Future of Work

Understanding the impacts of technology on the rural and remote health workforce

Ministry of Health NSW

FINAL REPORT

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> "*Rural health systems are pushing the boundaries of what is possible through digital healthcare in ways that will soon be necessary for all health systems seeking to create more efficient, more patient-centred models of care.*
>
> *- Clinical Excellence Commission*"

Introduction

More than 2.2 million people, or 28 percent of the New South Wales (NSW) population, live in rural areas.[1] NSW Health delivers health services to the communities within these areas through seven rural Local Health Districts (LHDs). Together, these cover an area of more than 775,550 square kilometres, delivering healthcare through 88 hospitals, 63 multi-purpose service locations, and 160 ambulance stations.[2]

The distinctive cultures, diverse communities, and often harsh and geographically isolated locations that are served by the NSW Health system pose challenges and opportunities that are very different to those in urban health systems.[3] In turn, the adoption of emerging technologies in rural areas is expected to be associated with some distinctive considerations for the workforce. These unique characteristics and circumstances of rural healthcare delivery must inform the NSW Health system's understanding of the potential benefit of emerging technologies as well as their impact on the Future of Work.

Purpose

This is the fourth in a series of papers that considers what the Future of Work means for NSW Health. The previous three papers, which distilled thought leadership about the Future of Work in healthcare, explored technologies and their workforce impacts on medical specialities, and discussed technologies and their workforce impacts on the shared services workforce, did not make a specific distinction between the metropolitan and rural health workforce.

This paper however, explores the rural and regional health context, and its unique opportunities and challenges. It identifies the emerging technologies that may offer a significant potential benefit to rural communities, and examines what this might mean for the rural healthcare workforce. Importantly, it recognises the existing health disparities between rural and metropolitan communities, and that any implementation of new technologies must assist in narrowing this gap.

It is intended that this paper assist NSW Health to consider the workforce implications of emerging technologies for the rural workforce and, in turn, put in place a clear strategy and actions to assist the workforce with the journey ahead. This paper has been informed by research of peer reviewed and non-published literature, and consultation with a small number of rural workforce stakeholders.

Scope and limitations

The scope of this paper is to understand how the rural and regional context may impact on the implementation of the findings in the previous papers.[a] The scope was limited to a scan of published and unpublished material pertaining to the impact of the emerging technologies identified in the previous papers (including but not limited to artificial intelligence, cloud technology, telehealth and internet of things) and considering their application and appropriateness in the rural and remote health context. This includes peer reviewed literature, as well as 'grey' literature as at March 2020. In addition, three stakeholder interviews were conducted with individuals agreed by NSW Ministry of Health, in order to provide further insight to the findings from the desktop review.

Terminology

Terms such as "remote" and "regional" are geographical classifications that are assigned to regions with specific and quantifiable criteria under the Australian Standard Geographic Classification. However, for the purposes of this paper, the term "rural" will be used to describe communities in locations that are isolated from urban centres and that consist of smaller populations.

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[a] These papers are: Understanding the Impacts of Technology on the Healthcare Workforce; Understanding the impacts of technology on medical specialties; and Understanding the impacts of technology on shared services.

NSW Health delivers health care to rural communities in NSW through seven LHDs. These are: Far West, Mid North Coast, Murrumbidgee, Northern NSW, Southern NSW, Western NSW, and Hunter New England (excluding metropolitan Newcastle).[4]

The structure of this paper

To ensure this paper provides a comprehensive understanding of the factors that are at play in the rural context and the interplay between these factors, relevant emerging technologies, and their effect on the Future of Work, this paper is divided into three sections:

- The first section examines the key factors which make rural NSW a unique environment for rural healthcare delivery

- The second section describes the technologies that are most likely to confer benefit for rural communities and will impact the healthcare workforce into the future, as well as factors that will influence the implementation of these in rural NSW
- The third section provides an overview of some of the important areas of impact for the rural workforce as a consequence of the adoption of these technologies and suggests key considerations for NSW into the future.

Current directions for rural health in NSW

In examining the potential impacts of the implementation of new technologies in the rural healthcare context, attention should be given to existing and emerging policies and strategies for rural health in NSW (and in health in NSW more broadly). These provide an important backdrop to the consideration of both the Future of Work as well as potential strategies to support the successful adoption of technologies which benefit rural communities.

Improving rural health outcomes: NSW Rural Health Plan

NSW Health has created an overarching vision and associated strategies for the delivery of quality health services in rural NSW in the NSW Rural Health Plan (the Plan). This Plan aligns with the policy directions within NSW State Health Plan: Towards 2021, that outlines directions of the NSW health system as a whole.[5] Amongst a range of initiatives outlined in the Plan, 'strategy three' specifically focuses on eHealth, and its use in solutions that strengthen connection and access to virtual health services in rural NSW. [6]

Between the release of the Plan in 2014 and 2018, NSW Health has achieved significant milestones in improving the health outcomes of rural communities.[7] It is important to acknowledge these achievements as it provides a clear view of the current progress in the rural health system and allows discussion about how further technology implementation can accelerate progress in line with the agreed directions and strategies.

In the area of technology, some of the specific successes include the statewide implementation of the HealtheNet Clinical Portal, rural focused tools such as the Virtual Allied Health Service which has increased access to allied health services, implementation of TeleHealth and virtual care in Western NSW LHD, and the pilot Tele-Stroke project that improved the timeliness of stroke assessment using telehealth.[8] The provision of secure, reliable, and available information was also enhanced through the connection of all hospitals, community health centres, and administration facilities to the health wide area network (HWAN) and the provision of patient and guest WiFi as a pilot in some rural locations.[9] While the Plan has provided sound guidance to rural LHDs in recent years, it is coming towards the end of its remit, and is likely to be refreshed in the near future.

High performing rural health systems

In 2019, the Clinical Excellence Commission (CEC) released the report 'High performing rural health systems'.[10] This report provides a reference model for rural health systems with the purpose of identifying enablers of high performance in the rural context. Specifically, it aims to support rural health systems in assessing the capability of their teams and organisations, and in developing a locally appropriate plan of action in response.[11]

Drawing from both the literature and a broad range of stakeholder consultations, this report identified six core and three supporting attributes for high performing rural health systems. 'Technology enablement' sits as one of the six core attributes, acknowledging how critical it is in:[12]

- breaking down barriers to access and empowering patients;
- using scarce specialist resources more efficiently and equitably across a region; and
- empowering clinicians who are working in remote settings by expanding the scope of the care they can deliver, enabling the escalation of care, reducing the risk of diagnostic error, and enabling early identification of deteriorating patients.

Importantly, digital technologies cannot be simply 'bolted on' to existing models of care and governance structures within rural healthcare settings. Rather, they must be supported by strong governance systems, culture change and clinician engagement, training and education, and new models of care.[13] Models of care need to be designed to fit patients, communities and clinicians, with a match to the technology required to enable this. [14]

The High Performing Rural Health systems report was developed in close consultation with NSW rural LHDs. It will be an important source to feed into any emerging statewide rural health strategy or plan.

Enablers for change

Five key enablers were identified in the first paper that need to be harnessed to support successful adoption of the expected changes to roles, functions and workplace processes as a result of technology. While these will be relevant across the entire NSW Health workforce, there are specific considerations for the rural workforce.

VISION & STRATEGY

To support real and consistent change, NSW Health should ensure there is a clear rural workforce vision and strategy. This should align with changes to roles, functions and practice determined both nationally, and where relevant, determined by professional bodies for specific disciplines. However, it will also need to be tailored to the rural context in order to ensure the endorsement of this from those with governance and service delivery responsibilities in rural NSW. The vision and strategy should make links to how technology will be used to narrow the gap between the health outcomes and experiences of those in rural communities, compared to their urban counterparts.

