Telehealth and the NBN

A submission to the

Australian House of Representatives Infrastructure and Communications Committee Inquiry into the role and potential benefits of the National Broadband Network

by the

Australasian Telehealth Society

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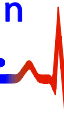
Australasian TELE HEALTH Society

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1 Summary

This submission aims to describe the benefits of the NBN in providing healthcare over a distance, and suggests ways in which these benefits can be maximised.

Several of the challenges being faced by the health system are summarised, including inequality of access, an ageing population, chronic disease, maintenance of safety and quality, workforce issues and indigenous health. Aspects of all of these challenges can be addressed through telehealth, especially if the NBN is available.

There are many advantages of the NBN over existing telehealth infrastructure, including its national and universal coverage, improved technical quality and the potential to include health consumers through home connections.

There is an existing evidence base of the efficacy of health care delivery over advanced networks, in pilots funded under the Government's Advanced Networks and Clever Networks programs. These pilots have all been successful, but there have been barriers to more widespread adoption of these technologies.

The success of the NBN in delivering telehealth services will require more than simply building a network. There are a number of overseas models for national health networks. Innovation will need to be encouraged to develop new models for health care delivery and new clinical applications. A national health network, using the NBN's infrastructure, should be created. Health-critical communities must be included in the NBN's coverage. Larger groupings of health care professionals providing peer support can help ensure safety and quality. All this should be part of a National Telehealth Strategy, built into long-term healthcare reform. This will need to include new funding models to create appropriate incentives.

If these reforms accompany the rollout of the NBN, there will be considerable benefit to health systems, clinicians and consumers of healthcare.

2 Introduction & definitions

2.1 About this submission

This submission was prepared by the Executive Committee of the Australasian Telehealth Society, coordinated by its Honorary Secretary, Dr Laurie Wilson. The views of the membership of the Society were sought, and where possible have been incorporated into the submission.

While telehealth has often been proposed as a key justification for proceeding with the National Broadband Network, the views of the Australian telehealth community have not previously been sought, nor a comprehensive case for telehealth on the NBN presented. This document has two aims:

- To describe the potential benefits to healthcare in Australia, through the provision of telehealth services on the NBN.

- To suggest ways in which these benefits can be maximised.

2.2   What is telehealth

The term *Telehealth* refers to healthcare delivery, or closely-related processes (such as education), when some of the participants are separated by distance and information and communications technologies are used to overcome that distance. The term *Telemedicine* is sometimes used in a slightly more restricted sense to denote the actual delivery of (medical) health care, but the two terms are commonly used interchangeably.

The World Health Organisation as adopted this definition:

> The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities.[1]

Almost every medical speciality, including General Practice and Nursing, has made use of telehealth. The Royal Flying Doctor Service was a pioneer in the first half of the twentieth century, but telehealth is usually considered to date from the late twentieth century, when communications technologies made it possible to transmit still and moving images. Image-based specialities (such as teleradiology, teledermatology and telepathology) are the most mature applications, while consultations built around teleconferencing (such as telepsychiatry) are becoming increasingly common. Consultations with specialists increasingly precede the transfer of emergency and intensive care patients from remote areas to major city hospitals. Specialists can easily "participate" in visits by medical teams to remote communities, especially indigenous communities, while a telehealth consultation can eliminate the need for a family to make a long journey for a routine visit to their doctor.

2.3   Telehealth and eHealth

Telehealth is usually considered to be a subset of eHealth, which refers to the use of Information and Communications Technologies (ICT) in healthcare. A primary focus of eHealth is the implementation and use of Electronic Medical Records, often referred to as Health Informatics. Clearly, the boundaries between some of these definitions can become blurred, and most definitions of telehealth require a human (patient, medical practitioner or carer) to be present at two or more of the nodes in a telehealth consultation.

2.4   The Australasian Telehealth Society

The Australasian Telehealth Society (ATHS) was formed in 2008 in response to a perception that the community of participants in telehealth did not have a forum in which to promote the use of this technology, and that telehealth was not being utilised to its full potential. The Society is the national member for Australia and New Zealand of the International Society for Telemedicine and eHealth (ISfTeH), and currently has about 80 members across Australia and New Zealand. In 2010, ATHS hosted the 15th International Conference of the ISfTeH in Perth, Western Australia.

