Change, Connectivity, and Challenge: Exploring the Role of Health Technology in Shaping Health Care for Aging Populations in Asia Pacific

Erin Penno and Robin Gauld*
Dean’s Office, Otago Business School, University of Otago, Dunedin, New Zealand

Abstract—Although the rapid increase in population aging observed across the globe poses significant challenges to the sustainability of health systems it has been paralleled by an exponential growth in health technologies. This article reviews the literature surrounding health technologies and explores how the future of aging and health care could be shaped by health technologies, with a particular focus on the Asia Pacific region. It shows that the field is wide in scope. The current expansion of information and communication technologies have brought a growing capacity to support health care, while future technology applications, such as robotics and 3D printing, offer a range of potential benefits to elderly populations. However, the uptake and level of development of health technologies varies widely throughout the region. Governments have begun developing frameworks to guide the implementation and monitoring of health technologies. However, a dearth of robust, evaluative studies, combined with the rapidly evolving nature of health technologies, present policy makers with a range of policy and implementation challenges, including issues surrounding infrastructure, funding, and the acceptability of technologies among older users. As health technologies play an increasingly pivotal part in health systems, there is a need to create robust mechanisms for ongoing assessment of health technology development.

INTRODUCTION

Policy makers across the globe are confronted with aging populations, none more so than in the Asia Pacific region. The increased demands for health and social care services present significant challenges to sustainability of health systems. At the same time, a declining workforce poses challenges in the way in which health services are organized, financed, and delivered. However, the rapid increase in population aging has been paralleled by an exponential growth in health technologies. Technology is
playing an increasingly important role in supporting and maintaining health and health care systems across the world and, as populations age and demand for health services grows, technology stands to transform health care services.4

This article explores how the future of aging and health care could be shaped by health technologies, with a focus on the Asia Pacific region. We interpret health technologies as encompassing the full gamut of health and medical technologies, including information communication technologies (ICT), mHealth and eHealth solutions, as well as new technologies that involve new forms of treatment and, potentially, new ways of organizing health care systems. The intent of the article is to assess the current state of development across the region and carry out a review of the literature surrounding the present and future applications of a range of health care technologies and the challenges associated with implementing technology-based initiatives as a core component of this. Accordingly, the article begins by outlining the current landscape with respect to technology, providing an overview of the availability of communication technologies across Asia and the Pacific. Secondly, it considers existing and future applications of health technologies and how they might be used to support aging in place. Thirdly, it reviews the diffusion of health technologies throughout the Asia Pacific region and outlines current research on their effectiveness. Fourthly, it considers some of the core policy and implementation challenges facing policy makers. Finally, it maps out some of the dimensions that have been incorporated in strategic frameworks guiding the diverse and evolving nature of technological developments and considers the key lessons emerging from the literature around the future of health technologies and aging populations.

METHODS

A semistructured review of the literature was conducted to gain an understanding of the scope of development and associated issues surrounding aging populations and health technology initiatives, with a particular focus on developments in the Asia Pacific region. The search was performed in the Scopus, Web of Science, and Google Scholar databases using the search terms “eHealth,” “mHealth,” “technology,” “ICT,” “robot,” “3-D printing,” “health,” “ageing,” “elderly,” “evaluation,” “effectiveness,” “strategy,” and “framework,” alone or in combination. Search results were limited to those published in English and, because we wanted to understand the current state of development, to papers published since 2007. The titles of retrieved articles were scanned and then abstracts reviewed for relevance. The findings are presented as a descriptive summary of the current state of health technology developments and the issues identified surrounding their implementation.

Connectivity Is Increasing

Over the past decade, the increasing capability and availability of mobile and Internet technologies has fostered growing connectivity within and between populations. Over the period 2005 to 2014, mobile phone network coverage across the Asia Pacific region has been extended to 99% of the population. Correspondingly, mobile cellular subscriptions have grown from 28 per 100 people in 2005 to 101 per 100 people in 2015. Access to the Internet has also grown rapidly. The number of households with access to the Internet quadrupled, and there has been a parallel increase in the proportion of individuals using the Internet.6 In tandem with the increase in availability of mobile and Internet technologies, the market for digital health services has grown rapidly throughout the Asia Pacific region. For example, it has been estimated that the market for mobile phone–based health services and devices in India will have increased tenfold over the period 2014 to 2020, rising from 100 million USD to almost 1 billion USD.5