EDUCATION & TRAINING

Education and training of the rural workforce will be key to the successful uptake of new technologies. While some components of training may be 'generic' for a specific technology, there is a need to consider the differing contexts within which these might be applied in a rural healthcare setting. In turn, some training may be best delivered in a rural environment, thus ensuring the specific challenges and other differences faced by those delivering rural health care are integrated into efforts to support capability development and adoption of new processes and care models. Training will need to be delivered with consideration of the broad scope of practice of many rural healthcare workers. It will also need to take into account the challenges these staff members may have in securing locum relief or backfill to attend training opportunities.
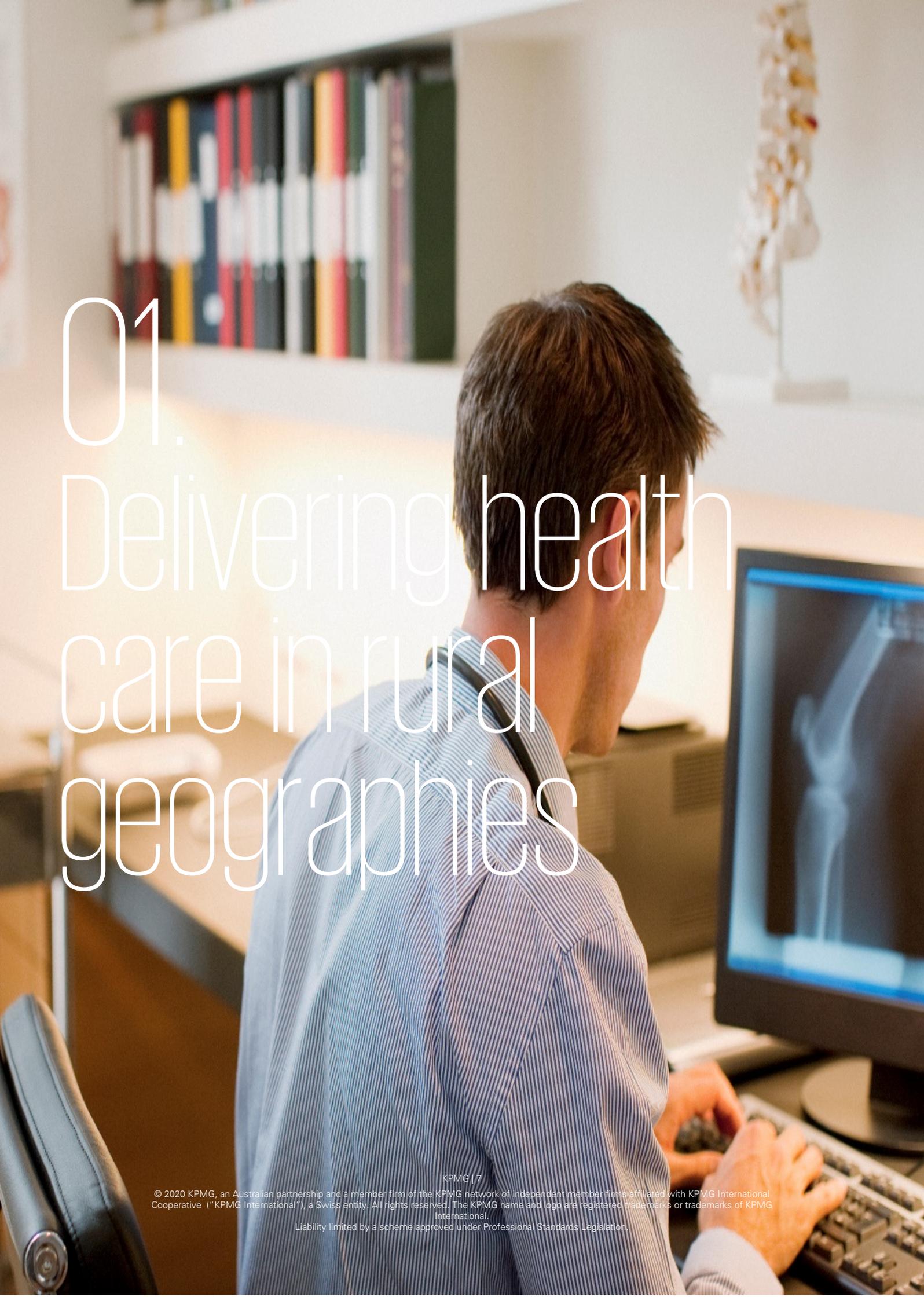
LEADERSHIP

A whole of system leadership strategy for the digital future will see demonstrable benefits for NSW Health, including for the rural workforce. In addition, leaders will be required across the rural workforce to champion and support the workforce through the expected changes. It is important that those working in rural areas see their own leaders' buy-in to both the new technologies as well as any new ways of working that may occur as a consequence.

INNOVATION & CULTURE

A culture of innovation and improvement is needed in order to capitalise on the most beneficial emerging technologies for the NSW population and realise improvements in health outcomes, quality, safety and efficiency. NSW Health may support this through pilot programs, evidence-based research on the benefits of new technologies (and potential negative impacts), and harnessing national and international examples of emerging practice with these new technologies. These need to include innovations which are specific to, or applied within, rural healthcare settings. Given the relative shortage of literature specific to rural settings, this is an opportunity for NSW rural LHDs to become world leaders in the adoption of technology to deliver outstanding care.

CHANGE MANAGEMENT

A workforce change management strategy will need to identify for each technology the impact for the workforce, including supporting and enabling processes, systems, and scope of practice changes that are expected. It may also include communication with consumers and the public about the technologies as new methods and approaches are used in practice.

01.
Delivering health care in rural geographies

The unique rural context for healthcare delivery

Like other essential services required for a healthy and prosperous community, Australians living outside of the urban environment need access to high-quality healthcare.

Nearly 30 percent of Australians live outside of major cities. Eighteen percent live in regional areas, 8.2 percent in outer-regional, 1.2 percent in remote, and 0.8 percent in very remote areas.[15]

The delivery of healthcare services in the rural context is not simply a replica of that delivered in urban settings. There are a number of unique characteristics of the rural environment and the delivery of healthcare services in this setting that have a significant influence on how services can and should be designed and delivered. While these are not factors which are specific to technology, they provide an important context to understand some of the key needs of rural communities, the types of technologies which are most likely to address these needs, and influences which are likely to impact the successful adoption of the technologies in a way that benefits patients.

The following sub-sections outline four key areas which make the rural environment unique in terms of healthcare delivery. For each area, we discuss the implications for implementation in NSW Health. Note, these considerations are outlined at a general level, with specific technologies, as well as the associated implications for the workforce, discussed in later sections of this paper. They highlight how, in the rural setting, there is a need to consider the education and training needs of the rural workforce, to take account of the diversity of rural settings, and the need to ensure that any new technology adoption confers benefit to patients.

Geographic size and scale

There are a range of differences in rural health services which relate to matters of geography. The first pertains to sheer size – rural health services all cover significantly large geographic catchments, with some services covering communities hundreds or even thousands of kilometres apart. This creates physical access barriers between services and patients, requiring either significant travel time or the delivery of services through other means (e.g. telehealth and virtual models of care). In this way, distance can create a barrier to equitable access to health care.

The 'separation' of communities is also a key difference – health services need to be delivered to multiple small sites. This can make it challenging

to achieve economies of scale and the associated efficiencies which can be realised through a more central, single site facility or service.[16] For example, Western NSW LHD covers an area of approximately 250,000km^2, and delivers care through a diverse range of sites including three major rural referral hospitals, 50 community health centres, and 38 inpatient facilities including 25 multipurpose services.[17]

What does this mean for emerging technologies?

As a consequence of both size and scale, rural healthcare services may need to consider differing strategies or models of care to ensure that patients and clinicians can connect efficiently, to deliver high-quality healthcare.

Many of these patient-clinician connections may be enabled by technologies – particularly those technologies which enhance communication between locations, whether this be via telephone, videoconferencing, or seamless and / or real-time transfer of data. Key to the success of any such technology however, is its ability to provide the necessary accuracy, fidelity and timeliness required for high-quality health care.

Vulnerable populations and poorer health outcomes

Many rural communities have populations with high levels of vulnerability. For example, in NSW, rural LHDs have a higher proportion of people over the age of 65.[18] They also have higher proportions of Aboriginal people living in their community, with over 60 percent of the NSW Aboriginal population living within a rural LHD.[19] Refugee populations in regional areas are also increasing due to voluntary settlement and assignment of humanitarian arrivals to mostly regional areas.[20] Mental health is also a concern for regional and rural populations. Although the prevalence of mental illness is similar to that of major cities, access to mental health services is significantly more limited.[21] This results in higher rates of self-harm and suicides with increase in remoteness.[22]

In addition, there are many indicators that rural communities have poorer health outcomes. Health risk factors, such as smoking, obesity, poor diet,

low physical activity, high alcohol consumption, and high blood pressure, are overall, more prevalent in rural areas in comparison to urban areas.[23] In turn, these contribute to the development of chronic health conditions such as asthma, heart disease, stroke and vascular disease, diabetes, chronic obstructive pulmonary disease, arthritis, and osteoporosis, all of which are also more prevalent in rural populations.[24]

Potentially preventable hospitalisation rates in remote areas are 2.5 times that of major cities.[25]

These chronic conditions, along with a comparatively higher prevalence of mental and behavioural conditions, and higher rates of family, domestic, and sexual violence, have all resulted in a decrease in life expectancy for both males and females as remoteness increases and a higher total disease burden rate in remote and very remote areas.[26] It is also important to note that poorer outcomes occur within a context of other socioeconomic disadvantage that can be prevalent in some rural communities. For example, there may be limitations in employment options and incomes may also be lower.[27]

What does this mean for emerging technologies?

The high proportion of vulnerable populations and poor outcomes experienced by many of those in rural communities heightens the need to ensure that any technology implementation or adoption confers a direct benefit to patients. New technologies can be expensive, and there is always the risk that a desire to provide access to 'cutting edge technology' usurps certainty that the technology will deliver better outcomes or experiences for patients. Those with governance responsibilities in rural health services will therefore need to ensure that the emerging technologies deliver anticipated benefits in the rural setting, and do not divert scarce funds or resources from these communities.

Diversity

A key characteristic of rural health services is the diversity of the communities they serve. 'Rural' communities are not homogenous and, in turn, neither are their needs.[28] While many communities face common challenges, the specific contexts or factors influencing or underpinning these challenges may differ. For example, in Northern NSW LHD (NNSW LHD), the population of those over 65 years of age is growing rapidly. In 2011, the population within NNSW LHD was 288,241, and is projected to increase by an estimated 16.3 percent by 2031; the population of persons aged 65 years and older however, is expected to

increase by approximately 71 percent in the same period.[29] In contrast, the Far West LHD has different health challenges, arising from a disparate population groups and significant morbidity related to lifestyle factors and chronic illness.[30]

What does this mean for emerging technologies?