More information about the Australasian telehealth Society can be found at www.aths.org.au, and the current Executive Committee is listed in an appendix to this submission.

3 Challenges for the health system

Health systems throughout Australia are struggling to cope with increasing demands and expectations. While new technologies can usually be shown to improve health care outcomes, the cost of these technologies can place extra burdens on limited health budgets. Many of the current challenges facing our health sector can be at least partially addressed through appropriate application of telehealth technologies, and later sections of this document will address some of these in more detail. We also assert that the implementation via a National Broadband Network has the potential to further enhance the deployment of many of these technologies.

3.1 Inequality of access to healthcare

Australia's health systems are capable of providing healthcare which is internationally recognised as being of a high standard [2], and most Australians regard access to such healthcare as one of their fundamental rights as citizens. But Australia's large distances and widely distributed demographics create challenges in providing this equity of access. In a recent study of men's health [3], the Australian Institute of Health and Welfare found that life expectancy for non-indigenous males living outside major cities was three years less than the life expectancy for their metropolitan counterparts. These inequalities become more significant for people living further away from major metropolitan cities.

3.2 Ageing population

The ageing of the population in Australia and most advanced countries will place large burdens on health systems. Currently, more than a quarter of Australian government spending is directed to health, age-related pensions and aged care.   Australian government spending on these areas is projected to increase significantly, pushing their share of total spending to almost half by 2049 50 [4]. The concept of "Ageing in Place" encourages the elderly to remain independent for as long as possible. This has obvious social benefits for the elderly, and produces economic benefits for providers of health and aged care. Information and communications technologies have played a role in aged care since the introduction of wireless personal alarms. Recent systems can provide various forms of interaction for the subjects (such as high quality videoconferencing with a carer), as well as automated systems for monitoring vital signs and other measures of well-being.

3.3 Chronic disease

Most industrialised countries are facing an increase in long-term and chronic disease, such as diabetes or chronic obstructive pulmonary disease. Many of these conditions can be managed by the patients themselves with careful monitoring and prompt intervention when necessary. As with aged care, the use of ICT for vital signs monitoring and videoconferencing can assist patients in self-management and ensure that intervention, when necessary, is timely [5].

3.4 Safety & Quality

Despite the high quality of health care in Australia, "adverse events" in the hospital system have been estimated to cost the nation between $1billion and $2billion annually [6], with a large proportion of such events seen to be preventable. In a number of recent, well-publicised cases, medical practitioners in regional areas were found to have been practising beyond their level of training, and without adequate without supervision or contact with their peers. There is likely to be

a role for telehealth in creating such contacts, and providing facilities for mentoring and monitoring the performance of isolated practitioners.

3.5 Stretched workforce

In 2005 the Productivity Commission conducted an inquiry into the Australian Health workforce [7] and its conclusions included:

> Australia is experiencing workforce shortages across a number of health professions despite a significant and growing reliance on overseas trained health workers. The shortages are even more acute in rural and remote areas and in certain special needs sectors.

While telehealth cannot create new health professionals, it can play a role in ensuring that the existing workforce is used efficiently and to its full capacity. For example, a specialist located in one hospital can deliver some services across a number of centres, helping to maintain facilities such as intensive care units in centres which might not be large enough to make us of such a specialist on a full time basis.

While workforce issues a most prominent outside capital cities, there are many hospitals with minimal specialist cover in metropolitan areas, and telehealth can play a role in sustaining such smaller metropolitan hospitals by having specialists deliver some services through telehealth, even when the distances involved are a few kilometres.

3.6 Indigenous health

Australia's indigenous population has some of the worst health outcomes in the world. Many of the conditions suffered by the indigenous population are well-controlled and are not life-threatening in the broader population. The recent publication *Closing the Gap; Prime Minister's Report 2011* [8] reported that the current gap in life expectancy is estimated at 11.5 years for males and 9.7 years for females. Approximately 70% of this gap is attributable to chronic disease.

Many indigenous Australians live in rural and remote regions. In the Northern Territory, 81% of the indigenous population live in remote or very remote areas, and in Western Australia this figure is 41% [9]. This makes very difficult the delivery of any services, especially health, and care delivery by telehealth is hampered by the lack of suitable networks.

