Australian Government

Department of Health and Ageing

Telehealth Technical Standards Position Paper

August 2012

Disclaimer

The Department of Health and Ageing (DoHA) makes the information and other material ('Information') in this document available in good faith but without any representation or warranty as to its accuracy or completeness. DoHA cannot accept any responsibility for the consequences of any use of the Information. As the Information is of a general nature only, it is up to any person using or relying on the Information to ensure that it is accurate, complete and suitable for the circumstances of its use.

This document is maintained in electronic form. It is the responsibility of the user to verify that this copy is of the latest revision.

Security

The content of this document is draft for consultation, and as such will be subject to change based on feedback provided.

Telehealth Technical Standards Position Paper
ISBN: 978-1-74241-561-1

Online ISBN: 978-1-74241-562-8

Publications Approval Number - D0542

Copyright Statements:

Paper-based publications

Internet sites

Table of contents

1 Purpose of document

1.1 Document scope

This work has been prompted by the commencement on 1 July 2011 of thirty-four new item numbers for Medical Benefits Scheme (MBS) rebates relating to particular referred consultation services delivered by video consultation between patients (with or without primary care clinicians and/or other supporting healthcare professionals in attendance) and specialists, psychiatrists or consultant physicians.

It seeks to address the question of whether existing industry-developed technical standards are adequate to enable these services to be performed.

This document provides a summary of the current standards environment within which the new MBS rebates operate, and discusses how video conferencing can be deployed operationally.

The document does not focus on the broader scope and opportunities of telehealth that may be possible with the advent of new and more powerful telecommunications technology, such as the National Broadband Network (NBN). The focus is on technical standards, by which is meant specifications (e.g. formats, procedures) which dictate specific elements of data and operations concerned with the utilisation of ICT equipment and software in video conferencing systems.

The document is targeted to address macro level issues in implementing the physical and logical ICT environment needed to support the clinical functions covered by the new MBS rebates, specifically two-endpoint video consultation using video conferencing. The work is intended to provide background information for use by the National E-Health Transition Authority (NEHTA), the Department of Health and Ageing (DoHA), and the Department of Broadband Communication and the Digital Economy (DBCDE).

1.2 Acknowledgement

The efforts and input from NEHTA as well as the standards community in the research and preparation of this paper is appreciated and duly acknowledged.

1.3 Specific deliverables

- Develop a telehealth standards position paper that is essentially a stocktake of the standards required and available to support those telehealth services that fall within the scope of services eligible for the new MBS rebates applying from 1 July 2011.

- Describe the services that are eligible under the rebates.

- Describe the range of tools and infrastructure that will enable those services to be delivered, including their capabilities, fit for purpose, degree of interoperability, benefits, and limitations.

- Comprehensively set out the existing technology and communications standards that underpin and enable those tools and that infrastructure to be effective for the purpose of supporting the eligible services to be delivered, including description of gaps or limitations (if any) in those standards as being fit for that purpose and recommendations for improvement if required.

- Describe, at a high level, the nature of any complementary desirable requirements to support the effective delivery of those eligible telehealth services, such as practice guidelines and organisational policies. NOTE: This section is not intended to describe the content of such complementary requirements, but merely the subject areas and purpose.

1.4   Background reference material

This work is informed by several detailed public access documents that have been produced recently at a national level, both as precursor work to the new MBS rebates and for other strategic direction setting around telehealth in Australia. Other documents emanating from technical standards development activities undertaken, or participated in, by the Standards Australia IT-14 Health Informatics committee and its IT-14-12 telehealth sub-committee were also considered, along with relevant Australian and International standards documents to which they referred. No review of other international documents of a similar nature was undertaken as they were deemed beyond the scope of this work.

In 2004, the International Organization for Standardization (ISO) published a technical report on *interoperability of telehealth systems and networks* [2]. This work indicated that while low level data coding and transmission standards were in place to support video conferencing, the disparate video conferencing standards available at the time did not assure that different systems complying with standards would be interoperable.

In September 2007, Standards Australia published a technical report providing a *survey of standards related to* telehealth [3]. This included a brief summary of the Australian and international telehealth environments, and discussed a number of examples of telehealth usage. The report defined a standards taxonomy for use in mapping existing and new standards into a common landscape based on 'tele' and 'health' dimensions, and listed standards deemed relevant to telehealth using that framework. A similar document was published in 2008 [4] on the related topic of Call Centres, and a comparable framework was defined with the dimensions of 'data' and 'systems'. Both reports provide specific recommendations on priority areas for standards development.

In September 2009, Standards Australia published a miscellaneous publication [5] providing details of data captured during some sample types of video conferencing telehealth sessions—related to the patient, practitioner and session—and suggested a need for further study of this aspect. This work was based on guidelines and operating procedures from state health department video conferencing services which were active on a large scale at the time.

In 2010, National ICT Australia (NICTA) undertook a review of telemedicine in the context of the NBN for DBCDE [6]. This exercise studied successful telehealth initiatives elsewhere to determine success factors, and described the status of Australian telehealth activities in terms of technologies and functions. A three-tier model for barriers to uptake of telehealth was presented, and roles for NBN support of telehealth were identified.

Across 2010 and 2011, DoHA funded an extensive project conducted through UniQuest to provide advice and options for the introduction of teleconsultation, with emphasis on establishing a business case [7]. It also studied a range of different telehealth scenarios to identify technical and operational aspects [8]. The project considered a range of issues in security/privacy/authentication, interoperability/integration, hardware/software requirements, clinical use and change management. In each of these areas, a set of recommendations was put forward. Overall it was advocated that an iterative implementation approach to national telehealth development, starting with the then-proposed new MBS rebates.

In November 2010, DoHA issued a discussion paper [9] on the topic of rebates for online consultations. The paper identified issues for consideration related to the intention of creating new MBS rebates for video consultations. This document indicated an expectation that 'many practices do or could conduct video consultations with the technology they already have' and that professional groups would need to provide advice on technical demands such as video resolution and data transmission capacities.

In June 2011, NEHTA commissioned an analysis of the current telehealth environment in Australia [10], intended to inform determination of its role in supporting the growth of telehealth. This report detailed some barriers and gaps in the Australian environment, and suggested a three-stage program for NEHTA engagement in the area, contributing respectively to interoperability, strategic planning, and governance. It articulated a set of principles which are desirable for any video conferencing solutions adopted for telehealth services.

To provide additional information on and explanation of terminology used within this document and more generally in the implementation of telehealth, a glossary has been included at Appendix B.

2 Medicare funded telehealth services

Telehealth is a significant part of the national eHealth agenda and there is a strong case, from both an economic and healthcare perspective, to support a national focus on the strategic rollout of telehealth services widely in Australia [11].

There have been significant investments in innovative telehealth projects in both private and public health systems in Australia since the mid-1990s. In 2001, the National Telehealth Plan [12] was released amidst a substantial body of work around the need for a coordinated approach to telehealth services delivery. Despite the development of this national framework, telehealth has continued to evolve in an *ad hoc* way, with some substantial developments in the hospital sectors, but very limited support for the primary care and specialist sectors.

Previously the Australian Government has provided telehealth services reimbursement through the MBS for only a few telepsychiatry items in recognition of very specific needs in that area. There are now new opportunities to integrate telehealth services into the Australian health system in a more strategic way, driven by the Australian Government's investment in the NBN and the introduction of video consulting MBS items.

2.1 MBS specialist video consultation items

From 1 July 2011, the MBS was expanded to include items for specialist video consultations.

There are eleven new specialist telehealth items, which allow a specialist, consultant physician or psychiatrist to bill a consultation provided to a patient by videoconference. These items are billed with an existing specialist consultation item under the MBS, and increase the base schedule fee for the consultation item by 50 per cent.

While it is not mandatory, the patient may have clinical support of a GP or other health professional in attendance during the consultation with the remote specialist or consultant physician if clinically required.

Twenty-three new patient end attendance items have also been introduced to support telehealth consultations with remote specialists. The schedule fees for these new patient end item numbers are higher than the standard consultation item fees. General practitioners (and practice nurses and Aboriginal health workers on behalf of GPs), midwives, nurse practitioners, and other medical practitioners can bill the relevant patient end attendance telehealth item.

The types of services covered by the new MBS items are provided by specialists, general practitioners, midwifes or aboriginal health workers.

Situation 1: GP, nurse practitioner, practice nurse, midwife or aboriginal health worker (providing clinical support to the patient) connects to the specialist or consultant.
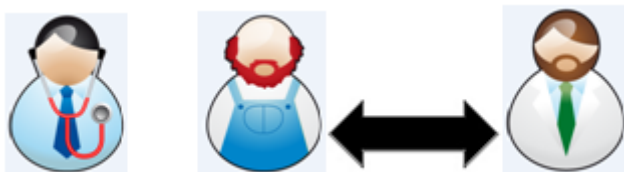
Situation 2: Specialist connects with the patient without clinical support.
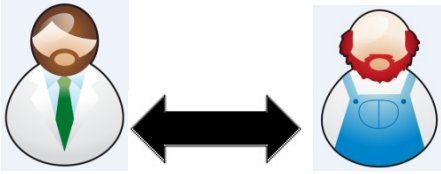
2.2   Pre-existing MBS telepsychiatry items

The new MBS items are in addition to existing items that have been available since 2004. These telepsychiatry consultations are performed by a consultant physician in the practice of his or her specialty of psychiatry where the patient, located in a regional, rural or remote area, is referred to him or her by a medical practitioner for assessment, diagnosis and/or treatment.