Nevertheless, although access to Internet technology has been expanding throughout the region, there are considerable differences between countries. For example, although almost all households in Japan, Korea, Singapore, and Australia have Internet access at home, fewer than one fifth of households in India and Vietnam can access the web from home. Likewise, greater than 80% of individuals report using the Internet in Japan, Korea, Singapore, Australia, and New Zealand but just half of China’s population uses the Internet and only a quarter of India’s and Samoa’s populations.6

Corresponding with the increase in Internet capability, social media networks have grown in popularity. Offering a dynamic, user-friendly means of communicating, social media has provided new ways for governments, health care providers, and industry to communicate and engage with populations, as well as for individuals to engage with each other.7 There are over 2 billion social media users globally.8 The Asia Pacific region accounts for just over half of the world’s social media users, with approximately 25% of the population active subscribers to social media networks.9 However, like other Internet and mobile technologies, there are wide variations in social media use between countries. For example, 64% of Taiwan’s population has been estimated to use social media, whereas just 4% of Papuans are users.9
At present, the use of mobile and Internet-based technologies in the Asia Pacific region is dominated by individuals under the age of 35. Significant uptake of technology among the millennial generation provides unprecedented opportunities to provide targeted health care interventions and support as they age. In the meantime, promoting greater engagement in digital technologies among older users is of growing commercial interest in Asia, in large part due to the lucrative “silver market.” Digital inclusion, nevertheless, remains linked to prosperity, with uptake of mobile and Internet-based technologies among older users greater among middle- and higher income groups.

Current Health Technologies
Accompanying the expansion of Internet and mobile technologies, information communication technology health initiatives, also known as eHealth or mHealth, have brought a growing capacity to support health care. Many health systems in the Asia Pacific region have already implemented comprehensive electronic medical record systems, and there is a growing market in technological support for clinical practice and health care delivery. Other eHealth applications have capitalized on the rapid expansion and popularity of communications technologies. For example, a wide range of health promotion tools, continuous monitoring, and treatment applications have been developed and are accessible via a range of platforms including mobile phones, social media, and web-based applications. Although use of mobile technologies is more common among younger populations, uptake among older users has been increasing. eHealth is seen as a potential solution to the rapid rise of non-communicable chronic disease among aging populations and is particularly useful for supporting patients to manage chronic conditions, such as diabetes, that are responsive to behavior change (see Case Study 1).

From a provider perspective, the potential of mobile technologies to increase accessibility of care while reducing costs as well as offering greater convenience for patients has been widely recognized. Accordingly, the use of telehealth interventions, in particular for chronic conditions, has grown rapidly throughout the Asia Pacific region. However, the mode of delivering telehealth solutions is linked to the capacity of infrastructure to support telecommunications. For example, in a systematic review of telehealth interventions in Asia, Durrani and Khoja found that the most commonly used form of telehealth in lower income nations was a “store and forward” modality; that is, using digital images or prerecorded videos. In comparison, higher income nations were more likely to use real-time technologies, such as live videoconferencing. Social media is also playing an increasing role in health systems; for example, through providing a dynamic and content-rich source of educational resources for providers as well as for patients. Many health care organizations throughout the Asia Pacific region use social media for health promotion and to make announcements. Likewise, patients use social media to learn about health care issues and services, provide feedback to health providers, and participate in community-based health campaigns or forums. However, use of social media also places new demands on clinicians and health practitioners, in particular around ensuring that the information provided is of sufficient quality and that the privacy of patients is protected, which have been shown to be major concerns among older users.