This diversity means that 'one size fits all' type approaches to health care, including the implementation of new technologies, is unlikely to be effective. Rather, taking a more flexible approach, governed by a core set of principles and regional oversight, and allowing for the application of different models for different contexts may have greater impacts.[31] This might mean similar technologies are implemented, but the model or approach to utilising the technology might be tailored to a specific community and their specific needs. It may also mean that different change management approaches for communities may be required.

Workforce access and specialisation

Rural communities have long faced challenges in attracting and retaining healthcare workers. Despite governments across Australia developing a range of strategies to try and address this gap, rural workforce shortages have continued.[32] Rural communities typically have a shortage of healthcare personnel, as well as shortages of specific disciplines or specialties. For the allied health workforce, mal-distribution is a key characteristic, with an over-supply in metropolitan areas and an under-supply in rural areas, especially of experienced staff, which is intensified with the degree of remoteness.[33] A similar trend is evident for medical practitioners, particularly specialists, where the number also decreases with increasing remoteness.[34]

In addition to the overall shortage of healthcare clinicians, there are a declining number with skills specific to the needs of rural settings.[35] Clinicians working in rural settings are required to respond to a broad range of clinical needs – typically covering a more diverse range of presentations and interventions than clinicians working within metropolitan areas. For example, much of the medical care delivered in rural settings is provided by GPs. However, these GPs, in addition to providing 'usual' primary care outside the hospital, may also be required to act as a visiting medical officer in order to deliver hospital generalist care, emergency physician care, as well as in other areas (e.g. obstetric care).[36] The number of GP proceduralists, or generalists, working across rural and remote Australia has been steadily declining.[37]

One of the consequences of the workforce shortage is the relatively common use of international medical graduates (IMGs) as locums to fill positions. The proportion of these alternative workforces is higher than in metropolitan areas – for example, while IMGs make up 31 percent of employed medical practitioners in major cities, they comprise 41 percent of employed medical practitioners in rural areas of Australia.[38]

What does this mean for emerging technologies?

Overall workforce shortages, as well as the existing workforce skills and the composition of the workforce in rural areas, must be a key consideration in the adoption of new technologies in rural healthcare settings. For example, use of store and forward telehealth may allow rural generalists to seek specialist advice in relation to non-urgent clinical matters. Similarly, access to virtual models of care are giving rural clinicians the ability to escalate care to specialists far more easily and rapidly. However, they need the right training to be able to do this effectively, as well as strong clinical governance systems to ensure care is delivered safely.

The available workforce (in terms of both number and skill mix) will influence levels of overall digital literacy as well as knowledge and skills in relation to the application of specific technologies. Where workforces are transient, this will also influence the level of interest and investment in gaining skills in any rural or community specific technologies. These factors need to be considered in the education and training of the rural health workforce in new technologies.

Delivering health care in rural geographies: Key findings

The delivery of healthcare services in the rural context is not simply a replica of that delivered in urban settings. There are a number of unique characteristics of the rural environment and the delivery of healthcare services in this setting that have a significant influence on how services can and should be designed and delivered. Four key areas which make the rural environment unique in terms of health care delivery are:

- **Geographic size and scale:** The sheer geographical size and separation of communities requires rural health services to deliver care to multiple small sites. This presents challenges in achieving economies of scale. Differing models of care to ensure that patients can connect efficiently with health services through technologies with high fidelity is a crucial success factor in addressing this challenge.

- **Vulnerable populations and poorer health outcomes:** Many rural communities have populations with high levels of vulnerability. This may be due to age, ethnicity, background, and higher instances of comorbidities. The high proportion of vulnerable populations and poor outcomes experienced by many of those in rural communities heightens the need to ensure that any technology implementation or adoption confers a direct benefit to patients and that the emerging technologies deliver anticipated benefits in the rural setting, and do not divert scarce funds or resources from these communities.

- **Diverse communities:** Each rural community will have different needs. This diversity means that 'one size fits all' approaches to health care, including the implementation of new technologies, is unlikely to be effective. Rather, taking a more flexible approach, governed by a core set of principles and regional oversight, and allowing for the application of different models for different contexts, may have a greater impact.

- **Workforce access and specialisation:** Rural communities have long faced challenges in attracting and retaining healthcare workers. Rural communities frequently have an overall shortage of healthcare personnel, as well as shortages of specific disciplines or specialties. Technology can assist in connecting patients to the types of clinical care and / or advice they may need. For example, use of telehealth may allow rural generalists to seek specialist advice in relation to non-urgent clinical matters. Similarly, access to virtual models of care are giving rural clinicians the ability to escalate care to specialists far more easily and rapidly.

02.
Emerging technologies impacting the rural workforce

Emerging technologies for rural health care

There are a broad range of technologies that have already been adopted or are emerging which will impact the healthcare workforce into the future. While some technologies are likely to impact the entire health workforce (such as cloud technologies or electronic records) others will have a more specific impact on particular disciplines or specialties (for example, genomics). In the rural setting, some technologies will have a more significant impact, particularly those which address the key challenges in delivering health care in a rural setting, including economies of scale, access to workforce, and the distance between patients and clinicians.

This section outlines some of the key technologies which will impact the healthcare workforce in the rural setting. Note, it does not aim to provide an exhaustive list of all emerging technologies pertinent to health care – rather, it focuses on those which are likely to have the greatest impact in delivering health care to rural communities in the next two to five years. A broader range of technologies which will impact the healthcare workforce are discussed in the other papers in this series.

Cloud technology

Cloud technologies provide users access to computing services over the internet. In the context of health services, this means providing access to servers, software, networking, storage, analytics, databases, and intelligence. As outlined in the previous section, rural health services may be delivered over multiple, disparate and small sites covering a large geographic area, leading to challenges in achieving economies of scale for resources and infrastructure needs. Cloud-based solutions however, provide access to the necessary connectivity and interoperability to manage health care across multiple (small and remote) locations, where the costs of establishing and managing locally hosted servers can be prohibitively high.[39]

Cloud technologies are now available through mainstream providers. For example, Medical Director have developed 'Helix' which is a cloud-based clinical software solution. As it does not rely on a locally hosted server, it enables clinicians to access the information they need, regardless of location.[40] This supports more timely access to necessary information, as well as reducing administrative overheads, thus freeing up time to deliver care. Other vendors, including Best Practice, will have cloud-based offerings in the near future. Similar technologies are available more broadly. Cerner's 'CommunityWorks', for example, provides an integrated, digital record for each patient across the continuum of care via cloud-based technology. This provides health services with scalable versions of more traditional solutions, without having to invest in significant infrastructure.

One limiting factor of cloud technologies in the rural and particularly remote areas is its dependency on internet access – further discussion on this is covered in the following section.

Telehealth

Telemedicine is the use of communication and information technology to provide patient care.[41] It involves the transmission of images, voice, and data between two or more sites using telecommunications to provide health services, such as clinical advice, consultation, education, and training services.[42]

Telehealth can be a powerful enabler, amongst others, for the delivery of high-quality health care in rural settings. It allows for care to be provided in a place near to where the patient lives, increasing the timeliness of care provided, and reducing travel times for the patient, consequently supporting the patient to receive treatment near to their families and local community.[43] Telehealth also supports local clinicians to access more promptly additional advice and specialist opinions, which is particularly vital in the effective management of emergency and unplanned patient presentations.[44] It also provides staff with access to a greater number and diversity of remote education and training on location.[45][46]

There is an emerging evidence base of the widespread benefits of telehealth technology – not only for patients, but also for the viability of the health system. In the United States, Intermountain Health Care supports 40 rural clinics in seven US states via a telehealth centre. This centre has its own dedicated staff in addition to on-call access to additional specialists. A recent study of its neonatal

program evaluated the effect of video-assisted resuscitation on the transfer of newborns from eight community hospitals to newborn ICUs in Level 3 trauma centres. The service achieved reduction in a newborn's odds of being transferred by about 30 percent. This was estimated to equate to 67 fewer transfers each year and savings of USD$1.2 million for affected families.[47]

While telehealth itself is already available, the ability to access health care via telehealth is

> **Case study: OTN - a virtual care system[50]**
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> The Ontario Telemedicine Network (OTN) is the largest telemedicine network in the world, servicing a population of 13.6 million and providing more than 1.7 million patient events each year. The network delivers 'virtual care', using options in care delivery such as video conferencing, remote monitoring, apps and web-based solutions. The intention is to minimise any geographic, socio-demographic and cultural barriers to accessing care.
>
> Through OTN, a range of digitally enabled services are available. Examples include:
>
> - eVisits: 'videoconferencing' between the patient and the clinician over a secure network. This can be completed within the patient's own home or at a local health centre;
>
> - eConsults: use of a secure, web-based tool to assist a clinician to access specialist or additional advice from another clinician, within one week;
>
> - Bounceback: online videos and telephone coaching to help manage symptoms of mild to moderate depression and anxiety (available in multiple languages); and
>
> - Telehomecare: a coaching and remote monitoring program for people with chronic obstructive pulmonary disease and heart disease.

evolving over time.

