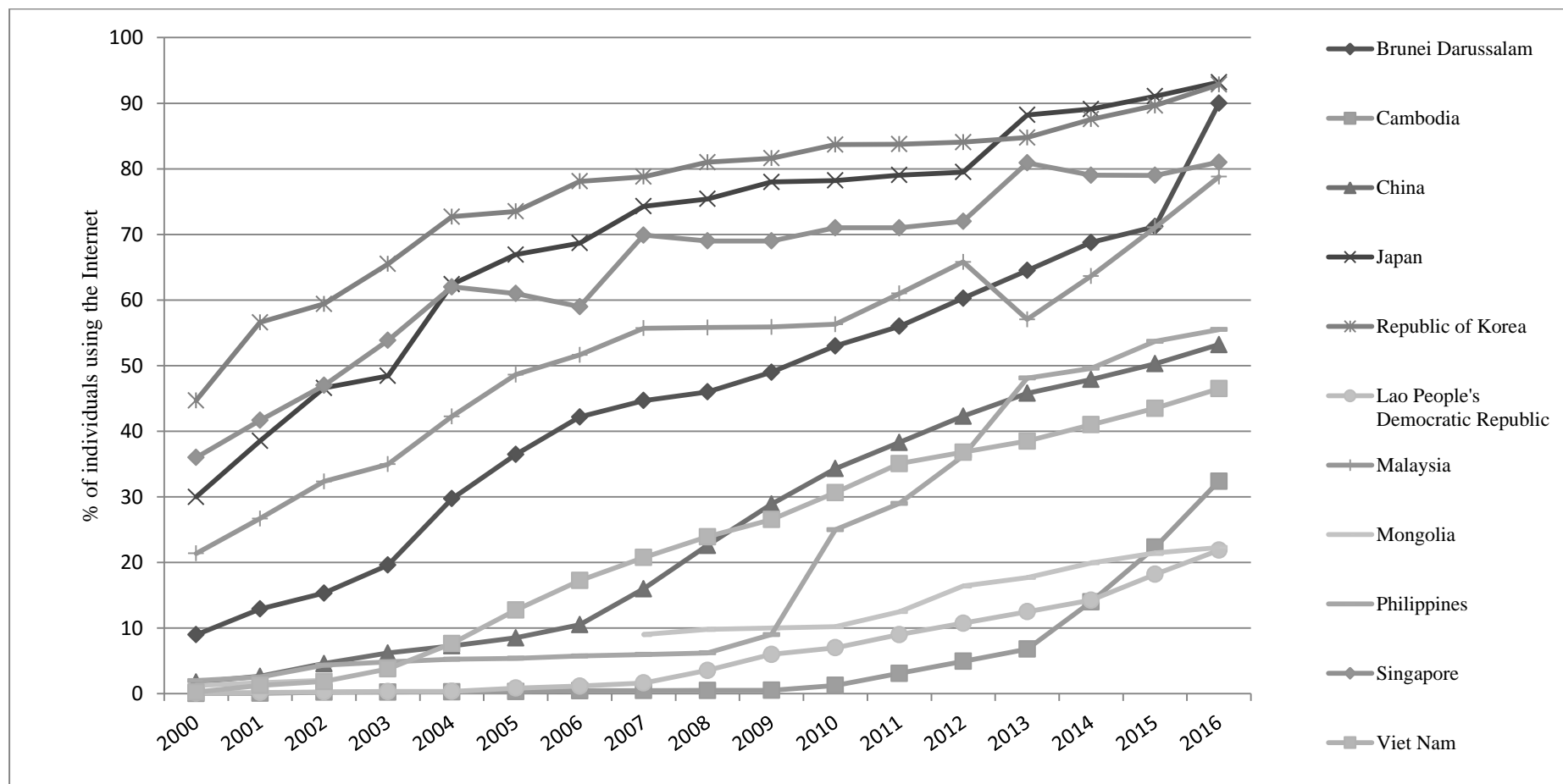
... Data not available

- Zero or quantity less than the unit shown.

Source: ITU World Telecommunication/ICT Indicators Database.