Situation 3: Psychiatrist connects to the patient.

These items do not provide a rebate for a GP or other health professional during a remote consultation with a psychiatrist. This has been identified by the profession as one of the main reasons for the low level of usage of these items since they were introduced.

3   Technical implementation issues

Physical realisation of clinical services catered for under the new MBS telehealth items will require some adaptation and extension of existing workplaces for the participating clinicians, quite apart from any necessary changes in workplace activities such as clinical workflow and practice. These technically-based changes can be characterised in three levels of complexity as follows:

- **Infrastructure:** telecommunications connectivity, peripheral equipment, location setup

- **Video conferencing systems:** adoption and use of suitable video conferencing products or services applied to video consultation

- **Broader operations:** information sharing, session record keeping, billing, and software integration.

Each of these three areas is examined in turn to give some idea of their scope and to inform the discussion of standards which will follow. Each area contributes different aspects to the issue of interoperability which is the dominant need to be addressed by standardisation.

Interoperability promotes competition and competition encourages innovation and quality. Business conditions introduced by the widespread use of telehealth should encourage manufacturers to make their products interoperable so that different providers and/or products can be used together without complicated and expensive interfaces.

For interoperability of video conferencing systems to be achieved through the adoption and implementation of open standards there is a need for industry to work with other interested stakeholders to define and agree on a common set of standards.

3.1   Infrastructure level

Implementation of specialist video consultations depends fundamentally on the existence of ICT equipment and connectivity beyond the expected normal office infrastructure (i.e. telephone, computer, Internet). Additional infrastructure will be needed to allow the capture, presentation and transport of the elements of the video consultation sessions.

Capture requires the use of cameras - the quality or resolution of the image captured is limited by the specifications of the camera used. Low end VGA cameras are capable of images up to 640 x 480 pixels, these may range from fixed configuration low end peripherals or inbuilt laptop/PC cameras. There are many more sophisticated units available which are capable of HD video with images of 1280 x 720 pixels and above. For a high end configuration, Full HD broadcast quality images of 1920×1080 pixels or more are available. Such high end cameras are often steerable and zoomable. Many cameras have inbuilt microphones to capture audio. Otherwise lapel, tabletop or boom/pendant units may be used.

The UniQuest report [7] recommended that cameras for non-diagnostic purposes include VGA video as a minimum.

In order to render an image of good quality, a videoconferencing facility must offer light of the right level, angle, and colour temperature. There must be enough light to provide a "noise-free" picture (lack of fine-grained static in the displayed image) with adequate depth and focus, and it must come from the proper direction to avoid undesirable facial shadows. Lighting must also enhance image depth and contours by intentionally creating desirable shadows and highlights. In addition, particular care must be given to the tonality of colour that will be visible in the room, in regards to how it will affect the auto-iris function of a particular camera.

Presentation requires a screen of suitable resolution (commonly ranging from VGA to HD), size (commonly ranging from 10-inch diagonal Netbook or Tablet to 50-inch diagonal TV) and brightness/colour properties. Alternatively, presentation could be via a more sophisticated display surface such as a smartboard, backlit screen, or data projection. Speakers or headphones will also be required for audio aspects of the presentation. It should be noted that many video conferencing technologies require that speakers have echo cancelling capability. Laptops and display screens with in-built speakers may not have echo cancelling capability.

Transport requires a broadband connection such as ISDN, DSL, fibre or other broadband facilities. Traditionally, synchronous transport protocols have been preferred for continuity and reliability of service. Where asynchronous transport protocols are used, it is important to be aware that the quality of the connection may be limited by the reduced upload speed of the connection. Conversely, the additional bandwidth allocated to the download speed may facilitate multicast consultations with reduced bandwidth overhead.

Issues such as latency and delay can result in lag or dropouts making the conferencing interactions unintelligible. Contention ratios can also impact Quality of Service (QoS). This is particularly common in wireless based telecommunications services. Wireless services currently offer at best a very marginal connectivity solution as the channels are of much lower bandwidth than typical installed wire or fibre, and the modes of operation adopted by commercial service providers do not support sustained multichannel dedicated use, or consistently high QoS.

Location characteristics for the appropriate use of this equipment requires the location to have suitable:

- lighting (e.g. colour, brightness, uniformity);
- placement of the participants (e.g. seated/standing/lying in positions/proximities for adequate video and audio performance);
- decor (e.g. non-distracting background, non-reflecting windows);
- privacy (e.g. closed room with sufficient soundproofing levels);
- environmental controls (e.g. bright lights in eyes, disruption by air currents, discomforting temperatures, noise); and
- freedom from interference (electrical or radio frequency).

These aspects, although technical, are very difficult to standardise because they are so closely linked with all the unconstrained aspects of the physical setting and in some cases individual preferences.

Additional specialised input or output devices may also be required for diagnostic purposes to support the type of consultation being undertaken. Common examples include augmenting the fixed camera for talking to the individual with a portable camera to inspect eyes, throat, skin, etc). In some cases additional devices to capture vital signs (e.g. digital thermometer, heart beat monitor, digital stethoscope), or probes (e.g. tactile/haptic feedback) may be required. Those devices in this category which are subject to standardisation (e.g. IEEE 11073; Continua) generally do not produce data in a form compatible with any video conferencing standard and special arrangements need to be made to allow data from them to be sent to, received by and displayed at the remote site.

3.2   Video conferencing systems level

Video conferencing systems are software or hardware-and-software systems which manage the functional aspects of video conferencing usage sessions on top of the installed ICT infrastructure level. This role includes managing users, connections, security, content and interactivity during a session. These systems can be categorised according to three different component dimensions:

A. **Implementation component:** the computer systems environment which supports the delivery of video conferencing traffic		
A1. **Web-based:** Systems accessed through a web browser with a remote hosting environment capable of turnkey operation and automatic adjustment for use of open infrastructure (e.g. Adobe Connect).	A2. **Application-based:** requiring a vendor supplied system with downloadable software used with a remote hosting environment or requiring configuration for selective use of infrastructure but may operate over open infrastructure (e.g. Polycom).	A3. **Dedicated service:** 'hardwired' into the infrastructure and only able to operate over dedicated connections in a closed infrastructure or in-house network (e.g. Access Grid).

B **Control component:** functions that users can make use of during video conferencing for various interaction/collaboration activities		
B1. **Video and audio single/multiparty:** allow person-to-person or person-to-group conversations, with speaker only (e.g. 'push-to-talk') or all parties active (e.g. chat/meeting room).	B2. **Simple meeting/ collaboration tools:** basic meeting support capabilities beyond simple conversations such as screen sharing, webinar style environments.	B3. **Complex meeting/ collaboration tools:** more sophisticated tools for interactive information manipulation such as document access/sharing /editing, interactive pointing/drawing/ selecting, recording and annotation of sessions.

C. **User access component:** nature of the relationship between user and the video conferencing system		
C1. **Open access:** open freely to the public with simple automated registration process and either web-based access or downloadable software.	C2. **Subscriber-based:** requires authorised membership and identification/validation of users via a secure portal, possibly with layered or role based access controls.	C3. **Session-based:** joining video conferencing sessions is performed on a one-off basis, requiring individual per session access controls (e.g. meeting keys).

There are numerous examples of video conferencing solutions which embody different combinations of the above components. Compiling an exhaustive list of these would be of limited value due to the rapidity of market changes. A list of some popular products and their characteristics is given in the UniQuest report [7] p82-95. Most of these are produced by companies dedicated to this type of product (e.g. Cisco, Tandberg, Polycom). Some other widely known solutions (typically A1-2, B1-2, C1-2 types) can be located from websites which maintain or generate product reviews or listings and some examples of these are listed below.

Web-based solutions:	**Application-based solutions:**
Confabio	Anymeeting
Dimdim	ConnectNow (Adobe)
MeBeam	GoToMeeting
Meebo	HearMe
MegaMeeting	iChat (Apple)
TokBox	InstantPresenter
Vyew	LiveMeeting (Google)
WebEx (Cisco)	Meetanywhere
ZohoMeeting	Mikogo
	ooVoo
	Redback
	SightSpeed
	Skype
	TinyChat
	Vidyo
	WengoMeeting

High-end systems offer a different range of facilities compared with 'consumer' mass-market oriented products. Typically they are better for multi-site situations where high fidelity (quality), high availability (capacity) and high reliability (robustness) are important characteristics of their usage. Two examples are the Cisco TelePresence environment which offers a highly optimised and instrumented video conferencing room, or the Access Grid projection-based environment which has nodes in many university and research unit locations. These systems are also suitable for specialised clinical purposes such as intensive care (e.g. VICCU, Visicu), multi-media case conferencing (e.g. Telesynergy) or telesurgery (e.g. HaiVision).

The technical characteristics have been defined to provide services using several different 'business models' for video conferencing in order to address the needs of different market sectors. These models can be categorised as:

- **Enterprise solutions** which provide business grade video conferencing using specialised and sophisticated equipment (e.g. Polycom, Tandberg).