Case Study 1: A voice-based service to provide individualized, real-time feedback to help control type 2 diabetes
Kim et al. investigated the use of a “ubiquitous health care service” (known as u-health care), to support elderly patients with diabetes in Seoul, South Korea, to manage glycemic control without causing hypoglycemia. Because ease of use was found to be a significant limitation in a previous study by the same authors, patients in this study used a voice-based reporting system that allowed them to send health data, including information on blood glucose levels, diet, exercise habits, and medication adherence through to a u-health center using their existing home or cellular phone. A clinical decision support system then analyzed the data and provided instant, individualized feedback back to patients using either voice or text messages. After six months, patients who used the u-health care system achieved significantly lower hemoglobin A1c levels compared to patients receiving standard care. The u-health care group also experienced a significant drop in body weight and body mass index compared to the standard care. Although there was also no significant difference in the number of hypoglycemic events between patients using the u-health care system and those receiving standard care, severe hypoglycemia occurred less frequently among the u-health care group. By integrating the u-health care system with technology patients already used (glucometers and phones), the authors reported that patients found the system easier to use. Patients were also more comfortable relaying health information by phone than writing it down or entering it on the web.
The Future of Health Technologies

Beyond communication technologies, the number and range of applications for technologies for health services are immense. Futurists propose a world in which a combination of genetics, nanotechnologies, and robotics, known as the singularity, could see the elimination of age-related disease and rapid increases in life expectancy. However, although these technologies are in the process of being developed, at this point their combined potential remains unrealized. Nevertheless, there have been real advances in the technology to support health care delivery. Wearable technologies, such as smartwatches or wristbands, which allow wearers to monitor their physical activity, vital signs, and nutritional habits, have become increasingly popular. Wearable technologies have also been used to support management of long-term conditions, providing feedback to facilitate positive behavior changes. Among the elderly, wearable sensors have also been used as means of sensing and raising alarms after a fall or to locate individuals.

On a larger scale, there is also considerable interest in the use of robots to support health care delivery. Robotic-assisted surgery for a range of procedures has been widely adopted throughout the United States and Europe and can offer considerable improvements in precision. Other applications include remote clinical consultations with specialists, the provision of autonomous care such as providing anaesthesia, sterilizing rooms and equipment, and the use of drones to deliver medical equipment to remote regions. As population aging places greater pressures on scarce health resources, robotic solutions that reduce the burden on the health workforce, as well as increasing accessibility of care for older patients, will likely play an increasing part in health care systems.

Beyond clinically based applications, robots offer a range of potential benefits to elderly and disabled populations, at home and in residential care facilities. Considerable investment in developing companion robots is underway, with a number of animal and humanoid androids already available. In addition to companionship, robots are able to provide assistance with managing health conditions, such as improving medication adherence, and offer a range of other social functions (see Case Study 2). There is also great interest in developing assistive devices for lifting and feeding disabled individuals, in developing exoskeletons that would improve grip strength or aid walking rehabilitation, and in the use of robots to run simple errands and to help with daily activities such as bathing, cleaning, and laundry. Physical assistance rendered by robots has also been identified as a means of prolonging and enhancing participation of older people in the workplace. Acceptability of robots among older users, nevertheless, remains a key challenge. Complexity, perceived usefulness of the robot, and the potential stigma attached to their use are all highlighted as potential impediments to their acceptance. Moreover, the use of robots to support aging in place strategies are still in the process of being trialed, meaning that their real life benefits are poorly understood.

Other technologies, such as 3D printing, also promise to revolutionize health care. Although still in its infancy, the huge potential of 3D printing has created an expanding medical market. The current global value of 3D printing in health care has been estimated at 487 million USD and is expected to rise to 2 billion USD by 2020. Within the Asia Pacific region, the market in 3D printing is predicted to grow by

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Case Study 2: The use of health care robots in elderly people’s homes in a rural setting

Orejana et al. carried out a small trial to test the feasibility and usefulness of health care robots among elderly people living at home in a rural community in New Zealand. Robots were placed in the homes of four participants, each of whom had chronic conditions and took multiple medications. The robots’ primary function was to remind participants to take medications; however, they also had entertainment and Skype functions.

During the period in which the robots were present in participants’ homes, primary health care utilization was reduced. There was little change in medication adherence; however, quality of life scores rose for most participants. The music function was well received, although neither the entertainment nor Skype functions were widely used. This was in part due to a lack of familiarity with the games provided or problems with the robot and Skype user interfaces. Participants also reported some anxiety around the technical aspects of the robots, with some reluctant to fully engage with the robot or allow family members to touch it because they were concerned that it would break.