A good example of the difficulty of supplying health services to indigenous communities is that of Numbulwar, located on the north-east coast of the Northern Territory. The population of 672 people is 95% indigenous, just over half the population under 25. There is no resident medical practitioner, the nearest being located on Groote Eylandt, reachable only by sea or by air. The community is connected to Darwin by poor quality roads, which become impassable in the wet season. Presently, telehealth services are delivered via the only internet connection available, a 512K Telstra link shared by all services. The satellite link planned as part of the NBN may make a substantial difference to healthcare available in this isolated community.

4 Advantages of the NBN over current infrastructure

4.1 National deployment with universal coverage

The current network and management arrangements for telehealth reflect the fragmented and hierarchical structure of health care delivery, especially where distance is involved. Within the multiple state health systems, there are sometimes several separate telehealth systems operating. There is little contact between layers within the health systems (e.g. hospitals to GPs), and patients themselves are rarely part of the telehealth networks.

Newer models for healthcare delivery emphases the desirability of a patient-centric models and the ability to make relevant information available in a secure and timely fashion to whoever needs it to optimally deliver health care. Currently, a connection between any two participants in health care might currently involve several networks. By providing a single network connecting 93% of all premises in Australia at 100 MBit/s over fibre, the NBN should make it possible for any two participants in healthcare to be connected securely and reliably. A recent report on Telemedicine written by National ICT Australia (NICTA) [10] identified a number of "First Tier" barriers to the uptake of telehealth, including pervasive access and interoperability. Pervasive access is facilitated by including patients, GPs, hospitals and health administrations in a single network.

The national nature of the NBN will facilitate "national thinking" in several aspects of providing telehealth services. One of these is interoperability. Lack of interoperability remains one of the main barriers to the adoption of ICT in healthcare [11], and the national approach encouraged by the

nature of the NBN, will enable organisations such as Standards Australia (through its Telehealth Subcommittee IT014-12) and the Therapeutic Goods Administration to play a more significant role in facilitating telehealth.

4.2 Technical quality

The NBN promises 100Mbit/s bandwidth with high quality of service to its connection points [12]. This bandwidth will be delivered with high reliability and with minimal latency (time delay). This is higher than the bandwidth used for any current telehealth service, although major facilities such as hospitals will need to run several simultaneous services. Currently, most telehealth services use bandwidths of the order of several hundred kbit/s, although this has been governed mainly by the availability of bandwidth at the time such services were established.

As described in some examples introduced later in this document, higher guaranteed bandwidth creates opportunities for telehealth applications not available when the bandwidth is low or variable. Some of these include:

- Ability to rapidly transfer and interact in real time with large data sets, as generated by some 3D imaging modalities such as CT or MRI.

- High-definition interaction with camera- or computer-generated images.

- Simultaneous transmission of several video and/or data channels, which can support team interaction in complex critical care applications

- Broadcast-quality (or better) videoconferencing to create a high sense of presence and trust, without latency-induced time delays.

- Real time guidance or even robotic control of some procedures.

- High-quality, interactive teaching, accessible by medical trainees or practitioners seeking continuing medical education, wherever they happen to be located.

While many of these applications are possible (and have been demonstrated) with existing infrastructure, the lack of pervasive access has limited them to a small number of demonstration systems. Some remote communities are currently accessible only through commercial satellite communications, which are too expensive for routine use, and inhibit natural interaction because of large latencies. Some of these communities might be accessible through the NBN satellite product.

Many indigenous communities are also the most remote, and the universal access provided by the NBN promises to address the inequities associated with remoteness. It is likely that provision of continuity of care (essential in treating chronic disease) can be addressed through the ability to track nomadic patients as they move between health facilities.

4.3 Extension to home, community based self help kiosks and mobile telehealth

The revolution in personal communications on the one hand, and the rise in chronic and age-related disease on the other, are creating renewed interest in the provision of healthcare through home,

community based self help kiosks or mobile portals [13]. Technology can provide automatic monitoring of an individual's well-being, self-help advice, measurement of vital signs, tele-rehabilitation, detection of adverse events (e.g. falls) or regular contact with carers. This is the fastest-growing area of telehealth, and its growth is limited only by the lack of adequate funding models.