- **Consumer centric solutions** which provide video conferencing attached to cloud offerings as a value added service and are often paired with instant messaging and mobile phone platforms (e.g. Skype, Google talk).

- **Management solutions** which provide management platforms that allow booking of events and allow multiple parties to attend (e.g. Attend Anywhere, Webex).

The enterprise solution providers have been the most successful in the public hospital sector where there are sufficient inbuilt support mechanisms and dedicated networks to manage the overhead of equipment. Without significant external support (perhaps via a managed service) it is unlikely that existing enterprise providers could scale service delivery across numerous small practices.

Alternatively, consumer centric solutions and management solutions are less likely to need onerous support within small practices. These systems rely on significantly less expensive equipment and support contracts, and may include integrated directory and booking management infrastructure. Criticisms of all of the solutions (enterprise, consumer or management) are that they are often based, or have been historically based, on proprietary protocols (i.e. one product cannot connect to another and often results in the individual having to install multiple applications on their desktop). The consumer centric solutions are increasingly able to interoperate across products as a result of increased demand and competition. Some of the consumer and management solutions have lower levels of security (which are for some products unproven) and may deliver lower quality video and/or audio. There is a large range of products and services available, and aspects such as security, quality and interoperability can be checked with vendors when considering the various products.

3.3   Broader operations level

The interface between video consultation activities and the overall healthcare delivery system includes resources and activities which are mostly independent of the use of video conferencing, but nevertheless need to be accessible to users of video conferencing. There are two main areas:

Clinical information and tools: e.g. EHRs, decision support, results/reports. This level of integration is not necessary to support the delivery of the telehealth services covered by the new MBS rebates.

Administrative information and tools: e.g. ordering, billing, session recording

While many of these functions will be supported with separate elements of the current and emerging eHealth environment, in future there will be a desire for these functions to be easily integrated with video consultation sessions. For example, during the video consultation there may be a clinical need to obtain a record of some aspect of the patient's appearance (e.g. images of facial appearance or skin condition), to record output from a device (e.g. digital stethoscope), or check medication records (e.g. repeat prescriptions). These tasks may be possible using existing separate systems already in a clinician's office, but in such cases manual entry or transfer of data may be necessary.

Administratively, another aspect for consideration at this level is the need for compliance with legislative (e.g. privacy, security) and clerical (e.g. billing, record keeping) needs. The video conferencing system may provide some inbuilt privacy and security features, but these may be insufficient or incompatible for the remote location, so additional mechanisms may need to be employed which may include additional encryption/decryption software or hardware. The automatic recording of session times and participants by the video conferencing system would assure simpler generation of billing and records information.

Rapidly evolving eHealth technologies and services will create demand, and be a catalyst, for greater integration of clinical and administrative information into telehealth consultations. In the future, this may require the application and further development of appropriate enabling technology standards. This is not required for the current MBS telehealth items.

A **National Health Services Directory** (NHSD) is being established to make accurate and current provider and service information available to support health service providers in their delivery and transfer of care - especially using electronic means - and to widen public access to quality information about health providers and their services. In meeting this primary purpose, the directory will also support the broader eHealth agenda. The NHSD could be developed quickly to meet the most immediate telehealth needs. This would be an inexpensive solution as it can be added to existing arrangements and infrastructure under management arrangements already agreed between jurisdictions.

The Directory could support telehealth in a number of ways such as:

- Creating the necessary fields in the directory database in order to facilitate parties to:
  - locate suitably equipped healthcare services and providers;
  - decide the most appropriate video technology to use;
  - schedule an appointment or request an immediate video call;
  - make the connection at a technical level;
  - launch learning tools at various stages where appropriate; and/or
  - capture feedback.
- Mechanisms to acquire and keep information up to date.

- Mechanisms for parties to 'broker' the most suitable video technology to use based on business rules and knowledge of each parties technical capability.

- 'Open' booking or scheduling mechanisms.

- Facilitation of connection to additional service providers in the directory (e.g. ancillary service providers like interpreters).

- Quality Assurance mechanisms.

- Communication tools.

- Web services to enable third party telehealth solutions, learning modules and practice information and management systems.

4 Standards and video conferencing

This section describes the relevant video conferencing related standards and health informatics related standards, and describes the work currently being undertaken by various peak health bodies to develop clinical practice guidelines and standards.

4.1 Video conferencing related standards

Video consultation using video conferencing, in simple terms, involves bi-directional, synchronous, real-time communication of video and audio (and possibly other data) streams between two or more parties. Video conferencing standards have their origins in videophone developments commencing in the 1970s (e.g. H.120), now superseded by more complex multimedia standards (e.g. MPEG) and more recently the explosion of Internet/web-based products and services.

Early commercial implementations of video conferencing, developed in the 1980s, were large and expensive multi-component systems of high complexity. These systems now face strong competition from smaller and cheaper PC/webcam based systems which are simple to install, operate and update. Today's more advanced systems provide 'collaboration' environments in which multimedia data streams are exchanged with many more options than plain video and audio (e.g. supporting 'telepresence' or 'virtual reality' situations).

A comprehensive listing of the numerous technical standards relevant to video conferencing has been given in the UniQuest report [7] p77. A similar publicly available table, including container standards for packaging of data into compatible formats for interoperability with other user session management and data transfer software, is provided at Appendix A. Essentially there are three broad layers in the domain of ICT technical standards that need to be considered for enabling of video conferencing:

1) Information layer: Handling of streams of information which are part of the video conferencing activity (including video, audio, data and link control components). These standards support a sequence of operations, including capture or generation of the video/audio/data streams, processing and enhancement, encoding/decoding, telecommunications transport, display presentation, and error recovery. Examples of widely used standards in this area are the H.26X family for video coding, and the G.72X family for audio coding.

2) Session layer: Overall management of video conferencing sessions, with functions for session initiation/termination, connecting of video conferencing units/participants to a session, adjusting characteristics of the connection, revising screen layout, merging multiple participants and information streams, recording of the session, and summarisation/annotation. Examples of widely used standards in this space are the H.32X family for video conferencing, and SIP for internet-based audio and video interactions.

3) System layer: Provision of a suitable environment within which video conferencing sessions can occur, including interoperability across different video consulting sub-systems.

Existing approaches in these three layers can be based on one of two different strategies:

1) Adoption of open standards: Often via open source or sometimes proprietary implementations that allow for some degree of user or developer extensibility and orchestration for interoperability (e.g. Openmeetings, Optiportal).

2) Development of *de facto* 'industry' or *ad hoc* standards: By specific agencies or vendors, often built around encapsulated open standards which are not necessarily identified, which tend to be inaccessible and consequently lead to exclusive and non-interoperable products.

The range of video conferencing solutions which have emerged in the market have tended to be aligned with one or the other of these approaches, and this differentiation makes it difficult to bridge the two; however in recent years, the consumer based videoconferencing products are becoming more interoperable based on increased use, demand and competition.

Direct interconnection model
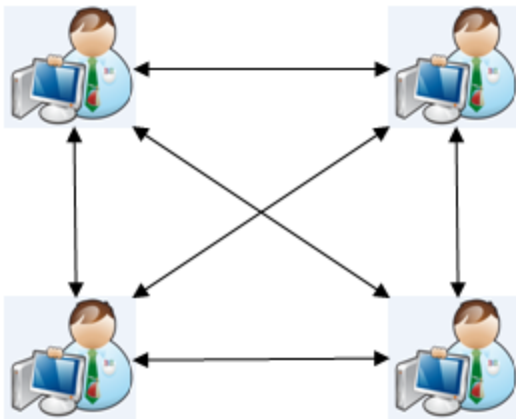
In an environment where it was deemed desirable to cater for many different vendor products, multiple inter-communication protocols would be needed (possibly one unique protocol per vendor product). This would result in the configuration shown on the left.

Indirect interconnection model
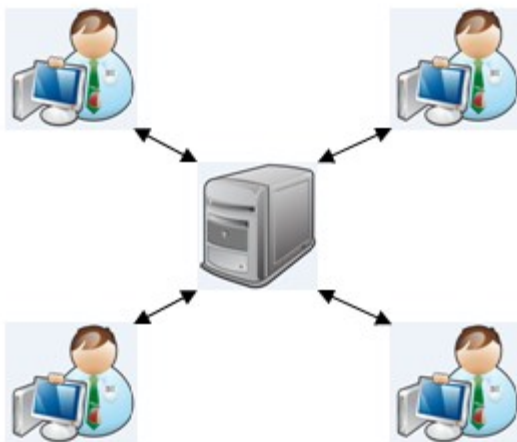
The alternative approach is to provide some intermediate processing component in the system, which would allow translation of the different protocols to achieve interoperability. This would result in the configuration shown on the left.

Currently it would be challenging to build an environment which accepts feeds from several different video conferencing systems and transforms them in such a way as to

be able to deliver them to all of the other systems. Such a development would challenge existing market competition models, which are delineated by proprietary features and protocols.

4.2   Health informatics related standards

Technical standards related to software and ICT equipment development and usage generally also apply in health applications, sometimes with greater demands placed on them for certain aspects (e.g. compliance and failure mode behaviour). Some standards of this type have been expressly extended or developed by Standards Development Organisations (SDOs) for Health ICT as the target usage area (e.g. through ISO TC-215 and CEN TC-251). In Australia, the Standards Australia IT-014 Committee undertakes work in this field.