The authors concluded that deploying health care robots in elderly peoples’ homes was feasible and had positive effects, reducing primary care use and increasing quality of life scores. However, they suggested that improving the design and usability of the robot—for example, by using a larger, less sensitive screen—would make them easier to use for people with poor eyesight or dexterity. They also noted that the rural setting introduced technical challenges, making it more difficult, expensive, and time consuming to source engineering expertise and parts when technical problems arose.
almost 25% by 2020.\textsuperscript{43} Currently, the majority of applications revolve around printing models of anatomical structures, such as organs and bones, to assist with preoperative planning as well as medical education and training.\textsuperscript{44,45}

Printing biomaterials, such as dental or orthopedic implants, developing custom prostheses, and providing personalized pharmaceuticals, has also been trialed.\textsuperscript{45-49} As 3D printing capabilities expand and become more sophisticated, the potential to overcome current shortages in materials, such as human organs, could offer life-saving opportunities to millions.\textsuperscript{57}

Given increases in longevity alongside rapid increases in chronic diseases such as diabetes and obesity, older adults could be expected to be one of the main beneficiaries of such technologies. However, although the costs of technology are expected to decrease, the current costs associated with setup and materials place significant limits on the viability of 3D printing, particularly in lower income countries, although these costs are expected to decrease over time.\textsuperscript{45,49}

The Diffusion of Health Technologies Throughout Asia Pacific

Seen as fundamental to promoting universal health coverage, promotion of health technologies has been identified as an international priority for over a decade.\textsuperscript{50} However, their uptake and level of development vary widely. Table 1 summarizes country responses to the World Health Organization’s Global Observatory for eHealth 2015 survey throughout the Asia Pacific region.\textsuperscript{12} All countries surveyed have engaged with health technologies to some degree; however, the report presents a very mixed picture of the uptake and diffusion of eHealth services. For example, only half of the countries surveyed report having an electronic medical record system in place. In comparison, most countries have invested in mHealth initiatives, including the presence of health call centers, decision support systems, and patient monitoring, although the level of development and breadth of mHealth services vary widely between countries.

The variation observed throughout the Asia Pacific region does not appear to follow any consistent pattern. However, in many cases, gaps in reporting combined with the summary nature of the survey make it difficult to establish the true level of engagement in with eHealth services. Ultimately, differences in the coverage of eHealth services are likely to reflect different national priorities as well as variations in infrastructural and health systems factors between each country.\textsuperscript{50}

Gauging the diffusion of more sophisticated and experimental health technologies, such as robotics and 3D printing, is more difficult. The experimental nature and ad hoc implementation of these technologies means that there is currently no systematic analysis of their use in different countries. However, the literature suggests that applications are being trialed in both high- and low-resource settings.\textsuperscript{45,51,52} Nevertheless, at this stage, it is unlikely that these newer technologies will enjoy the same embeddedness as more established technologies. Indeed, given current technological and resource constraints, their diffusion is likely to be more gradual and reflective of the financial capacity of individuals and health systems to adopt expensive and experimental technologies.

How Effective Are Health Technology Initiatives?

The vast range of options and increased flexibility that health technologies offer has stimulated considerable optimism in their capacity to alleviate the burden posed by aging populations on health systems throughout the world. Yet, despite the widespread uptake of technologies, most notably eHealth technologies, at this point in time it is difficult to ascertain their effectiveness. Table 2 provides an overview of the current state of development of various health technologies and the current evidence surrounding their effectiveness. To date, few published studies on health technologies have included robust evaluations of their effectiveness.\textsuperscript{15,22,29,33,53}

This is a particular issue for interventions that are relatively novel, such as robotics and 3D printing. However, there remain significant uncertainties as to the effectiveness of even established technologies. Where studies have evaluated initiatives, there is mixed evidence surrounding their effectiveness. For example, in a systematic review of eHealth and mHealth interventions to improve diet and physical activity in lower income countries, Muller et al.\textsuperscript{57} found that the majority of interventions were effective in at least one outcome measure, such as physical activity or dietary habits. However, few studies demonstrated success across all outcome measures. Likewise, in a review of mHealth interventions primarily in the Asia region, Chigona et al.\textsuperscript{15} found that there was mixed evidence on the success, cost-effectiveness, and practicality of the eHealth interventions.