The universal coverage provided by the NBN will facilitate a range of services now limited by the availability of technology. Regular videoconferencing with carers is a vital part of the spectrum of services. The ability to do this with low-latency, broadcast-quality video will assist in creating and maintain trust between carer and patient, make it easier to detect subtle changes in appearance or demeanour which might signal the onset of more serious conditions. In theory, this can be done with today's networks, but the practical experience is that there are hurdles to overcome. For example[1], the South Australian Royal District Nursing Service home medication management service in Adelaide has now done over 50,000 virtual visits by home videophone. In principle this could have been done with DSL, but because of problems with this technology, the company responsible for the engineering (Design Networks a.k.a. VidCo) have engineered the system to run on 3G, but even so, this has needed considerable telecommunications expertise to ensure adequate signal strength to most homes in Adelaide for quality real time video; the universal service provisions of the NBN would certainly resolve this issue.

Chronic disease (such as diabetes) can be self-managed with guidance and intervention by medical practitioners where necessary. All of these services can be delivered without regard for the distances between carer and patient.

The cost savings of "ageing in place" as well as self-management of chronic disease are realised through health consumers staying out of the far more expensive residential care system, including hospitals and nursing homes.

5 Evidence base

5.1 CSIRO projects

Between 2001 and 2007 the Commonwealth Scientific and Industrial Research Organisation managed the Centre for Networking Technologies for the Information Economy (CeNTIE). The major source of external funding was the Advanced Networks Program of what is now the Australian Department of Broadband, Communications and the Digital Economy. The guiding principle of CeNTIE was to answer the question "What would life be like if bandwidth were free and infinite?". This was done by mounting some demonstration projects as suggested by industry and community-based focus groups. Several of these were in the health domain, although one (the ICU-based ECHONET project) was suggested by a focus group addressing regional issues.

The outcomes of these projects have been described in detail elsewhere [14]. Four different telehealth systems were installed and evaluated in a clinical setting:

- The Virtual Critical Care Unit (ViCCU), Support for Emergency Departments

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[1] Information supplied by Dr Victoria Wade, ATHS member.

- ECHONET, support for Intensive Care and Echocardiography.

- Remote Interactive Diagnostic Examination System (RIDES), supporting paediatric outpatient consultations

- Collaborative Surgical Training, providing surgical training by simulation, with teacher and trainee separated

All four were operated with a higher bandwidth link than normally used for telehealth, and used at least two high quality video channels for transfer of information from at least one of the sites. They were all designed specifically for the application in a collaborative user-centred process between the technical team and the users. The design process was described in more detail in [15].

Overall, it was found that a combination of an advanced network, multiple information channels and a user-centric design and implementation process resulted in:

- Highly usable systems which permitted users to maintain patient focus, even in high stress critical care situations.

- High media quality (large bandwidth, low latency) created a strong sense of presence, promoting trust and collaboration between the two sites, sometimes rated as better than face to face.

- Participants were able to work in a complex information space in clinical specialities not previously supported by telehealth (e.g. critical care), supported by multimedia, even when information was generated during the examination. Having a complete picture of a patient's condition facilitated remote decision-making on patient management.

- The strong sense of presence promoted social and organisational links between the sites; "one team over two sites".

ViCCU and ECHONET continued in operation after the formal trial, the surgical simulation was commercialised and discussions are continuing about ongoing implementation of RIDES.

While these demonstrations were extremely well received at the time, extension into the health systems was made difficult by the absence of cost-effective network infrastructure; the National Broadband Network is precisely the kind of infrastructure which can take advantage of the success of these demonstrations.

Based on the success of ViCCU (which connected two hospitals), Telstra collaborated with Loddon Mallee Rural Health Alliance in Victoria to connect eight hospitals in Northern Victoria in a system based on the principles established by ViCCU, but using commercial equipment. This was supported financially by the Australian Government's Clever Networks Program. Telstra has announced a commercial version.

5.2 Surgical training initiatives

The ability of advanced networks to deliver several channels of high quality video in interactive settings has been used by the surgical community to provide training in advanced surgical

techniques. Notable among the international demonstrations have been connections between Flinders Medical Centre and various Asian centres [16]. Most of these exercises have been set up as "one-off" events, but the availability of the NBN will facilitate making such interactive education available on a routine basis to medical practitioners wherever they are located. High quality video and interactivity (e.g. the ability to ask questions of the surgeon) are essential for the success of the learning experience.