Other generic ICT standards that are embraced widely in the business/industry sector (e.g. IEC, ITU, IEEE) may also be relevant in this area (e.g. data compression, security encryption). Many of these will affect the way in which video conferencing for health might take place. In addition, the future widespread use of all forms of video consultation may require some existing mainstream health informatics standards to be modified and extended.

The areas of Health Informatics technical standardisation addressed by ISO TC-215 are:

- Data structure;

- Data interchange;

- Semantic content;

- Security;

- Pharmacy and medicines business;

- Devices;

- Business requirements for electronic health records; and

- SDO Harmonisation.

The areas of Health Informatics technical standardisation addressed by CEN TC-251 are:

- Security, safety and quality;

- Technology for interoperability;

- Information models; and

- Terminology and knowledge representation.

The areas of Health Informatics technical standardisation addressed by Standards Australia IT-014 are:

- eHealth concept representation;

- Information security;

- Messaging and communication;

- Patient administration messaging;

- Prescription messaging;

- Electronic health records interoperability;

- Supply chain; and
- Telehealth.

Additional information on IT-014 projects and publications is available at:
http://www.e-health.standards.org.au

Areas of health informatics standardisation covered by other SDOs are more specific: these include health data structuring and messaging (HL7), coding and terminologies (IHTSDO and WHO), health research data formats (CDISC), image formats (DICOM), numbering systems (GS1). Efforts are being made to harmonise both standards and workplans between these organisations.

Any of the above areas for technical standardisation could potentially impact on telehealth. However, there are some areas that deserve particular attention as they are more strongly associated with other core operational aspects in the health environment. In this paper ISO standards have been accepted as the reference domain because Standards Australia has a national affiliation with the ISO.

The emerging issues for standards that will be required for telehealth consultations are listed below.

Data and messaging standards:

- Coding and terminology standards may need to make provision for video conferencing situations (e.g. describing the type of consultation, or clinician rating of connection quality).

Privacy and security:

- Additional opportunities exist for privacy and security breaches during capture, transmission and storage of video conference consultations and may need to be addressed (e.g. eavesdropping on sessions, recognising patient from face/voice).

- Existing standards in this area will need to be interpreted expressly for video conferencing situations. Examples of existing standards to consider are:

  - ISO 27799:2008 Health informatics — Information security management in health using ISO/IEC 27002. The objective of this standard is to specify guidance on healthcare organisations and other custodians of personal health information on how best to protect the confidentiality, integrity and availability of such information by implementing ISO/IEC 27002 which has been adopted by Standards Australia and Standards New Zealand as AS/NZS ISO/IEC 27002;

  - ISO/IEC 27001 Information security management systems — Requirements. The standard is designed to ensure the selection of adequate and proportionate security controls. Annex A to ISO/IEC 27001 succinctly lists the information security controls from ISO/IEC 27002, while ISO/IEC 27002 provides additional information and implementation advice on the controls;

  - ISO/TR 11633-1:2009 Health informatics — Information security management for remote maintenance of medical devices and medical information systems — Part 1: Requirements and risk analysis; and

- ISO/TR 11633-2:2009 Health informatics — Information security management for remote maintenance of medical devices and medical information systems — Part 2: Implementation of an information security management system (ISMS).

Medical device standards:

- Compliance with normal equipment standards issues for health applications of computing devices would be expected. For example, ISO/TR 21730:2007 Health informatics — Use of mobile wireless communication and computing technology in healthcare facilities — Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.

Telehealth standards:

- The progression of ISO DTS 13131 Health Informatics - Quality criteria for services and systems for telemedicine, should be monitored as this will provide some elements of bridging between technical standards and clinical standards. It may be desirable to encourage adoption of principles from this document within some of the clinical standards currently being developed, as discussed below.

4.3   Clinical practice guidelines and standards

Video conferencing is a service delivery activity used in a clinical situation and therefore requires appropriate clinical practices to be employed for its use. QoS can translate into a major clinical safety issue for teleconsultations. Peak medical bodies both in Australia and overseas have produced clinical guidelines on telehealth to assist doctors in exercising their professional clinical judgement about whether a particular consultation with a particular patient can be safely and effectively delivered by video conference.

These guidelines are expected to describe the operational issues required to support best practice use of telehealth video conferencing. In time, these clinical guidelines may be expanded to address different issues for other types of consultation such as multidisciplinary case conferences or for other media such as SMS, email or telephone.

The Medical Board of Australia guidelines for technology-based consultations were released on 16 January 2012. These guidelines complement "Good Medical Practice: A Code of Conduct for Doctors in Australia" (Good Medical Practice) and provide specific guidance on technology-based patient consultations. The Medical Board of Australia expects medical practitioners to apply the principles contained in Good Medical Practice, and these guidelines, when they consult a patient outside the traditional face-to-face setting. The guidelines are available at:
http://www.medicalboard.gov.au/Codes-Guidelines-Policies.aspx

The Australian Medical Association (AMA) in its Position Statement: Online and Other Broadband Connected Medical Consultations, published in 2006, released a set of principles to guide the provision of telehealth consultation systems.

The Royal Australian and New Zealand College of Psychiatrists (RANZCP) in its amended Position Statement # 44, published in February 2009, has detailed examples of telepsychiatry services and quality practice guidelines to support the delivery of telehealth services. These guidelines include areas such as patient identification, communication with the patient, evaluation of information relevant to the consultations, and appropriate records management. The RANZCP position statements can be located at: http://www.ranzcp.org/resources/position-statements.html

The Royal Australian College of General Practitioners (RACGP) has published a paper for clinical standards or guidelines for general practices to support the safe usage of telehealth video conferencing. These guidelines are comprehensive and highlight a range of safety and quality issues of particular significance to general practices offering video consultations with medical specialists. Other topics covered in detail are: patient identification, clinical handover, consultation notes, presence of a third party, clinical governance, privacy, security, practice facilities and equipment. Additional information is available at: http://www.racgp.org.au/telehealth

The Australian College of Rural and Remote Medicine (ACRRM) is developing a telehealth standards framework for clinicians. The ACRRM telehealth standards framework will be underpinned by, and referenced to, the final version of the Medical Board of Australia's telehealth standards. Further information is available at: http://www.ehealth.acrrm.org.au/telehealth-standards

It is inevitable that more guidelines for the safe use of video conferencing for telehealth consultations will be developed by local peak bodies that will be informed by the excellent work done by overseas organisations such as those published by the **American Telemedicine Association (ATA)** which are now considered to be mature.

Recognising the benefits of appropriate contact points in providing accurate advice to the health professions eligible for telehealth MBS rebates, DoHA established the Telehealth Support Program to assist practitioners with professional issues and to provide targeted support.

In 2010-11, DoHA funded the RACGP and ACRRM to develop clinical standards, guidelines and other supports, including the engagement of Telehealth Support Officers.

The role of Telehealth Support Officers is to provide a single point of contact so that Fellows of a given College can obtain profession-specific technical advice and other supports, for example, on how their practice could become telehealth-enabled.

5   Commentary

Several categories of limitations can be identified, in the form of unresolved issues and unmet needs. This section articulates these limitations and in some cases discusses potential resolutions. The work being done by organisations such as the RACGP and ACRRM is designed to resolve some of these issues.

The domain of interest here remains technical implementation and technical standards issues. While those may inform the choice of technical alternatives, they should also be tolerant of a choice of different technical options for different situations.

5.1   Infrastructure issues

Selection of peripheral equipment and physical location layout characteristics for video conferencing is not readily standardised by technical criteria, this is more the domain of best practice guidelines. Equipment characteristics (such as resolutions) capable of delivering acceptable/fit for purpose clinical performance have been established by experience and experiment, but not rigorous evidence-based methods, so these can at best be determined by describing 'typical' or 'minimum' choices. It would not be productive to drive telehealth consultations down the same path as radiology where high grade equipment and repeated calibrations are essential to operational procedures. Rather, a 'fit-for-purpose' professional judgement may need to be exercised by the user, and acceptance/responsibility for clinical decisions made contingent on that.

Until the NBN roll-out is substantially underway, the existing telecommunications connection and transmission environment is a major source of limitation for video conferencing. Service quality aspects such as speed, latency, availability, reliability, and robustness are difficult to guarantee other than on an averaged percentage basis on existing infrastructure, even with high grade or high bandwidth solutions. An added factor is the need to tolerate asymmetric situations, where high bandwidth channels may be available for most of the connection but the final 'last mile' connection to an endpoint may be restricted in capacity. This situation may occur when there is a need for flexibility at one of the endpoints (e.g. if a wireless connected tablet is substituted for wired connection PC). This will remain as a limitation until Australia is able to fully leverage the NBN infrastructure. Not withstanding the current technology limitations, it is possible to deliver fit for purpose telehealth consultations in line with the current policy intent which is aimed primarily at consultations between a patient and GP at one end and a specialist at the other. This approach maximises the appropriate telehealth adoption today and reduces the risks associated with the current infrastructure limitations of video conferencing.