One key barrier has been funding, for example GP consultations via videoconference has only recently become available and are only accessible to certain rural communities. The criteria to be eligible for subsidised telehealth consultations is currently quite restrictive, where the patient is required to live in a Modified Monash Model location 6 or 7, have an existing clinical relationship with the GP providing the consultation (defined as three face-to-face consultation in the past 12 months), and be at least 15 km by road from the GP.[48]

Changes however, are occurring which provide support for rural communities in NSW. For example, patients accessing mental health care under the Better Access Initiative, can now access seven of their 10 funded consultations via telehealth.[49]

Telehealth is increasingly being used as one part of broader models of care which are digitally enabled through the application of a range of different technologies. Virtual care systems are one such model and may be a powerful means through which to meet the needs of people in rural communities.

Artificial intelligence (AI) and robotic process automation (RPA)

AI involves the use of software applications in order to mimic or surpass human cognitive or analytical capabilities to perform tasks.[51] AI may also include a 'machine learning' component, where the AI can automatically learn and improve from experience without being explicitly programmed.

While AI may bring a range of benefits to rural health, one clear opportunity is to support access to much needed health care for rural communities in NSW through its ability to improve workflows and the workload associated with certain tasks. For example, where there are high volume, repetitive tasks of a specific nature, these may be able to be completed by RPA. In turn, this could free up clinician time to spend in direct patient interactions and / or reduce unsustainable workloads.[52] The maturity (or readiness) of AI in practice however varies. For example, AI is more mature in radiology where it is likely to have a significant impact in the detection of tumours and other abnormalities detected in scans.

A significant number of AI-based, low-cost and portable diagnostic tools are in various stages of development which can replace more expensive or difficult traditional screening equipment that is not available in rural areas.[53] For example, a low-cost, swallowable endoscopic capsule with AI analysis technology can be used to screen for upper gastrointestinal cancers, thus replacing expensive or difficult traditional screening equipment or the need to have specialist medical teams available.

However, it is acknowledged that, at present, the availability of these technologies alone is not sufficient to confer a benefit to rural communities.[54] The AI needs to be delivered in the context of other enablers, including adequate infrastructure (e.g. internet access), continuous training, supervision, financial support, technical

upgrades and quality assurance.[55] A robust legislative and regulatory framework is also required, both to protect patients from unproven and / or lower quality health delivery, and to ensure health service providers have confidence in delivering AI-enabled health services.

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Case study: AI driven primary care in China[56] [57] [58]

A range of AI driven technologies are supporting better access to primary care in China.

Ping An Good Doctor, is an AI-driven 'clinic', in China. Each clinic is unstaffed and is the size of a telephone booth. Within this, the patient consults a virtual AI doctor, which collects health data through text and voice interactions. This information is then reviewed by a (human) doctor, who in turn provides a diagnosis and, if required, online prescriptions. Prescriptions can be dispensed by a vending machine style dispensary at the clinic.

The Good Doctor approach has further been expanded to a 'Village Doctor' model designed for rural communities. Existing village doctors in China's rural areas are trained to use AI-powered mobile health apps and devices to support care.

'WeDoctor' is another AI driven tool. Weighing around five kilograms, this portable device can run up to 111 tests ranging from measuring blood pressure to ECGs, as well as basic urine and blood analysis. The results are uploaded automatically to a data system for further online consultation. If further consultation is required, the patient can videoconference clinicians at city hospitals.

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Internet of things (IoT) and use of mobile devices

IoT technology harnesses the connectivity of devices to the internet.[59] It enables the development and application of networks of sensors for data collection, monitoring, decision making and process optimisation and allows for improved and remote monitoring of patients in health care.

In practical terms, IoT is a key enabler for the use of mobile information and communication devices (mobile health, or 'mHealth') in order to deliver better, and more efficient, patient care. mHealth covers a range of devices, sensors, apps and wearables, all of which are used for remote monitoring and treating chronic diseases, to raise

awareness and improve health literacy, as well as for behavioural modification.[60] Benefits associated with mHealth have been reported to include the reduction of barriers to treatment (in particular waiting times for appointments or travel time) and enabling the exchange of information between the patient and the clinical team about the patient's health condition.[61,62] In addition, mHealth can increase the accessibility of health information to support self-management.[63] Frequently, mHealth is considered an important adjunct to telehealth services.[64] Like cloud technologies however, these technologies require internet access, which may present a challenge in some remote locations. Further discussion on this issue is covered in the following section.

The breadth of conditions or symptoms that can be monitored through mHealth is significant. For example, US-based InfoBionic's remote patient monitoring system, MoMe Kardia, is designed to help detect cardiac arrhythmias in patients by sensing ECG, respiration, and motion. The lightweight monitoring device can be worn as a necklace or belt attachment.[65] This device transmits data to a cloud-based platform and the clinician can then access the patient's data via a web or iPad app. The 'physician dashboard' provides views of patient monitoring progress and generates automated reporting in multiple parameters and data displays.[66] Home-based healthcare devices such as MoMe Kardia not only increase access to healthcare for those in rural and remote areas, but also improves the patient's health outcomes. Trials of home-based health care with tele-monitoring for patients with COPD found that the disease-specific quality of life improved significantly for the patients who were tele-monitored in comparison to traditional monitoring.[67] Additionally, the Hospital Anxiety and Depression score for these patients also significantly improved.[68]

In rural areas of the US, mobile apps have been used to support 'remote' preparation and recovery for surgeries, particularly for planned or more routine procedures such as joint replacements. Through the app, patients receive daily activities covering all aspects related to pre-op preparation, including nutrition, exercise, pain/risk management, mindfulness tips and information on how to prepare their home to eliminate fall hazards. Once the procedure is complete, the app allows for the clinicians to track the patient's recovery process.[69]

Emerging technologies impacting the rural workforce: Key findings

In the rural setting, some technologies will have a more significant impact, particularly those which address the key challenges in delivering health care in rural communities (such as economies of scale, access to workforce, and the distance between patients and clinicians). Some of the key technologies for rural healthcare include:

- **Cloud technology:** Provides users access to computing services over the internet. Cloud-based solutions assist rural and remote health services by providing access to services such as servers, software, networking, storage, analytics, databases, and intelligence via the internet, where the costs of establishing and managing locally hosted servers can be prohibitively high. However, cloud-based solutions are dependent on access to the internet, which can be limited in some remote locations. Consideration also needs to be given as to where data is being stored when using cloud technologies (i.e. whether or not the data will be hosted within Australia).

- **Telehealth:** Allows for care to be provided in a place near to where the patient lives, increasing the timeliness of care provided and reducing travel times for the patient, consequently supporting the patient to receive treatment near to their families and local community. Telehealth also supports local clinicians to easily access additional advice and specialist opinions, which is vital in the effective management of emergency and unplanned patient presentations. It also provides staff with access to a greater number and diversity of remote education and training on location.

- **AI and RPA:** AI involves the use of software applications in order to mimic or surpass human cognitive or analytical capabilities to perform tasks. AI may also include a 'machine learning' component, where the AI can automatically learn and improve from experience without being explicitly programmed. A significant number of AI-based, low-cost and portable diagnostic tools are in various stages of development which can replace more expensive or difficult traditional screening equipment that may not be currently available in rural areas.

- **IoT and mobile devices:** IoT enabled mHealth covers a range of devices, sensors, apps and wearables, all of which are used for remote monitoring and treating chronic diseases, to raise awareness and improve health literacy, as well as for behavioural modification. Benefits associated with mHealth have been reported to include the reduction of barriers to treatment (in particular waiting times for appointments or travel time) and enabling the exchange of information between the patient and the clinical team about the patient's health condition. In addition, mHealth can increase the accessibility of health information to support self-management.

03.
Implementation of technology in the rural setting

Implementation of technology in the rural setting

The effectiveness and sustainability of technologies to enhance healthcare delivery is contingent upon various factors. Some of these, such as proximity to skilled technicians for regular maintenance and repair, the required throughput to justify costs, and interconnections with supporting devices and networks, are much more easily acquired or are intrinsic to urban health systems, while the same factors may be much more difficult to acquire in the rural context.

In considering which technologies should be adopted in rural healthcare systems, and how, the primary principle of assessment should be whether the technology works to narrow the gap between the health outcomes and experiences of those in rural communities, compared to their urban counterparts.

Rural health care will be influenced by a range of new and emerging technologies, and NSW Health will play a key role in determining when and how these are adopted in the NSW rural context. Key factors that will influence whether a promising technology should be adopted in rural LHDs are outlined below.

Internet access and the digital divide

The widespread adoption of the internet and uptake of information technology across the population has supported many individuals and communities to harness opportunities to access a virtually unlimited amount of data and / or information. However, with this has come a new type of inequality for stakeholders who for whatever reason, may have limited or restricted use of, or access to, internet and other technologies. This is known as the 'digital divide'.[70]

Unfortunately, those living in rural areas of Australia experience lower levels of digital inclusion when compared to people living in urban areas. Digital inclusion is 8.5 points higher for those living in capital cities than country areas across Australia, and in NSW specifically, the 'capital – country' gap sits at 8.9 points.[71]

Digital inclusion is slowly starting to shift in recent times. With the focus on prioritising rollout of the National Broadband Network (NBN) with related Sky Muster Satellites to rural areas, uptake of NBN fixed broadband services is stronger in rural communities than in their city counterparts.[72] This improvement in take-up and access will ensure that powerful and versatile technologies within eHealth, such as remote patient monitoring systems and telehealth video consultations, can be effectively implemented in rural sites now.[73]

What does this mean for the implementation of new technologies?