Appendix 2. Percentage of individuals using the Internet in countries in the Western Pacific Region with available data, 2000–2016

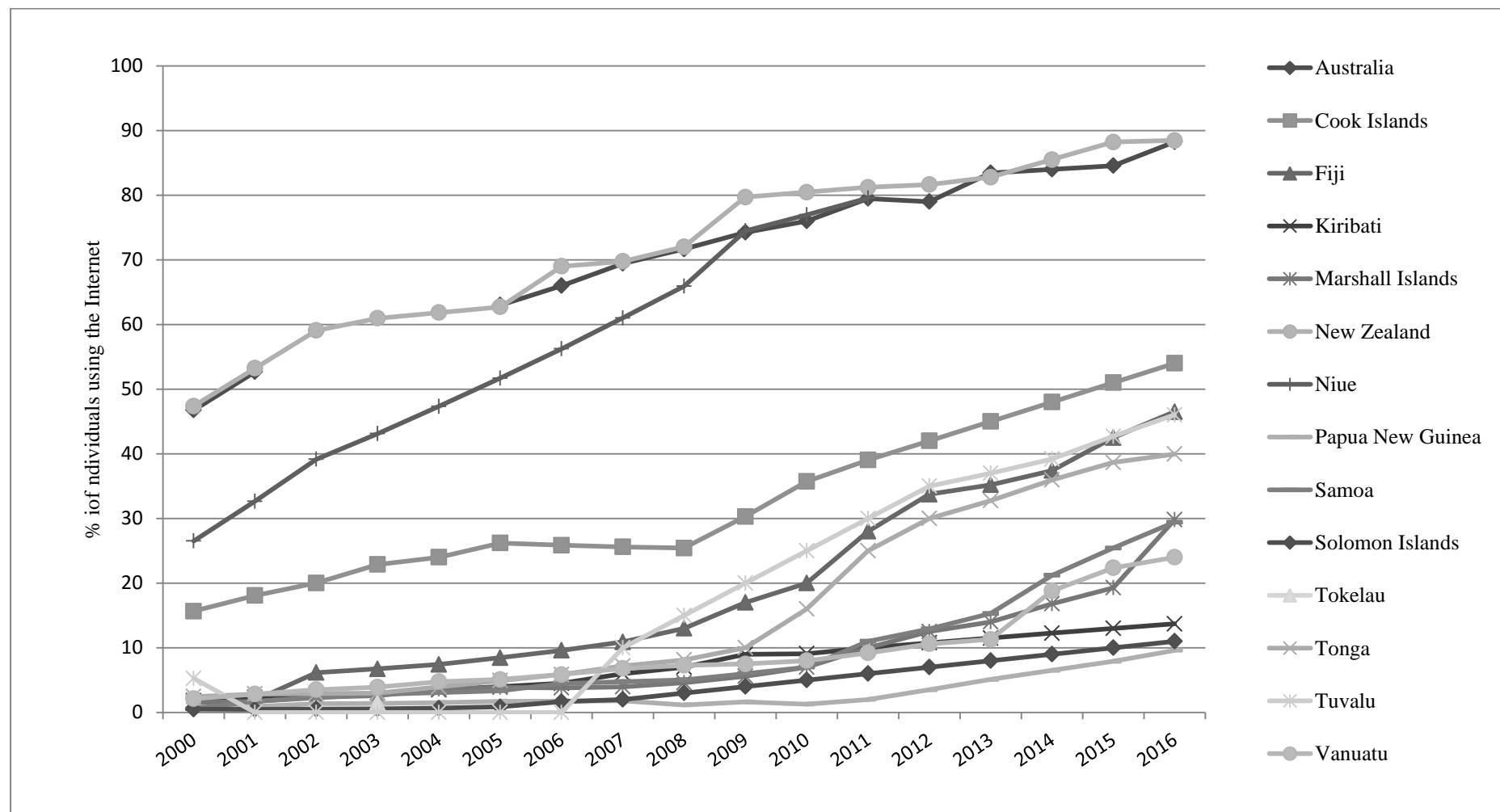
Appendix 2a. Percentage of individuals using the Internet in Asian countries