5.2   Video conferencing issues

The plethora of available video conferencing solutions with differing performance characteristics and functionality, and varying degrees of standards compliance, tends to confound the choice of a 'best' or even 'top few' systems. The existing range of videoconferencing services includes both high-end proprietary systems, which would have the advantage of connecting with corresponding systems in public sector health enterprises (e.g. state or hospital systems), and low complexity simple web-based systems, which are more affordable and still able to provide a fit for purpose consultation. There remains an issue that users may need to have more than one system available for dealing with a wider range of endpoints, following the 'Direct Interconnection' model. The cost of these services is however not prohibitive, and remain a viable alternative for short term delivery of valuable and beneficial telehealth services.

While well established international standards exist for information communication and session control in video conferencing systems, they contain sufficient optional and framework aspects which can be implemented in different ways by different manufacturers and yet still achieve compliance. The end result is a lack of interoperability between different vendor solutions. The situation is similar to that of medical image storage formats, where DICOM is a widely used standard for medical image representation but different vendors of DICOM compliant products have implemented the standard in sufficiently different ways as to make their data files not fully portable. There are two different operating models that would most easily support videoconferencing interoperability, however, in the absence of both of these suggested operating models, any provider-to-provider interoperability requirements should be discussed between those providers.

1) **Model 1:** Vendors agree on some form of minimum common implementation of standards and provide that option bundled in with their full proprietary systems. This enables a widespread 'Direct Interconnection' model of operations which could operate uniformly.

2) **Model 2:** An independent third-party type service is provided which accepts a video conferencing stream in any vendor format and reframes it for output in a different vendor format (analogous to telephone conferencing services). This enables an 'Indirect Interconnection' model of operations which could operate either regionally or nationally.

Model 1 requires vendor cooperation and investment, and may result in a system limited in functionality as a 'lowest common denominator' approach is likely to be taken. **Model 2** offers a quicker and easier solution to implement (as there would be no requirement for vendors to change their products) but it is likely to be a far more costly option than model 1, whether publicly funded or commercially operated, due to ongoing maintenance and technical support needs.

If the 'Direct Interconnection' model is ultimately adopted, an additional complication is the need for users to be able to locate other users with compatible systems (or endpoints). A national 'subscriber' directory service could resolve this issue, with an enforced protocol for updating so that it was never out of date. Provision of a 'ping' facility would be advisable so that it was possible to validate the currency of entries automatically. Even for the 'Indirect Interconnection' model, directory information will be needed to locate clinicians who are willing to undertake teleconsultation; however, this could possibly be achieved by setting flags in the national provider directory associated with provider identifiers. This begs a question of whether system-wide

scheduling capabilities for video conferencing sessions would also be desirable, to avoid the difficulty of person-to-person negotiations for common calendar space.

5.3   Broader operations issues

A broader issue is the need to adhere to legislative and best practice requirements for privacy and security. While there are analogies to telephone and email use, video conferencing is often regarded as more vulnerable because of the immediate human capacity to interpret speech and picture. Some threats to be addressed include eavesdropping on sessions, interception of transmissions, and visibility of any recorded parts of sessions. Encryption of transmissions within a video conferencing system is inevitably a proprietary implementation which the vendor or operator is unlikely to be willing to disclose. Therefore, it may be more workable and efficient to apply a separate encrypt/decrypt layer as a 'wrapper' or 'transformation' to the raw transmission data, using well established methods like public/private key cryptography.

5.4   Future operational issues

While the use of video conferencing technologies can be used in telehealth applications as they are today, there may be a requirement for future work to integrate the video capabilities with other clinical software systems and services.

Intersections between the capabilities of video conferencing systems and clinical information systems capabilities need further consideration. The ability to log details of video conferencing sessions automatically into patient administration records, and clinical observations into electronic health records, may require some extensions to data structure and terminology standards, and messaging. This enhancement may also offer solutions to video conferencing session audit and validation needs, such as correct identification of the participants. Integration of access to clinical information systems for retrieval, sharing and modification of patient data during a videoconferencing session may also be beneficial, especially if it allows the same information to be contributed to records kept by each of the participating clinicians. Needs for intersection with information managed by specific services such as a national authentication service for health (NASH) and Medicare Australia may also be resolved by this form of integration.

6   Conclusion

This document describes the technical standards required to support the telehealth services eligible for the new MBS items that became available on 1 July 2011, and the MBS items for telepsychiatry services existing since 2004. Section two provided an overview of these MBS items and illustrated the types of services covered. Section three surveyed the range of factors that influence how those services will be delivered at an infrastructure level, video conferencing level and broader operations level.

Section four set out relevant video conferencing related standards and health informatics related standards, and described the work currently being undertaken by various peak health bodies to develop clinical standards. Section five identified limitations in standards and discussed methods of realisation with remarks and some open questions that will need further consultation to resolve.

In conclusion, the matters considered in this document suggest that generally the technical standards space caters well for video conferencing, and that the current technological environment is sufficiently standardised to support delivery of telehealth services under the new (current as at 1 July 2011) MBS rebates.

The issue of interoperability between video conferencing products implemented by different vendors persists as an impediment to free ranging video conferencing between arbitrary systems, despite the existence of these relevant technical standards. There is a need for development of complementary clinical standards defining protocols and processes to support clinicians to deliver telehealth services. These are expected to improve over time based on improved technologies, increasing use, demand and competition.

Appendix A – Compression and Container Formats

v · d · e	Multimedia compression and container formats	
Video	ISO/IEC	MJPEG · Motion JPEG 2000 · MPEG-1 · MPEG-2 (Part 2) · MPEG-4 (Part 2/ASP · Part 10/AVC) · HEVC
	ITU-T	H.120 · H.261 · H.262 · H.263 · H.264 · HEVC
	Others	AVS · Bink · CineForm · Cinepak · Dirac · DV · Indeo · Microsoft Video 1 · OMS Video · Pixlet · RealVideo · RTVideo · SheerVideo · Smacker · Sorenson Video, Spark · Theora · VC-1 · VC-2 · VC-3 · VP3 · VP6 · VP7 · VP8 · WMV
Audio	ISO/IEC	MPEG-1 Layer III (MP3) · MPEG-1 Layer II (Multichannel) · MPEG-1 Layer I · AAC · HE-AAC · MPEG Surround · MPEG-4 ALS · MPEG-4 SLS · MPEG-4 DST · MPEG-4 HVXC · MPEG-4 CELP
	ITU-T	G.711 · G.718 · G.719 · G.722 · G.722.1 · G.722.2 · G.723 · G.723.1 · G.726 · G.728 · G.729 · G.729.1
	Others	AC-3 · AMR · AMR-WB · AMR-WB+ · Apple Lossless · Asao · ATRAC · CELT · DRA · DTS · EVRC · EVRC-B · FLAC · GSM-HR · GSM-FR · GSM-EFR · iLBC · iSAC · Monkey's Audio · TTA (True Audio) · MT9 · A-law · μ-law · Musepack · OptimFROG · Opus · OSQ · QCELP · RealAudio · RTAudio · SD2 · SHN · SILK · Siren · SMV · Speex · SVOPC · TwinVQ · VMR-WB · Vorbis · WavPack · WMA
Image	ISO/IEC/ITU-T	JPEG · JPEG 2000 · JPEG XR · lossless JPEG · JBIG · JBIG2 · PNG · TIFF/EP · TIFF/IT
	Others	APNG · BMP · DjVu · EXR · GIF · ICER · ILBM · MNG · PCX · PGF · TGA · QTVR · TIFF · WBMP · WebP
Containers	ISO/IEC	MPEG-PS · MPEG-TS · ISO base media file format · MPEG-4 Part 14 · Motion JPEG 2000 · MPEG-21 Part 9
	ITU-T	H.222.0 · T.802
	Others	3GP and 3G2 · AMV · ASF · AIFF · AVI · AU · Bink · DivX Media Format · DPX · EVO · Flash Video · GXF · M2TS · Matroska · MXF · Ogg · QuickTime File Format · RealMedia · REDCODE RAW · RIFF · Smacker · MOD and TOD · VOB · WAV · WebM

Appendix B - Glossary

The eHealth industry is evolving rapidly, along with increasing activity in the area of telehealth. Terminology that is used to describe telehealth is also evolving. This glossary seeks to clarify a number of the terms used in the document and/or currently in widespread use.

ADSL. *Asymmetrical Digital Subscriber Line.* Refers to a pair of modems connected by a copper line that yields asymmetrical transmission of data.

Aperture. Controls the amount of light that reaches the digital camera's charge coupled device (CCD). The diameter of an aperture is measured in "f-stops." A lower f-stop opens the aperture to admit more light. Each f-stop doubles the amount of light available to the sensor. A combination of aperture and shutter speed determines exposure value. Most digital cameras have automatic exposure modes that control the aperture and shutter speed, although the automatic settings may not be ideal for all clinical uses.

Architecture. The selection, design, and interconnection of the hardware of a computer system.

Artifact. In digital imagery or video, an unwanted byproduct of the image creation, compression, or transmission process. Especially with lossy compression techniques, errors can inadvertently appear in the compressed image that are perceptible to the viewer.

Asynchronous Communication. A mode of communication where the transfer takes place over a period of time, or in separate time frames, not requiring the transmission to take place simultaneously. Examples include e-mail or store and forward.