While such a divide still remains, the implementation of new technologies must consider the level of digital inclusion in rural areas. Telephone coverage in Australia, NBN services, data capacity and bandwidth issues are often poorer in rural and remote areas and are more expensive.[74] Digital inclusion in rural areas may also be influenced by other socio-demographic characteristics which are more prevalent in rural communities; these include older age, lower household income, or lack of employment.[75] This may mean that the feasibility to apply technologies such as mobile or remote monitoring devices and / or apps, many of which require reliable internet access, are not practical in certain locations.

Concurrently, there is a need to identify broader strategies to narrow the digital divide and address barriers to uptake and effective utilisation of healthcare technologies in rural settings; this is critical to ensuring that those living in rural communities have access to the same standards of care as those in urban settings.[76]

Financial sustainability

A critical barrier to the introduction of emerging technologies is the multiplication of costs associated with implementing and maintaining the technology in geographically isolated areas. Delivering services, including those enabled by technology across multiple sites, may not offer the same economies of scale that are available in urban health settings. Further, the rural health system inherently has a lower throughput of consumers in their services. Particularly in the purchasing of devices, the acquisition of one device may only be able to assist one rural

community but not others due to geographical distances.[77]

Justifying the added value of new and expensive technologies may be challenging. Rural systems will also have difficulties associated with maintaining infrequently used equipment, paying large connectivity fees, and paying to renew and extend commercial licences.[78]

What does this mean for the implementation of new technologies?

It is important to monitor the costs of any new technology and consider how this balances with its expected benefits across a range of areas including quality and safety, efficiency, reliability, and system and process improvement. In a constrained resourcing environment, it is vital that new technologies deliver value for rural communities – be it through better health outcomes, more positive experiences, or being able to access care closer to home.

Logistics barriers

A range of the financial barriers discussed above are mostly underpinned by the logistics challenges associated with operating in a rural environment. Not only does the implementation of a technology require a significant commitment to the transport of equipment and technicians to remote sites, maintenance and repairs of the technology also face the same challenges. More frequent extreme weather events and poor reliability from weak connections are more commonplace in rural settings. This, combined with possible shortages of skilled local technicians, means that downtimes of existing technologies are typically more prolonged in rural areas than in metropolitan areas. In addition, infrastructure may also present a challenge, with some older buildings not being conducive to reliable internet access. These issues may further limit the throughput of technologies in rural areas and may reduce evidence for justification for future technology adoption.[79]

What does this mean for the implementation of new technologies?

For the adoption of technologies in rural settings to be feasible, careful consideration of the specific logistical challenges which may be encountered must be part of the evaluation of any new technologies. These logistical challenges may look very different in a rural setting when compared to the urban context. This may also mean that some technologies, such as those enabled by cloud technologies, may in fact hold even greater value for those delivering rural health care.

Reimbursements

The financial incentive for health professionals to deliver appropriate services to rural communities may also present a challenge to the successful adoption of new technology.

For example, while Medicare Benefits Schedule (MBS) reimbursements for telehealth removes some barriers associated with accessing services, the current scheme is only available for video consultations between specialists and patients who are located in telehealth eligible areas.[80] In addition, the medium of telehealth services that can be delivered is limited in that MBS covered telehealth consultations require all parties (i.e. GP, specialist, and patient) to be present at the time of the consult.

This restricts the growth of more versatile telehealth uses, such as secure communication between health professionals, remote patient monitoring, and "store-and-forward" communication where transmission of images and information can occur through secure networks which allow parties to receive and send information in their own time.[81]

What does this mean for the implementation of new technologies?

Reimbursement models play a significant role in whether new technologies are adopted by clinicians. As such, including incentives as one of the many factors to examine in evaluating the feasibility, cost effectiveness and appropriateness of a new technology for a rural healthcare setting is vital.

Safety and quality, and benefit to patients

The implementation of new health technology in any geographical setting requires the recruitment of health practitioners that match the skills, experience and qualifications needed to utilise the technology to deliver high-quality health care. Additionally, the implementation of technologies, such as AI assisted diagnostic tools and remote monitoring services, are associated with safety and quality risks though misuse.[82]

Rural organisations that have limited resources are likely to lack the capacity needed to adopt these processes or fall short in some elements.[83] Rural settings may also lack the patient throughput to justifiably continue these processes for required technologies and / or provide an adequate throughput of patients required to ensure continued safe use or application of new technologies.

What does this mean for the implementation of new technologies?

Processes that need to be completed to ensure safety and quality must be established. This includes re-defining the scope of practice, establishing credentialing and re-credentialing processes, ensuring regular supervision, performance and peer reviews, performance development, and clinical documentation auditing, etc.[84]

Further, there may be a need to reconsider clinical governance systems for some models of care which are enabled by technology, such as virtual care systems. Existing clinical safety systems (such as the rules and protocols that govern activities such as escalation, clinical supervision and handovers) have been established with hospital-based care in mind. These may need to be reconsidered to determine their appropriateness and effectiveness in a virtual care setting.

Any technology that is adopted needs to demonstrate a benefit to patients, for example, through improved patient experience or patient outcomes.[85] Patients' care and their health outcomes must always remain the priority – the technology should only ever been seen as a means to support this aim. Ensuring these benefits are realised will be a key consideration in a time of fiscal constraints, increasing health service demand, and increasing consumer expectations. Importantly, technologies must demonstrate their success in conferring benefit for patients when implemented in a rural setting; success in urban healthcare contexts may not mean the same benefits are achieved in rural health systems.

Security and privacy

Health delivery can, and will, expand to geographically isolated places by leveraging advances in information and communication technology infrastructure. However, the utilisation of this infrastructure for rural health delivery generally involves the transfer, management, and storage of personal or protected health information (PHI)data.

With the transfer and storage of data, questions of system security will be raised by the community, patients and health professionals. For example, cloud technology can be a weak spot for cybersecurity threats without the proper encryptions.[86] Regardless of the technology approach, robust cyber security controls will need to be established and routinely tested.

Examples of robust and secure security software is already in use today. The Royal Flying Doctors Service of Australia (RFDS) use Citrix XenApp to access the RFDS Central Operations IT network when on remote operations.[87] This allows medical personnel to remotely and securely log into the central database for patient information through laptops and site-side desktops. [88] Importantly, the software wipes all traces of data off shared computers upon logging off the remote device, ensuring that other parties will not have access to the previously downloaded data. [89]

What does this mean for the implementation of new technologies?

When considering the implementation of new technologies, the security and encryption of data must be considered as a high priority. Unless the security of systems can be guaranteed, implementation of the technology should be reconsidered. Governance of new technologies, as well as regulatory requirements are also key. Co-design can be used as a strategy to ensure security and privacy issues are anticipated and addressed.

Implementation of technology in the rural setting: Key findings

Key factors that will influence whether a promising technology should be adopted in rural LHDs are outlined below:

- **Internet access and digital divide:** Those living in rural areas of Australia experience lower levels of digital inclusion when compared to people living in urban areas. While such a divide still remains, the implementation of new technologies must consider the level of digital inclusion in rural areas. Digital inclusion in rural areas may also be influenced by other socio-demographic characteristics which are more prevalent in rural communities; these include older age, lower household income, lack of employment, or particular cultural backgrounds. In turn, digital inclusion issues for rural health care may range from the ability to access devices (for example due to cost), to those of health literacy and cultural safety. All these factors should be considered in order to determine if, and how, technologies can and should be adopted to enhance access to and improve the quality of health care.

- **Financial sustainability:** A critical barrier to the introduction of emerging technologies is the costs associated with implementing and maintaining the technology in geographically isolated areas. Justifying the added value of new and expensive technologies may be challenging. It is important to monitor the costs of any new technology and consider how this balances with its expected benefits across a range of areas including quality and safety, efficiency, reliability, system and process improvement, and its impact on patient outcomes and experiences.

- **Logistics barriers:** There are a range of logistics challenges associated with operating in a rural environment, such as remoteness, extreme weather, and longer downtimes. For the adoption of technologies in rural settings to be feasible, careful consideration of the specific logistical challenges which may be encountered must be part of the evaluation of any new technologies.

- **Reimbursements:** The financial incentive for health professionals to deliver appropriate services to rural communities may also present a challenge to the successful adoption of new technology. For example, while Medicare Benefits Schedule (MBS) reimbursements for telehealth removes some barriers associated with accessing services, the current scheme is only available for video consultations between specialists and patients who are located in telehealth eligible areas. As such, including incentives as one of the many factors to examine in evaluating the feasibility, cost effectiveness and appropriateness of a new technology for a rural healthcare setting, is vital.

- **Safety and quality, and benefit to patients**: Rural organisations that have limited resources are likely to lack the capacity needed to adopt these processes or fall short in some elements. Rural settings may also lack the patient throughput required to achieve safe use or application of new technologies. In order to ensure that technologies deliver safe and high-quality care in rural health services, processes, governance frameworks and demonstration of benefits must be established prior to the implementation of any new technology in the rural setting.

- **Security and privacy**: Advances in information and communication technology infrastructure will require the transfer, management and storage of personal or protected health information. When considering the implementation of new technologies, the security and encryption of data must be considered as a high priority. Unless the security of systems can be guaranteed, implementation of the technology should be reconsidered.