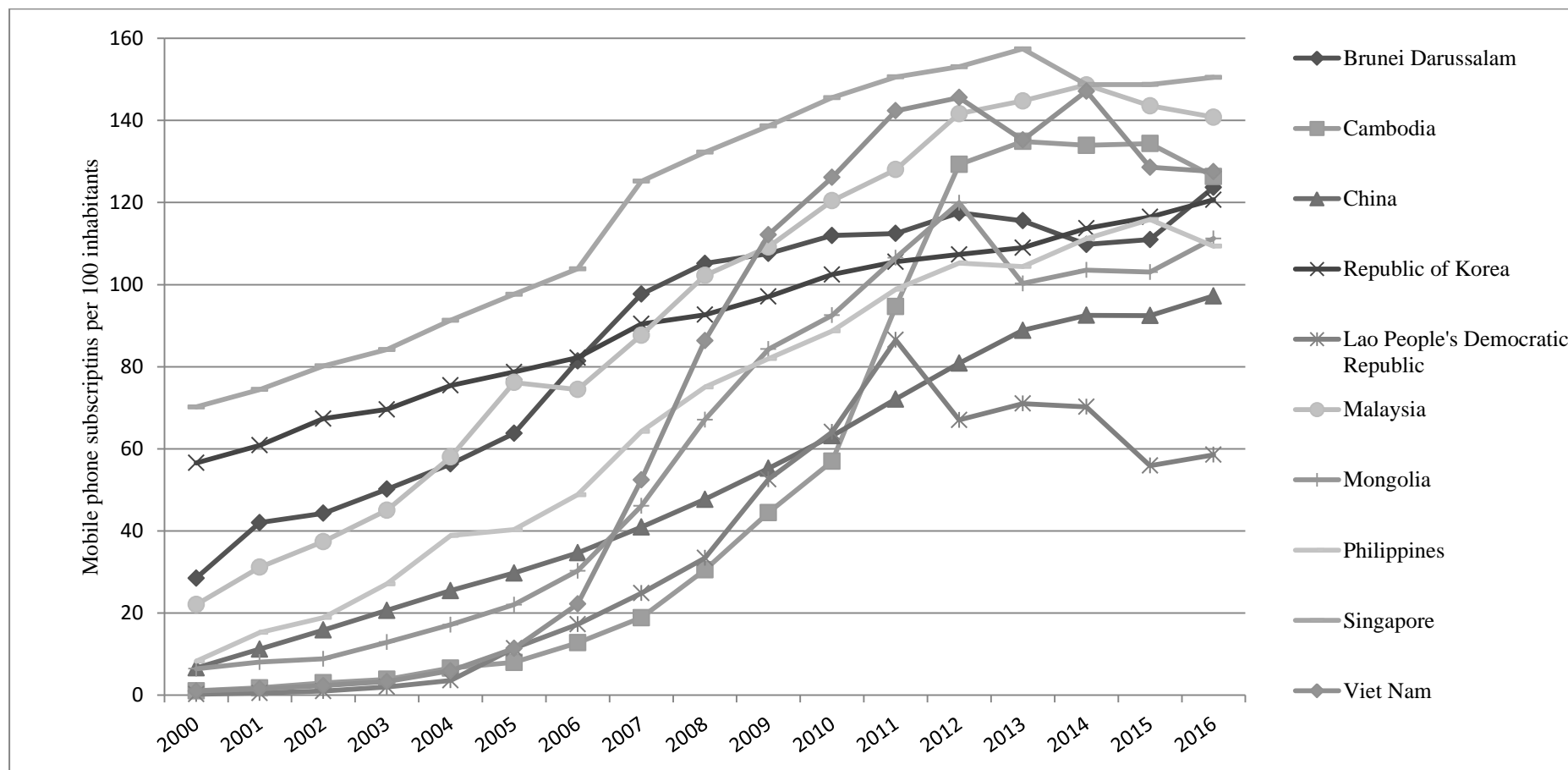
Source: ITU (2018b).