ATM. *Asynchronous Transfer Mode.*   A high-speed networking standard designed to support both voice and data communications. Point-to-point connections are established by ATM switches, and data flows directly from source to destination. It is connection-oriented, rather than connectionless like traditional IP. ATM creates a dedicated path between source and destination, which can guarantee bandwidth and quality of service.

Authentication. A method of verifying the identity of the person sending or receiving information by use of passwords, keys and other automated identifiers.

Bandwidth. Measures the ability of a communications channel to carry information. The capacity of information increases relative to a higher megahertz (cycles per second) in an analog transmission, and in megabits/second (Mbps) for digital transmission.

Bps. *Bits Per Second.* A measure of transmission rate. Bps, also called "bit rate," is concerned with the rate of data transmission, and should not be confused with the often seen term "baud rate," which refers to the rate of the carrier signal, not the amount of data actually carried.

Bridge. A device that can link multiple videoconferencing sites into a single videoconference. A bridge is necessary to conduct a multipoint conference with three or more participants (exception: some videoconferencing equipment has built-in limited multipoint ability). A videoconferencing bridge is also often referred to as a multipoint control unit (MCU).

Brightness. The perception of luminance by the human eye. Although luminance and brightness are often used interchangeably, they are not exact synonyms.

Broadband. In networking terminology, a telecommunications medium capable of transmitting multiple data signals simultaneously. The term broadband is also used to describe media that transmit data at a high rate, generally comparable to T1 or better, and occasionally as a synonym for DSL. Television, microwave, and satellite telecommunications are examples of broadband media.

Browser. Also known as a Web browser. Any program that permits access and searches on the World Wide Web.

Cache. A dedicated system of memory designed to alleviate processing bottlenecks and improve the performance of computing devices and peripherals. Caching also refers to the mathematical techniques for efficiently storing and retrieving data from such memory systems.

Camera Control. An important consideration in conducting an encounter via videoconferencing. The provider should have the ability to control both the local and remote video cameras. This control is usually a built-in functionality of the videoconferencing system. The acronym "FECC" (Far End Camera Control) is often seen in the literature describing features of videoconferencing systems. The acronym "P-TZ" (Pan-Tilt-Zoom) is often used to describe the range of camera control functions, though focus and iris control may also be equally important, depending on the application.

Camera Preset. A time-saving feature of some videoconferencing systems. Using presets, the controller can select pre-defined camera zoom, angle, and other features and save them for recall at the push of a button. This allows a uniform appearance for camera transition throughout a conference.

CDISC. *Clinical Data Interchange Standards Consortium.* An open, multidisciplinary standards developing organisation formed in 1997 that develops global standards and innovations to streamline medical research and ensure a link with healthcare.

CEN. *European Committee for Standardization.* An international agency responsible for setting standards in health care informatics.

Channel. A radio frequency assignment designed depending on the frequency band being used and the geographic location of the sending/receiving sites.

Circuit Switched Network. A type of network in which a dedicated circuit must be set up between sender and receiver before communication may occur. During the communication, no other traffic may use that circuit, and the connection must be terminated when communication is complete. The most common example is the Public Switched Telephone Network.

Contention Ratio. The ratio of the potential maximum demand to the actual bandwidth. The higher the contention ratio, the greater the number of users that may be trying to use the actual bandwidth at any one time and, therefore, the lower the effective bandwidth offered, especially at peak times.

CoS. *Class of Service.* A traffic management technique that classes similar types of network traffic together (e.g. e-mail, streaming video, file transfers) and manages each class with its own level of service priority. Class of Service does not guarantee a level of bandwidth and delivery time as does Quality of Service (QoS). It is a "best effort" traffic control methodology.

CODEC. *Coder-Decoder.* A device, either hardware or software based, that encodes analog video and audio signals to digital video and audio, and vice versa. CODECs typically compress the digital code to conserve bandwidth and increase effective throughput.

Compression. This term refers to the mathematical means used to reduce bandwidth requirements for digital signals, enabling richer video and audio at a more manageable file size. A number of standards for both video and still picture data (e.g. MPEG, JPEG, GIF) are in common use. Compression techniques are either "lossy" or "lossless."

Continuous Presence. In multipoint conferencing, a mode that displays multiple participants in a portion of the screen at all times. Although an effective format for discussion, continuous presence is not generally the ideal mode for lectures, as any presentation graphics will be limited to a segment of the available viewing area.

Color Checker Chart. Industry standard color value reference chart used in still and video photography to identify and evaluate factors that may affect accurate color reproduction. Specific charts have been developed to evaluate white balance and color accuracy of digital cameras.

Crop. The use of image manipulation software to remove unwanted portions of an image. Cropping allows a particular feature of the image to be emphasised, or eliminates distracting elements.

CSIRO. *Commonwealth Scientific and Industrial Research Organisation.*

Data Compression. Method to reduce sheer volume of data by more efficient encoding practices, thereby reducing image processing, transmission times, bandwidth requirements, and storage space requirements. Some compression techniques result in the loss of some information, which may or may not be clinically important.

Data Repository. The element of an information system that accepts, files, and stores data from various sources.

DBCDE. *Department of Broadband, Communications and the Digital Economy.*

Depth of Field. Refers to how much of an image remains in focus from front to back as the camera focuses on the main subject. Depth of field is controlled by aperture and focal length of the lens. "Deep" depth of field is useful for panoramic shots. "Shallow" depth of field is more appropriate for close-up and portrait shots, and is most useful for clinical imagery. Shallow depth of field is produced by using a larger aperture and/or longer focal length (zoom lens).

DICOM. *Digital Imaging and Communications in Medicine.* A set of protocols describing how radiology images are identified and formatted that is vendor-independent and developed by the American College of Radiology and the National Electronic Manufacturers Association. The DICOM standards facilitate interoperability among medical imaging devices regardless of manufacturer.

Digital. Data that has been encoded into a discrete series of binary digits ("bits"), as opposed to the continuous variable waveforms of analog signals.

Digital Image Noise. Unwanted artifacts, such as randomly spaced pixels, which can occur in digital imagery. The possibility of image noise may be reduced by use of a lower ISO setting, use of the recommended flash settings in low lighting, and use of a tripod when using slow shutter speeds. Noise reduction software is available to remove these unwanted artifacts, but care must be exercised to avoid removing clinically significant elements.

Digital Signature. A digital tag attached to electronic documents to verify the identity of the sender and validity of the document. Legislation has been passed to allow electronic signatures to have the equal status with physical signatures for most electronic transactions.

Digital Zoom. A method employed by many digital cameras to enlarge a portion of the image in order to simulate the effects of optical zoom (the use of lenses to bring the subject view closer). The camera crops a portion of the image and then enlarges it back to the required size. Digital zoom generally results in a loss of image quality, compared to a similar shot taken using actual optical zoom.

DIISR. *Department of Innovation, Industry, Science and Research.*

Download. The process of transferring files or software from another computer to your computer.

DSL. *Digital Subscriber Line.* A dedicated broadband technology that uses the ubiquitous twisted pair copper wire connecting most homes and businesses today through the public telephone system to provide connectivity at relatively high speeds. DSL accomplishes this by dividing the existing telephone frequencies so that voice and data may be carried simultaneously without interference. Unlike a dial-up connection, DSL is always available. There are several different implementations available. The most common is called Asymmetric or Asynchronous (ADSL). An ADSL connection is characterised by a high-speed downstream channel, and somewhat lower speed upstream channel. Synchronous DSL is also available for business use. Distance from the subscriber site to the Telco's Central Office (CO) is the main determinant of the actual performance of a DSL connection.

Duplex. A system that allows data to be transmitted in both directions simultaneously. Using full duplex*,* the system is capable of transmitting and receiving in both directions at the same time. A voice conversation over the public telephone network is one example of this. Conversely, a half duplex system is capable of both transmitting and receiving information, but only in one direction at a time.

Dynamic Range. The characteristic of a communications or imaging system to reproduce or transmit various brightness levels.

Encryption. Encoding of information to protect it from unauthorised access. Encryption is one facet of electronic communications security, and is often used along with digital signatures and similar techniques to verify the integrity and authenticity of the communication. Common electronic encryption techniques include Public Key Infrastructure (PKI) for messaging and Secure Socket Layer (SSL) for transactions over the World Wide Web.

Firewall. A method of analysing and controlling access to and flow of data across a network through the use of hardware, software, or a combination of the two. Specific ports will have to be configured through the firewall to enable videoconferencing protocols to pass through. (When troubleshooting connectivity problems involving videoconferencing over IP, firewall issues can be a common culprit.)

Focal Length. A measure of the optic properties of a camera lens. Lenses are generally categorised as "wide-angle," "normal," or "telephoto," depending on their focal length. A "zoom" lens can have variable focal length for a range of uses. In digital photography, the size of the image sensor (CCD) also has an effect on equivalent focal length.

Frame Rate. The rate at which video frames are displayed, generally measured in frames per second (fps). Broadcast quality full motion video is considered to be 30 frames per second.

Full Duplex. A system capable of transmitting and receiving in both directions at the same time.

Full Motion Video. Video picture quality that is perceived without unnatural motion or delays by the viewer. In videoconferencing, compressed full motion video delivers approximately 10 to 30 frames per second, depending on bandwidth and network activity. Broadcast quality video is generally considered to be approximately 30 frames per second.