Impacts on the Rural and Remote Workforce

Workforce impacts of emerging technologies

There are a variety of ways in which the adoption of technologies will impact the healthcare workforce. This section provides an overview of some of the key areas of impact for the rural workforce. For each area, considerations for NSW Health in moving forward are also outlined. Note, this is not intended to provide a comprehensive discussion of the impacts of technology on the healthcare workforce generally; rather, it focuses on the impacts of technologies most likely to be applied in the rural setting, on the rural healthcare workforce.

Specialist generalists

As outlined earlier, there are workforce shortages in rural areas, including shortages of specialist clinicians. Where there are workforce shortages, or gaps in care delivery, it is more likely that existing workforces will be working at a broader scope of practice in order to respond to the diversity of patient needs. This can be described as generalism.

In recognition of the demand for the delivery of generalist care in rural settings, a range of bodies are developing more formalised approaches to train and support the rural medical generalist workforce. This includes for example, the Australian College of Rural and Remote Medicine (ACCRM) developing a rural generalist model.[90] In addition to training, there is recognition that specialist generalists must also be supported by formal recognition of their skills, easy access to specialist support when required, access to locum relief, improved support for GP proceduralists, and training delivered within the rural setting.[91] Other clinical disciplines, including nursing and allied health, are also commonly required to operate at a broader scope of practice.

Technology can be a key enabler for these generalist workforces. Technology can provide timely access to specialist or additional advice as well as a conduit to access education. For example, Telederm is an online resource, supported by ACCRM, which delivers advice to rural doctors in the diagnosis and management of skin disease in general practice. Dermatologists review submitted cases within 48 hours, and registered users can access over 1,000 education cases and procedural videos to support their further education.[92]

The presence of a generalist workforce brings some specific considerations with respect to the introduction of new technologies. In particular, NSW Health should examine issues such as:

- Will the safe implementation of a new technology require a specific new capability? This may be challenging in the context of a generalist workforce that tends to focus on broadening, rather than 'narrowing', their skill set (note this is a very different circumstance to metropolitan healthcare workforces who are increasingly sub-specialising).

- Where technologies are specialised, will the volume of patients who would use or access that technology be adequate to either justify the cost and / or ensure that clinicians are providing safe, high-quality care?

- What governance or delegation frameworks are required to support clinicians of all disciplines to operate broadly, and likely at the upper limit of their scope of practice, yet do so safely and with appropriate oversight?

New skills to support virtual care models

New and emerging technologies, particularly those which support the delivery of virtual care, offer potential benefits for patients and clinicians in rural settings. The rapid advancement of these technologies however, has resulted in poor levels of standardisation of care being provided through these new mediums. There is increasing recognition that specific knowledge and skills are required to use telehealth and remote monitoring technologies in a way which both fully realises the potential benefits of these technologies as well as reduces inconsistencies and potential risks.[93]

Virtual health as a discipline is now developing, and work is being undertaken to standardise the core competencies. It is also anticipated that this will become part of the mandatory curriculum for healthcare students.[94] This recognises that there are a range of skills which are very specific to undertaking assessments and providing care remotely – such as managing the nuances of interacting with patients via a camera, or identifying and mitigating risks associated with

diagnosing, prescribing and handling patient data through digital mediums.[95] [96]

In medicine, the skills of a 'medical virtualist' have begun to be defined. These include:[97]

- digital communication and 'webside' manner (optimal visualisation, body language and speech, graphic assisted communication, and virtual technologies)

- scope and standards of care (licensing, insurance, prescribing, virtual care pathways)

- virtual clinical interactions (environmental assessment, virtual physical exam, group interactions)

- multidisciplinary collaboration and decision making in a virtual care environment.

Over and above individual clinician skills, there are changes in the way clinical teams operate when virtual care models are applied. Part of the training is ensuring that whole teams and clinical departments are familiar and comfortable with new workflows.[98] Some early adopters also recommend that local clinicians provide hands-on training and mentoring to other colleagues or have super-users available at each site.[99]

One particular challenge for the NSW rural health setting will be how to manage skill development, and the operation of new ways of working for whole teams, where a proportion of the workforce may be transient. As outlined earlier, there is a high use of locums, and for medical practitioners, IMGs in NSW rural health services.[100] This means that a planned strategy to ensure new staff understand and are upskilled to support models of care, such as virtual care, will be critical to the successful implementation of these technologies. This may include a talent management strategy to help NSW Health identify competencies required for different roles, and the skill development needed to meet these competencies.

In order to support the development of skills and capabilities to support virtual care models in rural healthcare settings, NSW Health should consider the following:

- What types of virtual care will be practical and feasible in rural areas in NSW? What are the skills required to deliver safe virtual care? What are the models of care and workflows? Who in the workforce needs these skills and what is required to support capability development of the rural workforce? How will the capability of whole teams as well as individual clinicians be reviewed, assessed, monitored, maintained and enhanced?

- How will NSW Health work in partnership with clinicians, professional bodies, other jurisdictions, universities and other key stakeholders to ensure that the training is fit for purpose in equipping clinicians for the technologies and models of care of the future?

- What needs to occur to ensure that clinicians in rural settings have equal (or priority) access to tailored training and education, delivered in the rural environment (for example, but not limited to backfill to attend training)? What type of training can be delivered for transient / locum workforces to ensure they have the understanding and necessary skills to utilise these technologies? Is sufficient supervision available locally to support supervised clinical practice in new or emerging practices as a result of new technologies?

- Is there a way to increase the attractiveness of working in the rural setting through illustrating the innovations in delivering health care, enabled by technology? How could new models of care, such as virtual care, become part of the strategy to attract and retain talented clinicians to rural settings?

Adoption

A key consideration in the adoption of new technologies is uptake of these by clinicians and management. Clinicians and management must 'buy-in' to the adoption of the new technologies. This means more than understanding their benefit however – they need to commit to learning new practices and skills (and changing workflows) in order to adopt them into their everyday practice. A recent survey of US clinicians about virtual care illustrates the challenge: while 14 percent of physicians have video visit capability today, only 18 percent of the rest plan to add this capability in the next one to two years.[101]

A range of barriers to the adoption of technologies have been identified and typically include those related to cost and reimbursement, legality / licensing requirements, concerns about an additional time impost and / or added complexity in workflows. In the rural context however, other barriers exist, including those related to personnel (i.e. access to enough staff, as well as staff with the right skills), internet access, and having the right type of physical infrastructure to support the technology.[102]

Addressing these in a planned and proactive way will be key to supporting technology implementation. While examining the lessons learned from urban implementations is part of the picture, they will not provide the roadmap for

adoption in the rural context as models of care that work well in major population centres will not simply translate into the rural context.[103] The specific barriers and challenges faced by rural health services must therefore be identified early and in partnership with those with knowledge and experience in rural healthcare delivery.

In order to support the effective adoption of digital technologies in the NSW rural setting, NSW Health should consider the following:

- How ready and engaged are the rural workforce to adopt the new technology? Who are the early clinical adopters and change champions and how can their leadership be harnessed to support workforce readiness?

- What types of changes in the workflow might occur with adoption of the new technology? What will change and who will be impacted? How can those who will be impacted contribute to designing new processes or models of care to ensure the technology is integrated into clinical care in a way which maximises the potential benefit to patients?

- What might be the physical or technological barriers to implementation in the rural setting? How can those already working in technical, management and clinical roles contribute to identifying strategies to overcome barriers?

- What kind of changes might be required to the IT operating model to ensure availability of clinical information – for example where internet access may not be reliable?

- What regulation and governance is required? What information do those with oversight responsibilities need to ensure that technology is adopted safely, and with benefit conferred to patients and the communities?

Partnerships

Many of the technologies that aim to support high-quality care for patients in rural settings work by providing the mechanism to connect clinicians and patients in rural locations with additional or specialist support. The benefits of this capacity however, will not be realised without a commitment to collaboration and partnerships between clinicians at different sites. Networks between services located in rural and remote areas and their counterparts in urban centres need to be cultivated, and strengthening mutually respectful relationships between rural and remote services and the more specialised services in larger regional and metropolitan centres is essential.[104] Providing access to a partnering hospital, such as a tertiary or teaching facility, can mean that a rural site can deliver services locally that they may not otherwise be able to provide due to clinician or specialist availability or economies of scale.[105]

An example of a model where technology is being used to support partnerships between clinicians to achieve better outcomes of care is the Extension for Community Care Outcomes (ECHO) model. The ECHO model involves expert clinicians at one site connecting with rural / community sites via video conference for weekly 'clinics' to provide oversight (longitudinal case management) of patients that the rural site would not normally manage because of patient complexity.

This model was originally developed to support under-served communities in rural and prison locations who had the Hepatitis C virus infection. It involves training primary care clinicians using telehealth / videoconferencing to treat complex diseases. At these clinics, the supporting site may also provide other more general education, such as didactic presentations by interdisciplinary experts to improve content knowledge. [106] [107]

The ECHO model has since been applied more broadly,[108] [109] with the Royal Australian College of General Practitioners (RACGP) using the Project ECHO model for the first time in March 2019 with the launch of its new Alcohol and Other Drugs (AOD) GP Education Program, with six more ECHO hubs expected to launch in 2020. The ECHO model's goal is to "democratise medical knowledge and overcome the rural–urban health gulf by bringing specialist knowledge to primary care doctors, rather than forcing patients to travel long distances to city-based practitioners."[110] [111]

In order to support the effective adoption of digital technologies in the NSW rural setting, NSW Health should consider the following:

- Who are the key parties to partnerships to support rural healthcare delivery? What are the incentives for the partnership? How can these be harnessed to strengthen relationships and what is their effectiveness?