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Appendix 2b. Percentage of individuals using the Internet in Pacific countries



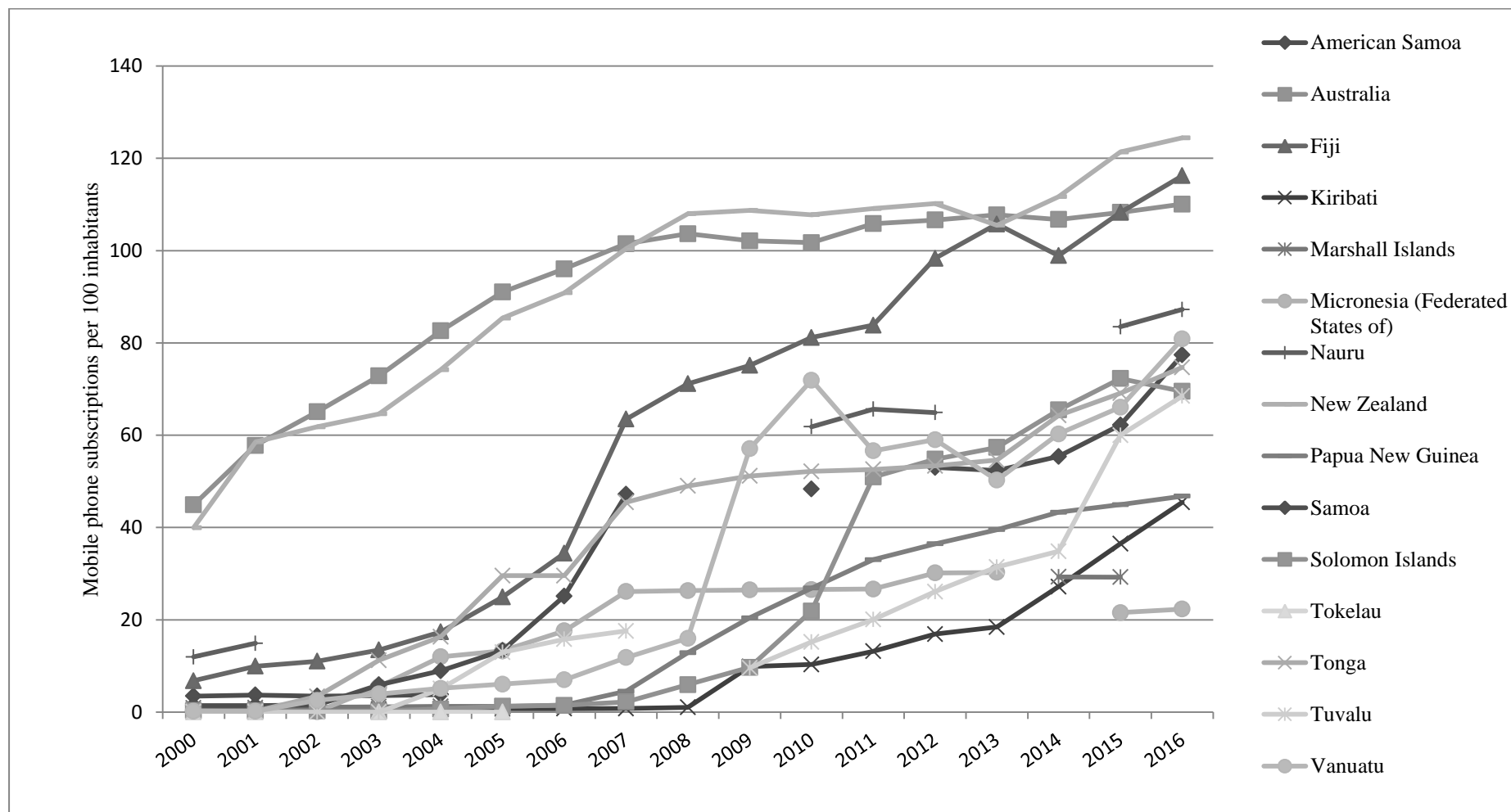
Source: ITU (2018b).

Appendix 3. Mobile phone subscriptions per 100 inhabitants, 2000–2016**Appendix 3a. Mobile phone subscriptions per 100 inhabitants in Asian countries**

Source: ITU world telecommunication/ICT indicators database (2000–2016) (<https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>, accessed 1 March 2018).

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Appendix 3b. Mobile phone subscriptions per 100 inhabitants in Pacific countries



Source: ITU world telecommunication/ICT indicators database (2000–2016) (<https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>, accessed 1 March 2018).