Where studies do undertake evaluations, they have been criticized for their narrow scope, focusing almost exclusively
| Country                | Electronic Medical Record Systems | mHealth Programs | Telehealth | Social Media |
|-----------------------|----------------------------------|------------------|------------|--------------|
| China                 | Yes                              | Mixed level of development. Various mHealth services available at local or regional levels. A mixture of established and pilot programs | Mixed level of development. Services predominantly operated at a local level and in pilot stages | Widely used by organizations and individuals for a variety of purposes |
| Japan                 | No                               | Mixed level of development. Range of established mHealth services operating and national and regional levels. Some services operating without formal processes or policies in place | Mixed level of development. A number of established programs operating at national level and others operating informally at the local level | No data on use by health care organizations. Used by individuals for a variety of purposes |
| Singapore             | Yes                              | Wide range of established mHealth services operating and national and regional levels | Mixed level of development. A number of established programs operating at the national level and others operating informally or in pilot stages at regional and local levels | Widely used by organizations and individuals for a variety of purposes |
| Vietnam               | No                               | Mixed level of development. Limited number of established mHealth service operating at national and international levels | Mixed level of development. Some services have established programs operating at international, national, and regional levels | No data on use by health care organizations. Used by individuals for a variety of purposes |
| Australia             | Yes                              | Limited number of established mHealth services, predominantly operating at a national level | Mixed level of development. A limited number of services have established programs operating at the national level | Used by health care organizations for a limited range of purposes. Used by individuals for a variety of purposes |
| New Zealand           | No                               | Wide range of mHealth services operating at national, regional, and local levels. Predominantly established programs, some services in pilot stages or operating informally | Mixed level of development. A number of established programs operating at national and regional levels and others in pilot stages at local levels | Widely used by organizations and individuals for a variety of purposes |
| Kiribati              | No                               | No data on use of mHealth services | No data on use of telehealth services or level of development | Widely used by organizations and individuals for a variety of purposes |
| Cambodia              | Yes                              | Mixed level of development. Range of mHealth services operating at national, regional, and local levels. Predominantly in pilot stages or operating informally | Limited use. Telepathology programs in pilot stage at the national level | Used by health care organizations for a limited range of purposes. No data on use by individuals |
| Lao People’s Democratic Republic | No | Limited number of mHealth services operating at national and local levels. Mixture of established and pilot programs | No data on use of telehealth services or level of development | Not in use or no evidence provided of use by health care organizations or individuals |

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on health benefits without evaluating wider social impacts. Although issues related to the cost of implementing new technologies are a primary concern for sustainability of eHealth services, evaluations of the cost-effectiveness of interventions are also rare. Others have raised concerns that the predominance of pilot studies in the health technology sphere means that there is limited evidence around the scalability and sustainability of technological initiatives or their long-term, real-life benefits. Ultimately, the lack of high-quality evaluations has led some to conclude that it is too early to determine the effectiveness of health technologies and prompted widespread calls for more robust evidence on their effectiveness and cost-effectiveness.

**Implementation and Policy Challenges**

**Infrastructure**

Although health technologies carry great promise for altering how people age in place and engage with health services, they present a number of implementation and policy challenges. Access to mobile and Internet technologies has been expanding throughout the Asia Pacific region. However, as outlined above, there are considerable differences among countries, suggesting different capabilities and capacity to engage with and implement eHealth care solutions. For less wealthy nations, infrastructural barriers, such as the availability of good quality roads and mobile coverage, may present challenges to implementing mobile health programs. Similar issues also confront the rollout of health technologies in rural areas in higher income countries. For example, Orejana et al. reported difficulties in sourcing appropriate expertise and parts to repair health care robots in a rural community in New Zealand.