- Are there specific skills or perspectives required to develop partnerships when parties to the partnerships are geographically separated? How can these be strengthened to benefit the delivery of rural health care?

- Where are there existing models of successful partnerships involving rural healthcare services? Can these be showcased to inspire and support other NSW rural health services to achieve similar results?

Impacts on the Rural and Remote Workforce: Key findings

There are a variety of ways in which the adoption of technologies will impact the healthcare workforce. Some of the key areas of impact for the rural workforce include:

- **Specialist generalists:** Where there are workforce shortages, or gaps in care delivery, it is more likely that existing workforces will be working at a broader scope of practice in order to respond to the diversity of patient needs. In recognition, rural generalist models are in operation. Technology can be a key enabler for these generalist workforces. Technology can provide timely access to specialist or additional advice (such as from large regional or metro centres) as well as provide a conduit to access education. Considerations prior to enabling technology implementations where they are being used by a generalist workforce include capability development, economies of scale, and governance and delegation frameworks.

- **New skills to support virtual care models:** Virtual health care as a discipline is now developing, and work is being undertaken to standardise the core competencies. It is also anticipated that this will become part of the mandatory curriculum for healthcare students. This recognises that there are a range of skills which are very specific to undertaking assessments and providing care remotely. These include digital communication and 'webside' manner, scope and standards of care, virtual clinical interactions, and multidisciplinary collaboration.

- **Adoption:** Clinicians and management must 'buy-in' to the adoption of the new technologies. This means more than understanding their benefit however – they need to commit to learning new practices and skills in order to adopt them into their everyday practice. In supporting the effective adoption of digital technologies in the NSW rural setting, health services should consider staff readiness and engagement, likely changes in workflow, physical and technological barriers to implementations in rural settings, the capacity of IT operating models, and governance and regulation structures to guide use.

- **Partnerships:** The benefits of technologies will not be realised without a commitment to collaboration and partnerships between clinicians at different sites. In supporting the effective adoption of digital technologies in the NSW rural setting, NSW Health should consider key parties to partnerships, specific skills and perspectives required to develop partnerships, and existing models of successful partnerships.

References

[1] NSW Health. (2018). *NSW Rural Health Plan: Progress Report 2017-18*
[2] NSW Health. (2018). *NSW Rural Health Plan: Progress Report 2017-18*
[3] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[4] NSW Health. (2014). *NSW Rural Health Plan: Towards 2021*
[5] NSW Health. (2014). *NSW Rural Health Plan: Towards 2021*
[6] NSW Health. (2014). *NSW Rural Health Plan: Towards 2021*
[7] NSW Health. (2018). *NSW Rural Health Plan: Progress Report 2017-18*
[8] NSW Health. (2014). *NSW Rural Health Plan: Progress Report 2017-18*
[9] NSW Health. (2014). *NSW Rural Health Plan: Progress Report 2017-18*
[10] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[11] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[12] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[13] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[14] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[15] Hendrie, D. Royal Australian College of General Practitioners (RACGP). (2019). *Rural-urban healthcare gulf still wide: AIHW*
[16] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*
[17] Western NSW Local Health District. Our organisation. https://wnswlhd.health.nsw.gov.au/our-organisation/our-story/welcome accessed December 2019.
[18] Bureau of Health Information (2016). The Insights Series – Healthcare in rural, regional and remote NSW.
[19] Bureau of Health Information (2016). The Insights Series – Healthcare in rural, regional and remote NSW.
[20] Settlement Council of Australia (2017). *Exploring Options for Regional Settlement*. Available at https://scoa.org.au/wp-content/uploads/2017/03/SCoA-Regional-Settlement-Policy-Paper.pdf
[21] National Rural Health Alliance Inc. (2017). *Mental Health in Rural and Remote Australia.*
[22] National Rural Health Alliance Inc. (2017). *Mental Health in Rural and Remote Australia.*
[23] Australian Institute of Health and Welfare. (2019). *Rural and remote health*
[24] Australian Institute of Health and Welfare. (2019). *Rural and remote health*
[25] Australian Institute of Health and Welfare. (2019). *Rural and remote health*
[26] Australian Institute of Health and Welfare. (2019). *Rural and remote health*
[27] Bureau of Health Information (2016). The Insights Series – Healthcare in rural, regional and remote NSW; BHI; 2016.
[28] Clinical Excellence Commission. (2019). *High Performing Rural Health Systems*.
[29] Northern NSW Local Health District. About the NNSWLHD. https://nnswlhd.health.nsw.gov.au/about/northern-nsw-local-health-district/ accessed December 2019.
[30] NSW Health. (n.d.). *Far West.* Accessed: https://www.health.nsw.gov.au/lhd/Pages/fwlhd.aspx
[31] Swannel, C. Medical Journal of Australia. (2019) National rural / remote health strategy: now more than ever.
[32] Australian Government, Department of Health. Stronger rural health strategy. https://www.health.gov.au/resources/corporate-plan-2018-2019/our-performance/stronger-rural-health-strategy accessed December 2019.
[33] Cosgrave., C., Malatzky, C., Gillespie, J. (2018). Social Determinants of Rural Health Workforce Retention: A Scoping Review. International Journal of Environmental Research and Public Health. 16: 314.
[34] Australian Institute of Health and Welfare. Rural and remote health – access to health care. Web report. https://www.aihw.gov.au/reports/rural-remote-australians/rural-remote-health/contents/access-to-health-care accessed December 2019.
[35] Hendrie, D. RACGP. (2018). *Who will be the rural GPs of the future?*
[36] Australian Government. National Rural Health Commissioner. National Rural Generalist Taskforce. Advice to the National Rural Health Commissioner on the Development of the National Rural Generalist Pathway. December 2018.
[37] Australian Medical Association. Rural Workforce Initiatives 2017 position statement. https://ama.com.au/sites/default/files/documents/AMA%20Position%20Statement%20on%20Rural%20Workforce%20Initiatives.pdf accessed December 2019.

[38] Australian Institute of Health and Welfare. Australia's Health 2018.

[39] Medical Director. Improving rural health with technology. https://www.medicaldirector.com/news/healthcare-in-the-cloud/2017/12/improving-rural-health-with-technology accessed December 2019.

[40] Medical director. Healthcare in the cloud.https://www.medicaldirector.com/news/healthcare-in-the-cloud/2017/12/improving-rural-health-with-technology accessed December 2019.

[41] Muir J. (2014). Australian Family Physician Volume 43, No. 12, Pages 828-830. Telehealth: the specialist perspective.

[42] Services for Australian Rural and Remote Allied Health. (2018). Telehealth.

[43] Muir J. (2014). Australian Family Physician Volume 43, No. 12, Pages 828-830. Telehealth: the specialist perspective.

[44] Muir J. (2014). Australian Family Physician Volume 43, No. 12, Pages 828-830. Telehealth: the specialist perspective.

[45] Moffatt, J., and Eley, D. (2010). The reported benefits of telehealth for rural Australians. Australian Health Review. 34(3) 276-281

[46] Harvard Business Review. Telehealth is improving healthcare in rural areas. May 2019. https://hbr.org/2019/05/telehealth-is-improving-health-care-in-rural-areas accessed December 2019.

[47] Albritton, J., Maddox, L., Ridout, E., Minton, S. (2018). The Effect Of A Newborn Telehealth Program On Transfers Avoided: A Multiple-Baseline Study. Health affairs, 37 (12). Telehealth.

[48] Woodler. RACGP. (2019). *New telehealth funding 'a good start'.*

[49] Australian Government. Better Access Telehealth Services for people in rural and remote areas. https://www1.health.gov.au/internet/main/publishing.nsf/Content/mental-ba-telehealth accessed December 2019.

[50] OTN Virtual Care for Patients. www.otn.ca/patients/ accessed December 2019.

[51] OTN Virtual Care for Patients. www.otn.ca/patients/ accessed December 2019. Human intelligence. Smart Learning Environments: 6:8.

[52] Hosny, A et al. (2018). Artificial intelligence in radiology.

[53] Guo, J., and Li, B., (2018). The Application of Medical Artificial Intelligence Technology in Rural Areas of Developing Countries. Health Equity Volume 2.1.

[54] Guo, J., and Li, B., (2018). The Application of Medical Artificial Intelligence Technology in Rural Areas of Developing Countries. Health Equity Volume 2.1.

[55] Guo, J., and Li, B., (2018). The Application of Medical Artificial Intelligence Technology in Rural Areas of Developing Countries. Health Equity Volume 2.1.

[56] Mobihealth News Ping An Good Doctor and Merck sign agreement to explore integrated health solutions in China https://www.mobihealthnews.com/news/asia-pacific/ping-good-doctor-and-merck-sign-agreement-explore-integrated-health-solutions accessed December 2019

[57] Ping An HealthCare and Technology Limited. http://www.pahtg.com/en/news/in-the-news/ai-technology-makes-ping-an-good-doctor-s-one-minute-clinic-the-most-popular-new-invention-at-pharmchina/ accessed December 2019.

[58] South China Morning Post. March 2018. Look how China is using technology to improve rural access to quality health care. https://www.scmp.com/tech/article/2135880/look-how-china-using-technology-improve-rural-access-quality-health-care accessed December 2019.