Appendix 4. Individuals using the Internet (from any location), by gender and urban/rural location (%)

Country	Year	All individuals	Gender		Urban			Rural		
			Male	Female	Total	Male	Female	Total	Male	Female
Australia	2015	84.6	84.2	84.9	85.3	85.5	85.0	78.3	72.0	84.1
Cambodia	2015	6.4	6.5	6.3	23.0	23.6	22.4	1.3	1.4	1.3
Japan	2015	91.1	92.9	89.3	92.8	93.6	92.1	89.9	92.4	87.6
Malaysia	2015	71.1	73.0	69.0	...	...	...	...	...	...
New Zealand	2015	81.6	81.2	82.2	...	...	...	...	...	...
Republic of Korea	2015	89.6	92.2	87.1	91.0	93.2	88.8	83.4	87.7	78.6
Singapore	2014	79.0	81.2	77.3	79.0	81.2	77.3	...	...	...

Note: Age scope of population varies across countries. Reference period for computer & Internet usage is three months only.

Source: ITU world telecommunication/ICT indicators database (2012–2015) (<https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>, accessed 1 March 2018).

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Appendix 5. Summary of e-health situation in countries in the Western Pacific Region (updated in June 2018 based on country inputs)

Group	Country	National e-health policy/strategy	National UHC policy/strategy	National HIS policy/strategy	National telehealth policy/strategy	Legal framework for eHR data sharing	Telehealth	National eHR system	M-health
Advanced stage	Australia	Yes (2017)*	Yes (2008, updated 2017)	No	No	Yes	Yes, telehealth includes medical video consultations which are eligible under the Medical Benefits Scheme. Australia also has teleradiology and telepsychiatry.	Yes (2012)	Yes, at national level for toll-free emergency, health call centres, community mobilization and patient records
Advanced stage	Japan	Yes (2014)	Yes	Yes	No	Not known	Yes, at national level for teleradiology, telepathology and remote patient monitoring	No	Yes, at national level for toll-free emergency, health call centres, decision support systems
Advanced stage	New Zealand	Yes, in development (2017)	Yes	No	No	No	Yes, at regional and local level for secondary and primary care remote clinical consultations and training including teleradiology and telepsychiatry	No	Yes, at national level for toll-free emergency, health call centres, management of disasters, community mobilization and decision support systems
Advanced stage	Singapore	Yes (2003)	Yes	Yes	Yes	Yes	Yes, at international level for teleradiology	Yes (2011)	Yes, at national level for toll-free emergency, management of disasters and emergencies, community mobilization, patient records

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Group	Country	National e-health policy/strategy	National UHC policy/strategy	National HIS policy/strategy	National telehealth policy/strategy	Legal framework for eHR data sharing	Telehealth	National eHR system	M-health
Developing stage	Malaysia	Yes (2006)	Yes	Yes	Yes	Yes	Yes, at national level for teleradiology, teledermatology	Yes (2003)	Yes, at national level for toll-free emergency, mobile telehealth, management of disasters and emergencies, community mobilization, access to information, patient records
Developing stage	China	Yes (2012)	Yes	No	Yes	No	Yes. at local levels only	Yes (2009)	Yes, at national level for management of disasters and emergencies and access to information/databases and tools
Developing stage	Mongolia	Yes (2008)	Yes	Yes	Yes	Yes	Yes, intermediate for teleradiology and telepathology	Yes (2004)	Yes, at national level for toll-free emergency, health call centres, management of disasters and emergencies
Developing stage	Philippines	Yes (2013)	Yes	Yes	No	No	Yes, at international level for telepsychiatry and teleradiology	No	Yes, at national level for appointment reminders, management of disasters and emergencies
Developing stage	Viet Nam	Yes (2006)	Yes	Yes (Circular No. 54/2017/TT-BYT issuing criteria for applying IT in health facilities).	Yes (Circular No. 49/2017/TT-BYT regulating on operation of distant health services)	No	Yes, at national level for teleradiology and telepathology	No	Yes at national level for toll-free emergency, health call centres, management of disasters and emergencies, patient records