**Funding**

How access to technologies will be funded is another issue confronting policy makers. Given concerns around the costs of eHealth programs, there has been debate surrounding whether those costs should be borne by individuals who directly benefit from the product or service or by society. In the Asia Pacific region, funding for health technology initiatives is derived from both the public and private sectors as well as from donors; however, the mix of funding sources varies among countries. Many countries feature fee-for-service at the center of their funding models, creating complexity when it comes to funding new innovations and high-cost initiatives. Where health technology initiatives are predominantly provided by the private sector or donors, some critics have expressed concerns around the sustainability of funding and accountability for outcomes.
support to these concerns, there is some evidence that programs that boast significant government ownership and oversight are more successful with respect to sustainability and scalability.29

The choice of funding source is also tied to issues of equity of access. If access to technology is largely privately funded, this carries the potential to exacerbate the digital divide between those who are able to access technologies and those who are not.25 Numerous studies have suggested that low-income individuals are less likely to engage with digital health services and therefore less likely to enjoy the associated benefits.3,58-60 Likewise, access to other health technologies, such as robotic surgery, has been linked to ability to pay.61 Consequently, the advantages offered by health technologies, at least initially, are more likely to accrue to the better off, particularly among older population groups.59,62 On the other hand, if governments play a substantial role in funding health technologies, they will be faced with questions surrounding eligibility, cost-effectiveness, and prioritization and sustainability of new health services.29,53 Governments may be more inclined to invest in health technologies where there is evidence that they may

| Technology                      | Level of Development                                                                 | Summary of Evidence on Effectiveness                                                                 | References |
|---------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------|
| Electronic medical record systems | Well developed and in operation in many countries throughout Asia Pacific             | Shown to improve quality and accessibility of record-keeping, patient safety, and evidence-based decision making. Drawbacks include high setup and maintenance costs and concerns around patient privacy | 12, 13     |
| mHealth and eHealth             | Various mHealth and eHealth programs in place in many countries throughout Asia Pacific | Mixed evidence surrounding effectiveness of mHealth and eHealth interventions. Predominance of pilot studies means that there is limited evidence around feasibility of large-scale deployment and little evidence around impact on stakeholders. Few studies focus specifically on effectiveness of mHealth and eHealth initiatives on older users | 12, 14, 15, 22, 29, 56, 57 |
| Telehealth                      | Mixed level of development throughout Asia Pacific                                   | Some evidence that telehealth programs are effective but evaluations are limited and of poor quality   | 12, 23     |
| Social media                    | Growing use of social media in health care settings. However, few countries in Asia Pacific have specific policies in place on the use of social media in health domains | Social media shown to increase patient engagement and social interaction and improve psychosocial well-being. However, there is limited evidence of impacts on physical conditions | 12, 17     |
| Wearable technologies           | Commercially available                                                               | Limited evidence that wearable technologies improve health behaviors                                 | 32, 33     |
| Robotic technologies            | Various levels of development. Robot-assisted surgery in routine use in Europe and the United States. A number of initiatives being trialed, including providing physical and psychosocial support and monitoring daily health | Evidence that robot-assisted surgery improves precision, although limited evidence surrounding impact on health outcomes. Studies surrounding other robot technologies are largely pilot studies, meaning that there is little evidence around the effectiveness of robots beyond clinically based functions | 28, 34, 45, 48, 68 |
| 3D Printing                     | Large numbers of 3D printers being produced. A wide range of applications have been identified for 3D printing in health, although only simpler functions have been trialed at this stage | Evidence largely derived from pilot studies. Early evidence suggests that 3D printed technologies facilitate valuable learning opportunities for health care providers and aid surgical planning. Pilot studies also suggest that 3D printing may offer a cost-effective means of providing prostheses in low-resource settings | 45, 48     |

TABLE 2. eHealth Technologies, Their Level of Development, and a Summary of Evidence on Effectiveness
reduce the burden on publicly financed health or social services. However, the current dearth of evidence surrounding effectiveness, cost-effectiveness, and scalability may act as a disincentive for government investment.

Acceptability

An area of growing interest is the acceptance of health technology solutions among older individuals, their families, and their caregivers. For older users, usability of health technologies has been found to be a key concern. Decisions to use technologies have been shown to be influenced by education level and technological experience, and physical and cognitive abilities—for example, visual impairments or dementia—may also impact uptake. Other key issues relate to the appearance of technologies. For example, whether robots appear human or not has been seen as dependent on their function. For wearable technologies, some users express anxiety that the devices may be stigmatizing, identifying them as frail or in poor health. The cost of technologies has been found to be a key concern. Decisions to technology solutions among older individuals, their families, and care-giving roles. Concerns that new ways of delivering care, in effect offering a substandard alternative to traditional modes of care, have generated some resistance among health practitioners. Similarly, older users have raised questions around the safety and reliability of technology-based products. Users have also expressed concern that intensified reliance on technology will increase their social isolation. Indeed, the question of whether health technologies and eHealth applications are truly patient centered has generated some debate. Health technologies and eHealth are often viewed in the context of empowering patients. However, although promoting independence, the emphasis on self-responsibility risks shifting the burden of care to elderly patients and informal caregivers.