G.711. The ITU technical standard for compression of 8-bit audio in the voice range, used in standard telephony and low-end videoconferencing connections.

G.722. The ITU technical standard for wideband speech encoding used to provide high quality audio in videoconferencing systems.

G.723. The ITU technical standard for dual-rate voice compression, designed for videoconferencing over videotelephony or IP.

Gatekeeper. A device that manages videoconferencing traffic and address translation within an IP-based (H.323) network, often for a specific zone. This device is useful in eliminating bottlenecks, enhancing quality of service, and simplifies addressing of videoconferencing endpoints.

Gateway. A computer used to provide translations between different types of standards. Generally refers to computers that translate complex protocol suites; for example, different E-mail messaging systems. Currently, it has been used to describe a "door" from a private data network to the Internet.

Ghosting. A video artifact often seen in the display of video images over a connection experiencing an unacceptable degree of latency. As the image moves across the screen it can leave a trail of perceptible "ghost" images.

GUI. *Graphical User Interface.*   A method of controlling computers using graphic images or icons, to which the user accesses using a mouse.

Guide. A list of online resources, usually Web sites, which may be generalised or specific, compiled by human editors. This index is generally less comprehensive than search engines, but often more specific. May also be known as a "search" or "subject guide."

H.239. The ITU technical standard that addresses multiple video streams (conferencing, presentation, etc.) within a single videoconference. Endpoints that support H.239 will receive the streams and display them in separate windows. Systems that cannot support H.239 will display the graphics in a single window instead of the far end video.

H.261. The original ITU technical standard designed for video compression over ISDN connections. H.261 was the first digital video compression standard that came into widespread use for videoconferencing, supporting the FCIF and QCIF formats. Subsequent video compression standards, including MPEG, H.263, and H.264 are all based on H.261.

H.263. The ITU technical standard that specifies video coding at low bit rates. It was originally designed for videoconferencing over H.324 (POTS-based) systems, but has also found usefulness in connections over ISDN, IP, etc. H.263 achieves acceptable compressed video over a low bandwidth using techniques including those similar to the MPEG standards.

H.264. The ITU technical standard (also known as MPEG-4 Part 10) that governs video coding at a very high compression rate. It represents a major improvement over H.263 and other previous CODECs. H.264 was designed to produce acceptable video quality at substantially half the bit rate required by previous standards.

H.320. The ITU technical standard for videoconferencing that allows different equipment to interoperate via ISDN connections.

H.323. The ITU technical standard for videoconferencing that allows different equipment to interoperate via TCP/IP.

H.324. The ITU technical standard for videoconferencing that allows different equipment to interoperate via Plain Old Telephone Service (POTS).

Half Duplex. A system capable of both transmitting and receiving information, but only in one direction at a time.

Hardware. Used to refer to all the tangible equipment related to information technology, including the computers, peripheral devices, such as printers, disks, and scanners, and the cables, switches, and other components of the telecommunications infrastructure that binds everything together.

HL7. *Health Level Seven Messaging Standard.* A series of communications protocol standards for the transmission of health information. HL7 messaging allows various applications and medical devices to successfully interact and exchange information.

HTML. *Hypertext Markup Language.* The guides to publishing used on WWW pages. It defines the events when the user clicks on a hypertext link embedded in the page. HTML is a publishing standard, not a programming language. HTML document comprise the core of a Web site, and can be identified by an .html or .htm suffix.

HTTP. *Hypertext Transfer Protocol.* The standard by which the World Wide Web operates.

IEC. *International Electrotechnical Commission.* A non-profit, non-governmental international standards organisation that prepares and publishes International Standards for all electrical, electronic and related technologies. The IEC cooperates closely with the ISO and the ITU. In addition, it works with several major standards development organisations, including the IEEE.

IEEE. *Institute of Electrical and Electronics Engineers.* Professional organisation that develops standards for electronic devices, including medical imaging and communication between medical devices.

ICT. *Information and Communications Technologies.*

Informatics. The use of computer science and information technologies to the management and processing of data, information and knowledge.

Integrated Circuit. A solid state microcircuit comprised of interconnected semiconductor components diffused into a single instrument.

Interface. The connection between two devices; applies to both hardware and software.

Interoperability. The ability of two or more systems (or components) to exchange information and to use the information that has been exchanged. Generally achieved through the implementation of standards.

IP. *Internet Protocol*. The principal communications protocol used for relaying network packets across network boundaries. The Internet Protocol is responsible for addressing hosts and routing packets from a source host to the destination host across one or more IP networks.

ITU. *International Telecommunications Union.* Now an agency of the United Nations, the ITU was originally founded in 1865 to standardise telegraphy. The ITU's Telecommunication Standardisation Sector (ITU-T) publishes a wide range of "Recommendations" (i.e. standards) relating to telecommunications and videoconferencing. Equipment based on these standards allows successful conferencing regardless of platform or manufacturer. The ITU-T standards most familiar to videoconferencing users are found in the H-series, "Audiovisual and Multimedia Systems," (primarily for control of videoconferencing over ISDN, IP, etc.), the G-series, "Transmission Systems and Media, Digital Systems and Networks," (primarily for control of audio transmission) and the T-series, "Terminals for Telematic Services" (primarily for control of data collaboration and similar features).

ISDN. *Integrated Services Digital Network.* A dial-up digital connectivity medium used commonly for videoconferencing. ISDN can transmit voice, data, and video simultaneously over a connection. Since ISDN services are used on demand by dialing another ISDN-based device, per-minute charges accumulate at a contracted rate and then are billed to the site placing the call. This service is analogous to using the dialing features associated with a long distance telephone call – whoever dials pays the bill.

ISO. *International Organization for Standardization.* Comprised of national bodies elected to set standards, this non-treaty organisation is involved in illustrating norms for all communications fields except electrotechnical.

JPEG. *Joint Photographic Experts Group.* An algorithm and standard for compressing digital photographic images. Related to GIF.

Kb. *Kilobyte.* A measure of computer storage and memory capacity. Equivalent to 1,024 bytes; often applied to 1,000 bytes as well.

Kbps. *Kilobits per second.* A measure of bandwidth and rate of data flow in digital transmission. One Kbps is 1,024 kilobits per second.

LAN. *Local Area Network.* A network of computers, generally small in number, whose reach is limited, typically within a building or campus, linked to allow access and sharing of data and computer resources by users. Differentiated from WAN by the size of the area, LAN is the smallest.

Latency. Perceptible delay between transmission and receipt of data across a connection. Latency can be increased due to a high level of network activity, or a poor or slow connection. A connection with high latency can produce unacceptable delays and lost data in video and audio transmission. Network management techniques often seek to improve quality of service by decreasing latency of audiovisual data.

Loopback. A common diagnostic tool in which a signal is transmitted over a connection and then returned to the sending device. Loopbacks are often used to test video equipment.

Lossless. A technique for data compression that preserves all elements of the original. Lossless formats cannot always guarantee a high level of compression, but are necessary when it is important to reproduce an exact duplicate of the original (e.g. an executable file). Common lossless formats include GIF and PNG for graphics, and ZIP for data files.

Lossy. A technique for data compression that achieves a relatively high level of file size reduction by removing elements of the original deemed to be unnecessary or imperceptible to the intended viewer. Lossy compression is most commonly used when processing audio, still image, or video data. Videoconferencing CODECs often take advantage of lossy compression methods to produce an acceptable quality presentation while minimising bandwidth requirements. Common lossy formats include MP3 for audio, JPEG for still images, and MPEG for video.

MCU. *Multipoint Control Unit.* A device that can link multiple videoconferencing sites into a single videoconference. An MCU is necessary to conduct a multipoint conference with three or more participants (exception: some videoconferencing equipment has built-in limited multipoint ability). An MCU is also often referred to as a "bridge."

Mbps. *Megabits Per Second.* A measure of transmission rate. A megabit is roughly one million bits (1,000,000 or 1,024,000 or 1,048,576 often depending on marketing usage).

Megapixel. A popular measurement of the potential resolution of a digital camera, in millions of pixels. The megapixel rating of a given digital camera can give the user a general idea of the maximum effective print size and image resolution that it is capable of, although many factors can affect the usefulness of a particular camera for a particular task.

MPEG. *Moving Picture Experts Group.* A series of standards for compression and file format for digital video and audio. The most common formats in this series are MPEG-1 (used in Video CD, MP3 audio, etc.) and MPEG-2 (provides broadcast quality pictures, and is used with some modification in the DVD format). MPEG-4 uses further coding tools with additional complexity to achieve higher compression than MPEG-2.

MP3. *MPEG Audio Layer–3.* A popular lossy compression format for digital audio.

MPLS. *Multiprotocol Label Switching.* An advanced network traffic management mechanism that can enhance quality of service by its ability to distinguish and handle different types of data packets according to specific criteria.