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Group	Country	National e-health policy/strategy	National UHC policy/strategy	National HIS policy/strategy	National telehealth policy/strategy	Legal framework for eHR data sharing	Telehealth	National eHR system	M-health
Initial stage	Cambodia	No	No	Yes	No	No	Yes, at national level for telepathology	Yes (2011)	Yes, at national level for toll-free emergency, appointment reminders, mobile telehealth, management of disasters and emergencies, treatment adherence, community mobilization, access to information, databases and tools, patient records
Initial stage	Lao People's Democratic Republic	No	Yes	Yes	No	No	Not known	No	Yes, at national level for toll-free emergency
Countries with small populations	Kiribati	Yes	No	No	Not known	No	Not known	Yes (2012)	Not known

* Australian Digital Health Agency (2017). Australia's national digital health strategy (https://conversation.digitalhealth.gov.au/sites/default/files/adha-strategy-doc-2ndaug_0_1.pdf)

Source: World Health Organization. Global Observatory for eHealth country profiles (2015) (<http://www.who.int/goe/publications/atlas/2015/en/>, accessed 9 February 2018).

Appendix 6. Inventory of eHIS strategies and systems in the Pacific

Country/Area	eHIS strategy	eHIS system
American Samoa	Consultant at the Pacific Island Health Officers' Association is conducting health information system (HIS) assessment to develop centralized HIS plan.	Self-built database
Cook Islands	National Health Strategy (2012–2016) includes priority to improve information and technology systems and strategies. Health Information Systems Strategy 2015-2019	Medtech32
Fiji	Health Information Systems Strategic Plan (2012–2016) and a Clinical Information Systems and HIS Strategy (2016–2020).	Custom-built PATISPlus platform. Fiji also has a paper based Notifiable Disease System, which is currently being scoped for digitization, and a laboratory information management system (STARLIMS) that is interoperable with PATISPlus. Other systems include ManageMyHealth (mobile app to capture individual screening information) and EPICOR (inventory management and warehousing system). Radiology information and picture archiving and communication system is currently being implemented in three divisional hospitals to provide interface for PATISPlus with radiology. The Consolidated Monthly Routine Information System, is a monthly data collection system for Public Health Information System (PHIS), Maternal and Child Health, a Nutrition Module, PHIS Narrative – Community Births and Deaths and School Health Summary. The Rheumatic Fever Information System is integrated with PATISPlus and other standardized manual systems for Diabetes Registration, Medical Cause of Death Certificates (PATISPlus) and disease registries for TB, HIV, diabetes, cancer, etc. Business Intelligent reporting is being looked at for balance scorecard dashboard reporting for clinical, public health and administrative cadres.
French Polynesia	Reform to national health strategy is under discussion and would likely include health information systems for good governance in health. Schéma D'Organisation Sanitaire de la Polynésie Française 2016–2020 sets out six priorities, the sixth of which is strengthening of HIS.	The tertiary hospital has its own, independent HIS, while primary and secondary systems have public HIS and clinics have their own.
Guam	No mention of an HIS strategy was found.	Indian Health Service Resource Patient Management System is being implemented in at least one community health center.
Kiribati	The Kiribati HIS Strategic Action Plan 2012–2015 outlines a vision for “timely, quality and accessible health information to strengthen health policies and services”.	There are two self-built information systems: one for hospitals (Kiribati HIS – KHIS) and one for outreach clinics (MS1). mSupply is used at the health centre level with tablets. Patient registry is used to track NCD patients but only in Tarawa.