5.3 Grampians Rural Health Alliance

Under the Clever Networks Program of the Department of Broadband, Communications & the Digital Economy, interconnectivity for secure videoconferencing has been established within the Grampians Rural Health Alliance in rural Victoria, with limited connectivity to external parties including metropolitan hospitals [17]. Use of videoconferencing has increased 150 per cent across the entire health network and up to 400 per cent in some dispersed hospital networks since project commencement. The success of this project has demonstrated the requirement for:

- Seamless connectivity across current organisational and network boundaries,

- A range of low to high end definition videoconferencing solutions, that can be chosen by the user as required for clinical consultation or education

- Engagement with clinicians about the use of the system and support for the changes in work practices to enable the use of videoconferencing to deliver effective clinical services.

- The knowledge developed in Change Management processes, essential to the success of the project, and developing new models of care are transferable to other projects and regions.

- There is significant potential to leverage the Clever Networks investment in WAN infrastructure, data services, facilities management and equipment to expand the project benefits across Victoria.

The Clinicians Online Project will expand the services delivered under Clever Networks in the Grampians region, across rural and regional Victoria and extend the capability across jurisdictional boundaries

5.4 Beyond pilots

Despite the success of many pilots such as those described above, larger-scale deployment of these technologies has been disappointing. The National Broadband Network will provide the infrastructure to take these new technologies beyond the pilot stage, but simply making the NBN available will not be enough, as discussed in the next section.

6   Ensuring that the NBN achieves its potential in healthcare

6.1 Overseas models

Most of the models for large-scale implementation of telehealth and eHealth are to be found in Scandinavian countries. For example [18] , Sweden has a dedicated health network Sjunet which connects all healthcare facilities and 99% of the population. There is a high degree of

interoperability and a variety of uses, ranging from e-prescribing to videoconferencing are supported. In total, 45 different "e-services" are provided, about half of these using videoconferencing facilities. Similarly, Norway has 99% access to broadband. Norwegian Health Net connects all public hospitals and 75% of general practitioners. All Scandinavian countries have well-developed national eHealth strategies, with telehealth fully integrated into these strategies. Of particular interest is the development of home telehealth systems, addressing the rise of chronic disease and the ageing population.

6.2 Need for innovation not just deployment

The overwhelming view of the membership of the ATHS is that the creation of a first class telecommunications network with universal connectivity will not be enough to ensure that its potential for telehealth is realised. The NBN will remove some technical barriers to new models of health care which will incorporate telehealth as a means of *delivery* of health care services, not simply consultation. However, the slow uptake of eHealth technologies over the last few decades has shown that such paradigm shifts are very difficult to implement in the health system. There will need to be a national strategy for facilitating and encouraging the changes to health care delivery which will justify the NBN on the basis of its ability to deliver healthcare services. Some of the actions needed include:

- Creation of a "National Health Network" as a layer of the NBN.

- Ensure that the NBN's coverage is well matched to health needs

- In close collaboration with users, development and proof-of-concept demonstrations of point-of-care technologies which take full advantage of the NBN's quality of service, and satisfy the needs of Australian clinicians.

- National strategy and guidelines for implementing new models of health care delivery, including training and managing process change.

- Better understanding and modelling of the benefits realised by the NBN, such as the benefits of ageing in place versus residential care.

- Financial incentives for clinicians to move to these new models for health care delivery, including the creation of larger professional networks.

- A central video conferencing infrastructure that will assist in the facilitation of interoperability between providers and between proprietary products.

These will now be discussed in more detail.

6.3 A National Health Network

Fragmentation of the current network infrastructure is one of the barriers to the wider adoption of telehealth in Australia. Concerns about security and privacy have also limited the more widespread deployment of telehealth in Australia. "The successful delivery of eHealth using the NBN will require the health sector to take the relatively minor additional step of implementing a national health network that sits over NBN infrastructure and maximises the potential to ensure end to end real

time performance of connections between practitioner and patient. Without this layer eHealth applications will be largely constrained to messaging services adequate for medical records and databases but incapable of reliably sustaining real time patient   practitioner interactions."[2]

Such a network could be implemented at very small incremental cost, but could supply the security and quality of service demanded by the users of health networks. However, as a virtual network, it would be able to take advantage of the ubiquitous nature of the NBN. Unlike current telehealth networks, it would be a national network, facilitating interstate consultations now difficult to set up for specialists who need to consult with colleagues or patients across state boundaries. Such a network could also work with a different funding model from that of the rest of the NBN.