Policy, Implementation, and Evaluation Frameworks for Health Technologies

Governments and international health agencies have already begun developing frameworks to guide the implementation and monitoring of eHealth initiatives at a national level. In particular, the World Health Organization has been a driving force, having developed an eHealth strategy toolkit intended to guide and support countries to develop national eHealth strategies. The toolkit is framed around three core tasks: developing an eHealth vision, putting it into action, and evaluating progress. Policy makers are encouraged to develop unique approaches, based on best practice, that are embedded in the context of their specific health systems and in which they actively and continuously engage with key health and non-health stakeholders, including health professionals, academics, patient advocacy groups, public and private care providers, donor organizations, ICT vendors, and wider government institutions and ministries. Many countries in the Asia Pacific region have developed national eHealth policies or strategies, although fewer have specific policies in place regarding specific components of eHealth, such as telehealth. There is also considerable variation in the maturity of eHealth strategies throughout the region, with some having had strategies in place for over a decade, whereas others have only recently introduced national policies or strategies. Likewise, the capacity of legislative and policy frameworks to support eHealth initiatives varies widely. For example, China, Vietnam, Timor Leste, and Cambodia, among others, do not have policies or legislation in place to address privacy of personally identifiable data or electronic health-related data. Given the widespread concern with respect to privacy among eHealth users and health care providers alike, it is likely that such legislative gaps will need to be broached before eHealth programs will be widely accepted.
Although there is growing emphasis on monitoring and regulating eHealth solutions, the relative novelty of more complex health technologies, such as health care robots and 3D printing, means that few countries have specific policies in place surrounding their use. The individualized nature of some of these technologies, such as 3D bioprinting, carries challenges to introducing regulatory frameworks, because custom-made devices are often exempted by regulatory authorities. However, there is a growing awareness of the requirement to introduce frameworks guiding the use of health technologies.

Overcoming Challenges: Way Forward for Older Users

Health technologies will, unquestionably, play an increasingly pivotal part in health systems and health care delivery, fostering greater connectedness between individuals, as well as changing the way in which people access and understand health services and information. Successfully achieving a balance between the benefits and risks of health technologies will require policy makers to adopt strategic, collaborative processes and to engage closely with older people, their families, service providers, funders, and society. Involving older users in the development of health technologies will be central to ensuring that they are appropriate, both technically and culturally, and policy makers should be prepared to communicate the tangible benefits of health technology initiatives to users.

Beyond practical considerations, policy makers will need to weigh complex issues surrounding the impacts of health technologies throughout populations. One such challenge will be balancing the potential intergenerational tensions created by providing of new models of care. Although carers and family members are influential in promoting the adoption of new technologies, the preferences of older users may be at odds with those of their family and caregivers, requiring policy makers to work toward reconciling these differences.

CONCLUSION

This article has overviewed the role and status of health technology, broadly defined, in shaping health care for aging populations in the Asia Pacific region. The field has a wide scope, from social media to 3D printing. This creates a number of challenges for policy makers, health care funders, patients, and the research community. In terms of research, the article has highlighted a dearth of robust studies evaluating the effectiveness of various technologies. As noted, the aim of the research behind this article was to assess the state of development of health technologies in the Asia Pacific region. The lack of evaluative studies is problematic but also an opportunity for the research community, given the considerable hope that policy makers and industry attach to health technologies for transforming how health care for older people is delivered and received. For policy makers and investors, it is difficult to know which technologies are likely to improve care for the elderly into the future and how. In terms of next steps, there is a need to create a mechanism for ongoing assessment of health technology development, which includes cost-effectiveness analyses and potential to transform and improve care for older people. The importance of this cannot be understated, given the pressures for latest technology that health policy makers, funders, and providers face but also for industry given the level of investment in health technology product and service development in the region.

DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

The authors do not have any conflicts of interest to declare.

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