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Marshall Islands	No mention of an HIS strategy was found.	Access database (being redeveloped)
Federated States of Micronesia	No mention of an HIS strategy was found.	CDEMS system, which is a Microsoft Access database application designed to assist medical providers and management in tracking the care of patients with chronic health conditions. CDEMS is pre-coded to track diabetes and adult preventive health but is customizable to change those tracking measures or define measures for monitoring other chronic conditions.
Nauru	Currently formulating a HIS strategy. A strategic objective of the Nauru National Health Sustainable Development Strategy 2005–2025 is to improve HIS. New legislation on CRVS including national ID	Currently has no eHIS; paper records are entered manually into Excel spreadsheets which are not linked to a larger database or network.
New Caledonia	No mention of an HIS strategy was found.	Unclear
Niue	No mention of an HIS strategy was found.	The Resource Patient Management System of the US Indian Health Service is used in at least one community health centre.
Commonwealth of the Northern Mariana Islands	The Department of Public Health has objective to install a new hospital information system. However, there is no formal strategy at the organizational level.	The Resource Patient Management System of the US Indian Health Service.
Palau	No mention of an HIS strategy was found.	CDEMS (see Federated States of Micronesia)
Papua New Guinea	Papua New Guinea–WHO Country Cooperation Strategy, 2016–2020 has highlights priority to strengthen HIS; draft e-health strategy (2017–2027)	The electronic HIS forms the basis of National Health Information System. It is a custom-built information system for the country.
Pitcairn Islands	No national health strategy.	Unclear
Samoa	Samoa e-Health Policy and Strategy 2017–2022	PATIS in two hospitals (recently upgraded from Medtech 32).
Solomon Islands	The National Health Strategic Plan has a priority to improve health information systems as part of “laying the foundation for the future”.	All public health data is fed into DHIS 2. Hospitals mostly use Excel. mSupply is used for procurement. All aggregated facility-based data are captured and analysed in the District Health Information System, Version 2. The National Referral Hospital uses a simple custom-built SQL-based application called “Patient Admissions, Discharges and Transfers (ADT) Summary” system. The Radiology Unit of NRH runs a radiology information and picture archiving and communication system for management of medical imagery. mSupply is used for drug procurement, stock management and distribution at National Medical Stores and all Second-Level Medical Stores. Tablet-based automated verbal autopsy instrument called Smart VA is used to capture verbal autopsies for out-of-facility deaths.

Annex

Tokelau	The Tokelau National Strategic Plan 2010–2015 and National Strategy for the Development of Statistics Roadmap (2015) both outline goals for advancing HIS.	Medtech Evolution (recently upgraded from Medtech32)
Tonga	Working with the Asian Development Bank to develop an e-health strategy and support processes, to be finalized by March, 2018. Developing e-Government strategy that includes CRVS.	Tonga Hospital Information System, mSupply (received funding from the Asian Development Bank for custom rebuild) and DHIS 2 pilot. Desire to upgrade existing patient administration system.
Tuvalu	Ministry of Health of Tuvalu strategy based on an MOU signed in 2011 to reinforce eHIS from hospital to clinics	Taiwanese eMR system is being implemented at Princess Margaret Hospital since 2013. Currently, offshore clinics use paper records and Excel spreadsheets are sent to hospital via USB. mSupply is in place.
Vanuatu	Vanuatu Ministry of Health HIS Strategic Plan 2016–2020 outlines vision for “integrated, sustainable, well-resourced HIS that collects, analyses and disseminates high quality, user-friendly information in a timely way for better health planning and management, and that empowers people to make healthy life choices”. A separate e-health policy is supported by the Asian Development Bank and is in the pipeline to begin in 2018.	Many different information systems used for different purposes: DHIS 2 for community health surveillance, mSupply for pharmacies, outpatient clinics use Excel and some hospitals use a Patient Administration Database (does not link between hospitals). Data are not exchanged between these systems (no interoperability) and have to be entered manually into DHIS 2.
Wallis and Futuna	No mention of an HIS strategy was found.	Unclear

Source: Adapted from Gevity Consulting (2018). Sparking solutions: regional approaches to increase benefits of eHIS adoption in the Pacific. Suva: World Health Organization [draft report has been distributed for review and comment by country stakeholders]

Annex

Appendix 7. Mapping to WHO headquarters digital classification

The classification of digital health interventions categorizes the different ways in which digital and mobile technologies are used to support health system needs.

This Regional Action Agenda introduces four levels of health service delivery, which can be mapped to the digital health classification by WHO headquarters.

The WHO headquarters digital health classification includes an additional level of “data services”, which is not included in the Regional Action Agenda as the scope focuses on service delivery. Furthermore, the Regional Action Agenda separates health-care organization and health system into two distinct levels for granularity.

Mapping of WHO headquarters digital classification terminology to the Regional Action Agenda

WHO headquarters classification terminology	Regional Action Agenda
Clients	Individuals, families and communities
Health care providers	Health service provider
Health system managers	Organization
Health system managers	Health system

Source: WHO (2018). Classification of digital health interventions v1.0. A shared language to describe the uses of digital technology for health (<http://www.who.int/reproductive-health/publications/m-health/classification-digital-health-interventions/en/>).