6.4   Ensure coverage of health-critical communities

The expected coverage of the NBN is based on reaching the maximum number of premises which can be accessed at "reasonable" cost. However, its business plan [12] states:

> The government has also encouraged NBN Co to explore mechanism by which community inputs and advice on regional priorities   in order to overcome the digital divide and improve the efficiency of the rollout   can be considered by NBN Co including through existing coordination structures like Regional Development Australia committees.

The connection priorities for the NBN need to take into account the community benefits to be gained through the provision of healthcare using the NBN. This should be particularly relevant for indigenous communities.

6.5   Development of new clinical applications and delivery models

A high proportion of telehealth consultations still take place away from the point of care and do not directly involve the delivery of health services. Reasons for this include the lack of telehealth equipment capable of delivering the rich information content suitable for patient management, the lack of bandwidth to provide that information, and equipment which can be used easily by clinicians while maintaining patient focus. The report by NICTA [10] identified the usability of current equipment as a barrier to uptake of telehealth, but most telehealth equipment now in use is designed as general-purpose teleconference units rather than clinical instruments. The benefits of user-centric design have been shown in a number of high-profile pilots, including the benefits of a greater investment in information channels and user interface [19]. Above all, health system administrators need to re-think the role of telehealth as being more central to the delivery of health services, not an adjunct.

Creation of new clinical applications must be accompanied with appropriate technical research and development, and with the development of new delivery and telehealth business models. An example is the NuPhysicia model developed in the USA for supplying health care to remote workers [20]; such models could be applicable to remote workers in Australia, and other health consumers would benefit indirectly.

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[2] Information supplied by Mike Rebbechi, consultant to Australian Academic Research Network (AARNet), ATHS corporate member.

A recent Australian example of a novel health care delivery model is 1300Health [21], a telephone service which connects health consumers directly with a medical practitioner.

Government has a role in providing suitable incentives for the development of such models.

6.6 Development of a National Strategy

Most of the changes described in this submission are occurring only incrementally through the current fragmented health system. The creation of a national facility (the NBN or its health-specific sub-network) is the opportunity to use the influence of a Federal Government to bring about the changes necessary for telehealth to reach its potential. Standards and guidelines for safe healthcare delivery and interoperability, agreements on cross-jurisdictional consultations and funding of large-scale demonstrations can be implemented immediately. Issues such as indigenous health can be addressed at a national level. Funding models which encourage innovative models of health care delivery must be implemented at the same time as technology innovations. The pervasive nature of the NBN will mean that more patient-centric models of health care can be implemented and coordinated; this ability to seamlessly connect all players in the health care of a given patient can be realised only with high-level coordination.

6.7 Funding models

All ATHS medical practitioner members who contributed to this submission emphasised that the ability to deliver health care services via telehealth needs to be recognised through the ability to be remunerated through the Medicare Benefits Schedule (MBS) for a wider range of services than currently available. Other specialities such as dentistry should be considered for claimable items.

We are aware that most of the proposals in this submission are for increases in Government expenditure. However, there are cost savings to be made elsewhere in the health system. Examples include:

- Early intervention for patients in rural and remote areas can help to avoid costly hospital stays and more expensive treatment if the condition is left untreated.

- Trauma patients admitted to Emergency Departments of rural, remote and regional hospitals can receive appropriate intervention in the "golden hour" following their injury, reducing further costs.

- Ageing in place delays the commencement of full-time residential care and the high personal and community costs of that care.

- Self management of chronic disease helps avoid costly interventions and residential care.

- Better targeted evacuations of patients needing care in major hospitals reduces the costs of caring for those patients, especially if they require special care during evacuations (e.g. ICU patients).

- The cost of visiting major centres for outpatients and their families can be reduced or avoided completely.

- Medical errors and the costs of dealing with their consequences can be reduced

Most studies of the costs versus benefits of telehealth do not take into account the overall benefit to the patient, family and health system which is realised through the use of telehealth. This is often because the economic benefits are not realised by the funders of the telehealth implementation; they might (in the same way as preventative strategies) be realised in terms of such things as longer life expectancy.