[59] Laplante, P., Kassab., M., Laplante., Voas, J. (2018). Building Caring Healthcare Systems in the Internet of Things. IEEE Syst J. 12 (3).

[60] Cosgrave., C., Malatzky, C., Gillespie, J. (2018). Social Determinants of Rural Health Workforce Retention: A Scoping Review. International Journal of Environmental Research and Public Health. 16: 314.

[61] Dupuis, K., and Tsotsos, L. (2018). Technology for Remote Health Monitoring in an Older Population: A Role for Mobile Devices. Multi model technologies and interaction. 2(43).

[62] Khairat, S., Liu, S., Zaman, T., Edson, B., Bianforcaro, R., (2018). Factors determining patients' choice between mobile health and telemedicine: predictive analytics assessment. Journal of Medical Internet Research Vol 7, No 6 (2019).

[63] Dupuis, K., and Tsotsos, L. (2018). Technology for Remote Health Monitoring in an Older Population: A Role for Mobile Devices. Multi model technologies and interaction. 2(43).

[64] Kessel, K., Vogel, M., Schmidt-Graf., F., Combs, S., (2016). Mobile Apps in Oncology: A Survey on Health Care Professionals' Attitude Toward Telemedicine, mHealth, and Oncological Apps. Journal of Medical Internet Research. Vol 18, No 11.

[65] Infobionic. Cardiac monitoring https://infobionic.com/cardiac-monitoring-solution-how-it-works/ accessed December 2019.

[66] Mobile Health News. https://www.mobihealthnews.com/content/infobionic-gets-50m-mome-kardia-connected-cardiac-monitor accessed December 2019.

[67] McDowell, JE, McClean, S, Fitzgibbon, F, & Tate, S. Journal of Telemedicine and Telecare. *A randomised clinical trial of the effectiveness of home-based health care with telemonitoring in patients with COPD.*

[68] McDowell, JE, McClean, S, Fitzgibbon, F, & Tate, S. Journal of Telemedicine and Telecare. *A randomised clinical trial of the effectiveness of home-based health care with telemonitoring in patients with COPD.*

[69] Healthcare IT news. May 2018. Mobile app helps rural patients pre and post op care. https://www.healthcareitnews.com/news/mobile-app-helps-rural-patients-pre-and-post-op-care accessed December 2019.

[70] Thomas, J, Barraket, J, Wilson, CK, Rennie, E, Ewing, S, MacDonald, T, 2019, Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2019, RMIT University and Swinburne University of Technology, Melbourne, for Telstra.

[71] Thomas, J, Barraket, J, Wilson, CK, Rennie, E, Ewing, S, MacDonald, T, 2019, Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2019, RMIT University and Swinburne University of Technology, Melbourne, for Telstra.

[72] Telstra. (2019). *Measuring Australia's Digital Divide: Australian Digital Index 2019.*

[73] Rural Health Information Hub. (2019). *Barriers to Telehealth in Rural Areas.*

[74] Rural Doctors Association of Australia. Digital Health Strategy Submission. 2017.

[75] Thomas, J, Barraket, J, Wilson, CK, Rennie, E, Ewing, S, MacDonald, T, 2019, Measuring Australia's Digital Divide: The Australian Digital Inclusion Index 2019, RMIT University and Swinburne University of Technology, Melbourne, for Telstra.

[76] Rural Doctors Association of Australia. Digital Health Strategy Submission. 2017.

[77] Rural Health Information Hub. (2019). *Barriers to Telehealth in Rural Areas.*

[78] Rural Health Information Hub. (2019). *Barriers to Telehealth in Rural Areas.*

[79] Garrett, P et al. Online Research Journal Perspectives in Health Information Management (2006). *Identifying Barriers to the Adoption of New Technology in Rural Hospitals: A Case Report.*

[80] Department of Human Services. Australian Government. (2019). *MBS and telehealth.*

[81] Chiron Health (2019). Telehealth Technology.

[82] Singh, H, & Sittig, D. (2015). *Measuring and improving patient safety through health information technology: The Health IT Safety Framework.*

[83] Rural Health Information Hub. (2019). *Barriers to Telehealth in Rural Areas.*

[84] Australian Commission on Safety and Quality in Healthcare. (2015). C*redentialing health practitioners and defining their scope of clinical practice: a guide for managers and practitioners.*

[85] NHS. (2019). *The Topol Review: Preparing the Healthcare Workforce to Deliver the Digital Future.*

[86] University of Illinois at Chicago. (n.d.). *Cybersecurity: How can it be improved in health care? https://healthinformatics.uic.edu/blog/cybersecurity-how-can-it-be-improved-in-health-care/* accessed January 2020.

[87] Royal Flying Doctors Service. (n.d.). *Remote access to RFDS Central Operations IT network.*

[88] Royal Flying Doctors Service. (n.d.). *Remote access to RFDS Central Operations IT network.*

[89] Royal Flying Doctors Service. (n.d.). *Remote access to RFDS Central Operations IT network.*

[90] Australian Government. National Rural Health Commissioner. National Rural Generalist Taskforce. Advice to the National Rural Health Commissioner on the Development of the National Rural Generalist Pathway. December 2018.

[91] Australian Medical Association. Rural Workfroce Initiatives 2017 position statement. https://ama.com.au/sites/default/files/documents/AMA%20Position%20Statement%20on%20Rural%20Workforce%20Initiatives.pdf accessed December 2019.

[92] Australian College of Rural and Remote Medicine. Tele-Derm https://www.acrrm.org.au/search/find-online-learning/details?id=13725&title=Tele-Derm accessed December 2019.

[93] Dan Bowman. ATA19: Why providers must prioritise virtual care training. HealthTech Magazine. April 2019. https://healthtechmagazine.net/article/2019/04/ata19-why-providers-must-prioritize-virtual-care-training accessed December 2019.

[94] Sharma., R., Nachum, S., Davidson, K., and Nochomovitz., M. (2019). Its not just FaceTime: core competencies for the medical virtualist. International Journal of Emergency Medicine: 12(8).

[95] Sharma., R., Nachum, S., Davidson, K., and Nochomovitz., M. (2019). Its not just FaceTime: core competencies for the medical virtualist. International Journal of Emergency Medicine: 12(8).

[96] Deloitte Insights. What can health systems do to encourage physicians to embrace virtual care? Deloitte 2018 survey of US Physicians. https://www2.deloitte.com/us/en/insights/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#endnote-sup-17

[97] Sharma., R., Nachum, S., Davidson, K., and Nochomovitz., M. (2019). Its not just FaceTime: core competencies for the medical virtualist. International Journal of Emergency Medicine: 12(8).

[98] Deloitte Insights. What can health systems do to encourage physicians to embrace virtual care? Deloitte 2018 survey of US Physicians. https://www2.deloitte.com/us/en/insights/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#endnote-sup-17

[99] Deloitte Insights. What can health systems do to encourage physicians to embrace virtual care? Deloitte 2018 survey of US Physicians. https://www2.deloitte.com/us/en/insights/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#endnote-sup-17

[100] Australian Institute of Health and Welfare. Australia's Health 2018.

[101] Deloitte Insights. What can health systems do to encourage physicians to embrace virtual care? Deloitte 2018 survey of US Physicians. https://www2.deloitte.com/us/en/insights/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#endnote-sup-17

[102] Deloitte Insights. What can health systems do to encourage physicians to embrace virtual care? Deloitte 2018 survey of US Physicians. https://www2.deloitte.com/us/en/insights/industry/health-care/virtual-health-care-health-consumer-and-physician-surveys.html#endnote-sup-17

[103] PwC. Digital Health in rural and remote Australia tackling the inequality of geography https://www.pwc.com.au/health/digital-health-in-rural-2018.pdf accessed December 2019.

[104] Australian Government Department of Health. National Strategic Framework for Rural and Remote Health.

[105] Royal Australian College of General Practitioners. Could this be the new model to end rural specialist waiting? https://www1.racgp.org.au/newsgp/clinical/could-this-new-model-end-rural-specialist-waiting accessed December 2019.

[106] Arora, S., Thonrton, K., Murata, G., Deming, P., Kalishman, S., Dion, D., Paris, B et al (2011) Outcomes of Treatment for Hepatitis C Virus Infection by Primary Care Providers N Engl J Med 364:2199-2207

[107] University of New Mexico School of Medicine. Project Echo. https://echo.unm.edu/about-echo/ accessed December 2019.

[108] Queensland Health. Project ECHO. https://www.childrens.health.qld.gov.au/chq/health-professionals/integrated-care/project-echo/ accessed December 2019.

[109] Mehrotra, K., Chand., P., Bandawar, M., Rao Sagi, M., Kaur, S., Raj, A., Jain, S., Komaromy, M., Murthy, P., Arora, S. (2018). Effectiveness of NIMHANS ECHO blended tele-mentoring model of integrated mental health and addiction for counsellors in rural and underserved districts of Chhattisgarh, India. Asian Journal of Psychiatry. 36:123-127.

[110] Royal Australian College of General Practitioners. Could this be the new model to end rural specialist waiting? https://www1.racgp.org.au/newsgp/clinical/could-this-new-model-end-rural-specialist-waiting accessed December 2019.

[111] Royal Australian College of General Practitioners. Ground breaking echo model at tipping point of acceptance. May 2019. https://www1.racgp.org.au/newsgp/professional/groundbreaking-echo-model-at-tipping-point-of-acce accessed December 2018.

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