There is a clear need for a better understanding of the benefits which can be realised through the use of telehealth, and a research effort in this area should be part of a National Telehealth Strategy. This need will become more urgent as the Australian Government moves to compensate medical practitioners under the Medicare Benefits Schedule.

6.8 Create communities of health professionals

Conscientious medical practitioners place high importance on benchmarking their skills and knowledge through professional contact with colleagues. This contributes to the high standard of care in Australia's major hospitals. Outside the major cities there is far less opportunity for this type of interaction, contributing to the difficulty of attracting specialists to postings in non-metropolitan areas, and occasionally resulting in excess adverse events [22].

Telehealth can play a significant role in reducing isolation, especially for hospital specialists. The ability to discuss difficult decisions with colleagues reduces stress, while rural practitioners can benefit from sharing the larger and more varied case load from major hospitals. For example, the ECHONET project linked Intensive Care Units (ICUs) in Royal Hobart Hospital and North West Regional Hospital, Burnie. Broadband dual-video connections could be made from the bedside of ICU patients in either hospital, and a third connection could be made to a Cardiology Department for expert Cardiac advice using echocardiography. Intensivists in Burnie reported satisfaction and relief of stress in being able to share difficult cases with their Hobart colleagues, while they also benefited from sharing case presentations from the much busier Hobart ICU, as well as teaching presentations from the Hobart ICU or Cardiology Department. Significant contributors to the feeling of community across the two ICUs were the high media quality and the ease of use of the equipment; clinicians could interact with their colleagues several hundred kilometres away more easily that with a telephone, but as naturally as with physical presence[14].

Widespread use of advanced telehealth systems can therefore make smaller specialist units more viable, through being able to share cases across multiple sites, and share expertise on difficult cases. The availability of specialist services in non-metropolitan hospitals is often seen by the local community as an indicator of the viability of the entire community.

By decreasing the sense of isolation for non-metropolitan specialists, such postings can be seen as more attractive; and NBN-enabled health system should have less trouble attracting specialists to its smaller hospitals.

With a national network, there is no need for such collaborations to stop at state borders. Some specialities (e.g. paediatrics) already deliver specialist services over large distances, and form professional communities across state borders (the Royal Children's Hospital in Melbourne supplies

specialist paediatric services to all of Tasmania, as well as Victoria). Such national collaboration will contribute further to very high standards of healthcare.

7   A vision of the future

The National Broadband Network, as an enabler for eHealth and telehealth, has the potential to change some of the fundamental assumptions about how health care will be delivered in the future. This potential is best illustrated by a vision of how an NBN-enabled health system of the future might work.

The way the health system might work is described from three points of view; the health system, the medical practitioner and the health consumer.

7.1   Health system

From the point of view of health administrators, the health system of the future will be less constrained by geography, since more medical services will be delivered over a distance. It will no longer be as important as it is now to cluster all specialities in a small number of very large hospitals; smaller hospitals will be able to offer specialist advice to other hospitals in the same cluster. For example, ICU services can be offered even where there is not the patient load to support a full time intensivist. By distributing services, systems can achieve greater efficiencies through specialists offering services outside their immediate geographical area. There will be savings in not moving as many patients physically from one hospital to another, or paying for patient to attend clinics in major centres.

There will be greater continuity of care since patients can be followed both through online consultations and through access to electronic patient records, from their home to their GP, though hospital stays and post discharge. For complex and chronic conditions, this continuity of care will allow health systems to better tailor treatment to the patient's condition, independent of where they live.

7.2   Medical Practitioner

The medical practitioners who benefit most from an NBN-connected health system will be those practising outside major metropolitan areas. They will feel less isolated, since they can continue to be part of active professional networks no matter where they practise. There will be access to Continuing Medical Educations through broadband multimedia, and access to cases outside their geographical area. They will be able to benchmark their skills against the "state of the art" for their particular practice. Difficult cases can be discussed with colleagues knowing that the colleagues are working in the same information space, using multi-channel broadband connections. They can have short video consultations with patients who might live several hours drive away; the connection will be so good that the practitioner can immediately sense if there is a problem, and the equipment sufficiently easy to use that they remain totally patient-focussed. If the practitioner has a visiting position at the local hospital (where they might be the only doctor on call), they can respond to calls for help at any time of the day or night, without necessarily having to physically visit the hospital.

If their patients move from one place to another frequently (as is the case with some indigenous cultures) they will be able to maintain continuity of care with that patient, or hand them over to

another practitioner. For some specialist services, a practitioner living in a remote area will be able to deliver services outside their area, even into metropolitan areas; this could be a further incentive to attract such professional to remote areas.

Of course, the funding mechanisms will ensure that they are adequately compensated for all of their work, even when they are not physically present with the patient. Their time will be spent more efficiently since they will not need to spend as much time on the road.

The use of eHealth and telehealth will be sufficiently ubiquitous that tomorrow's medical practitioner will take it for granted that healthcare will be delivered in this way; their training will ensure that they are as familiar with this type of equipment as they are with the stethoscope or scalpel.

7.3 Health consumer

The health consumer will take his or her rightful place at the centre of the health delivery system, enabled by eHealth, including telehealth. Health consumers will be personally empowered and encouraged to take more control of their own healthcare, especially preventative strategies. Control of and access to his or her own health record will help drive this shift in emphasis from treating illness to maintaining health.

The health consumers who will most befit from the NBN will be those living outside the major centres, the elderly and consumers who are subject to chronic disease.

The home computer can be augmented with easy-to-use devices for carrying out simple medical tests, such as ECG and blood pressure measurements. These measurements can be supplemented by broadband videoconferencing links to nurses, GPs or even specialists if the condition demands it. Family members can also form part of this online support network. Adverse trends requiring intervention can be detected long before complex treatment (e.g. hospitalisation) is required. Unnecessary visits to doctors (requiring long journeys outside metropolitan areas) can be avoided, but intervention when needed can occur more rapidly. Elderly patients can be fitted with unobtrusive wearable devices which, using the home LAN, can automatically detect adverse trends or specific events (such as falls). Hospitals will maintain post-discharge contact with patients; indeed the home portal will be a general health portal and the patient might well be unaware of which part of the health system is supplying which part of their care.

8   Summary and recommendations

The National Broadband Network can be of enormous benefit to healthcare, especially in a country such as Australia, with its large distances, small population and high expectations for standards of healthcare. Its impact on healthcare for Australians living outside metropolitan areas could exceed that of the introduction of the Royal Flying Doctor Service last century. However, this benefit will not be realised simply by merely building the network and making it available for healthcare. In order to realise the benefits to healthcare to be derived from the NBN, the Australasian Telehealth Society recommends:

- Potential health applications should be taken into consideration when deciding which communities should be connected. This is particularly relevant to indigenous communities.

- A National Health Network should be established using the NBN infrastructure, incorporating appropriate security, central video conferencing connectivity and quality of service.

- The Australian Government should develop and adopt a National Telehealth Strategy in conjunction with industry, aimed at improving health outcomes, especially through more widespread adoption of health delivery via telehealth.

- An appropriately constituted Commonwealth body, in collaboration with States and Territories, should be formed to devise and implement the telehealth strategy, with terms of reference to encompass such issues as interoperability, standards of practice, practice across jurisdictional borders and remuneration.

- An increased research effort should be mounted in close consultation with the new Body, to advise it on such things as process change, training requirements, new clinical applications and cost-benefits of telehealth.

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10 (Appendix) Executive Committee of the Australasian Telehealth Society (February 2011)

President	Dr Kanagasingam (Yogi) Yogesan	Research Director, Australian eHealth Research Centre (CSIRO)
Vice President	Prof Anthony Maeder	Professor of Health Informatics, University of Western Sydney
Honorary Secretary	Dr Laurie Wilson	Post Retirement Fellow, CSIRO ICT Centre; Adjunct Professor, University of Technology Sydney
Honorary Treasurer	Prof Colin Carati	Executive Director, IT Strategy, Flinders University
	Dr George Margelis	CEO, Care Innovations (GE, Intel)
	Mr Simon Hayden	CEO, Vivid Solutions (NZ)
	Ms Jackie Plunkett	Manager Strategic eHealth Projects, Northern Territory Department of Health
	Assoc Prof Anthony Smith	Deputy Director, Centre for Online Health, University of Queensland