Multipoint Videoconference. Videoconference with three or more participants. A multipoint conference generally requires the use of an MCU (or equipment with built-in multipoint capability). During a multipoint conference, there are two modes available to present the participants. In a continuous presence videoconference, all participants can be seen at the same time on the far end monitors. Microphones at all sites can be active, which may lead to extraneous noises and interruptions. This mode is not the best choice if data is to be displayed (e.g. via document camera, whiteboard, etc.) as the presentation will be limited to a portion of the screen. Conversely, in the voice activated mode, only the participating site that produced the most recent audio input will be visible. Other sites must ensure their microphones are muted to prevent inadvertently switching the video away from the intended speaker. Where several speakers take turns in voice activated mode, they must realise there is a tangible delay as the view switches from one site to the next.

NBN. *The Australian National Broadband Network.*

NEHTA. *National E-Health Transition Authority.*

NICTA. *National ICT Australia.*

Noise Cancellation. A technique for reducing or preventing audio feedback during a videoconference. Without noise cancellation, the signal emanating from a speaker is captured by the microphone and sent back to the originating location, thereby creating an echo or distortion.

Packet. A basic message unit for communications in networks. A short block of data comprised of data, call control signals and error control information and containing information on its source, content and destination that is transferred in a packet switched network.

PSN. *Packet Switched Network.* A type of network in which data is transmitted in relatively small "packets" and routed based on the address contained within each packet, relying on the network infrastructure to choose and manage the route. Transmitting data in packets allows the same path to be shared by many users at once. This type of communication is also called "connectionless." In contrast, regular voice telephony or modem connections are "circuit-switched" and use a dedicated data path that is unavailable to other users during the call.

Packet Switching. The procedure of transmitting digital information via an addressed packets so that a channel is occupied only during the transmission of the packet.

P-T-Z. *Pan-Tilt-Zoom.* A system allowing control of the major movement and focus functions of a video camera. Near and far-end camera control is essential to conduct a professional encounter via real time videoconferencing Telemedicine.

Peripherals. Attachments designed to enhance the functionality of various electronic devices. Examples include printers, scanners, keyboards, blood pressure monitors, ophthalmoscopes, document cameras, etc.

Ping is a computer network administration utility used to test connection to from one point to another on an IP network and to measure the round-trip time for messages sent from the originating host to a destination computer.

Pixel. *Picture Element.* The smallest unit of a video display, used as a measure of resolution for video formats.

Point to Point Conference. The classic videoconferencing mode consisting of two participants connected directly. This is the most common usage for patient encounters or provider consultations.

POTS. *Plain Old Telephone Service.*

Presentation Mode. Videoconferencing mode in which one site (e.g. a lecturer) is continuously displayed to all endpoints. Sometimes also called broadcast or lecture mode.

Protocol. A system of guidelines and procedures, applying to both hardware and software, that oversees communications between two computer devices. They are primarily concerned with three aspects of the communication process: how data are symbolised and coded, how data are transmitted, and, in file transfer protocol, how errors and failures are recognised and corrected.

PSTN. *Public Switched Telephone Network.* The circuit switched telephone system in public use worldwide. To a great extent, the PSTN is governed by ITU-T standards, (e.g., E.163 which defines telephone numbers) which allow interoperability between telephone systems around the globe. The PSTN is now almost entirely digital, with the notable exception of the majority of the world's "last mile" connections.

QoS. *Quality of Service.* A technique used to prioritise network data traffic. Identifying videoconferencing data as a high priority ensures that the session will not be interrupted by other network traffic, such as large file transfers.

Real Time. In telehealth terms, conducting an encounter or consultation where both parties are available and interacting simultaneously. Real time telehealth is generally conducted via full motion videoconferencing.

Remote Monitoring. An application of telemetry and telehomecare, using measuring devices linked via a communications medium, such as a phone line, to remotely collect and transmit patient data to a provider site for interpretation. Common uses include monitoring of one or more vital signs, such as blood pressure, weight, glucose levels, ECG data, etc.

Resolution. The level of detail a given device is capable of displaying, generally measured in pixels, dots per inch, color depth, or similar criteria.

Routing. The assignment of a path of communication.

Server. A computer designated to providing specific services to other computers. For example, print servers only accept, store, and print out documents sent to them by other computers, and nothing else. Web servers permit users from around the world to access the Web sites and documents stored on them.

SIP. *Session Initiation Protocol.* Emerging standard for initiation, termination, and control of multimedia communications sessions over IP. SIP is widely used in Voice over IP and instant messaging applications, and is becoming more prevalent in videoconferencing solutions. SIP provides a feature-rich control set with telephone-like operations, and human-readable elements similar to HTTP (e.g. "404 – Not Found").

Store and Forward. A telehealth/eHealth encounter or consult that relies on the asynchronous transfer of still digital images of a patient, or clinical data, such as blood glucose levels or electrocardiogram measurements, from one site to another for the purpose for rendering a medical opinion or diagnosis. Common types of store and forward services include radiology, pathology, dermatology, ophthalmology, and wound care.

Streaming. Transmission of video or audio data over a network on an as-needed basis. Such content is often available on web pages in various formats which play on demand by buffering portions of the file to temporary local storage as it is displayed rather than downloading the entire file before playing.

SVC. *Scalable Video Coding.* Standardises the encoding of high-quality video images in such a way as to provide multiple different streams, each containing different components of the high quality video image. The first video stream is a low resolution image that can operate at a modest bandwidth. Additional streams are then encoded that contain the information for higher resolution, higher frame rates and higher quality levels to create higher resolution and better motion images.

Switched Network. A system of telecommunications where each user has a separate address and any two points can be linked directly, using any combination of available routes in the network.

Switched Service. A telecommunications service, often based on telephone technology, that switches circuits to connect multiple points.

Synchronous Communication. A mode of communication where the transfer takes place simultaneously. Examples include real time videoconferencing or standard telephony.

T.120. The ITU standard for videoconferencing that covers a wide range of compatibility requirements for multipoint conferencing, including specifications for file transfer, program sharing, and whiteboard functions. Subsequent standards in this series cover specific functions in greater depth (e.g. T.126 for whiteboarding and remote application control).

TCP/IP. *Transmission Control Protocol/Internet Protocol.* A series of protocols used to control communication across the Internet. TCP/ IP uses two main protocols, TCP and IP. TCP enables two hosts to establish a connection and exchange packets of data. IP specifies the format and addressing scheme used for packets of data.

Telecommunications. Transmission and reception of voice, video, or other data over a distance. A telecommunications system has several components: a transmitter (electronic device), a transmission medium (e.g. wire-based Telco or LAN, wireless antenna, satellite), and generally a specific channel (e.g. radio frequency, phone number, IP address). Telecommunications can be point-to-point, multipoint, or broadcast (one way transmission from a sender to multiple receivers).

Teleconferencing. Interactive communication between two or more individuals at geographically separated sites, via a telecommunications system. Teleconferencing may be audio only, include video, and/or support the transmission of various files, graphics content, and other information.

Teleconsultation. The physical separation between multiple providers during a consultation.

Telehealth. The 'use of telecommunication techniques for the purpose of providing telemedicine, medical education, and health education over a distance', while drawing a distinction between this and telemedicine, which is defined as the 'use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers'.

Telehomecare. The use of remote technologies to provide care in a home setting. Based upon the clinical needs of the patient, this may include the use of real-time interactive videoconferencing systems to conduct homecare visits, or the use of remote monitoring systems that transmit patient data, such as blood pressure, weight, or pulse oximetry. Both of these approaches can use a wide variety of peripheral devices to collect vital signs or lab data, such as glucose levels. An education component is often a part of Telehomecare services, to promote medication compliance and encourage patients to become more involved with managing their health care needs.

Telemonitoring. The process of using audio, video, and other telecommunications and electronic information processing technologies to monitor the health status of patients from a distance.

Throughput. Measure of the amount of data transmitted across a network over a period of time, generally expressed in bits or bytes per second. Achieving higher throughput is one factor in reducing latency in a large transmission such as a videoconference.

Transmission Rate. The speed at which data travels over a communications channel, generally expressed in bits or bytes per second.

Turn-key System. A system of telecommunications in which all of the installation services and components needed for operational teleconferencing have been provided by a single vendor or contractor.

UHF. *Ultra-High Frequency.* A radio frequency in the second highest range of the radio spectrum, from 300 to 3,000 MHz.

Upload. Transferring files or software from one computer to another.

User Interface. The graphic and design components of a Web page that directs users on how to access the information contained in that Web site.

VGA. *Video Graphics Array.* A measure of image size, representing the capacity to display 640 X 480 lines, such as on viewing monitors for personal computers.

VHF. *Very High Frequency.* A radio frequency in the very high range of the radio spectrum, from 30 to 300 MHz.

Videoconferencing. Actual-time, generally two way transmission of digitised video images between multiple locations; uses telecommunications to bring people at physically remote locations together for meetings. Each individual location in a videoconferencing system requires a room equipped to send and receive video.

Voice Activated Switching. In multipoint videoconferencing, a mode that allows all participants to see the current speaker. Only the endpoint with the most recent audio input is displayed. This is often an ideal mode for lecture-style videoconferences.

WAN. *Wide Area Network.* A network covering a wide geographic area, whether several company sites or services by a common Internet service provider.

White Balance. A setting on a digital camera that adjusts the brightest portion of the framed shot so it appears white. Although the human eye will see white objects as white regardless of lighting conditions, a digital camera will not always do so. Most digital cameras are equipped with white balance settings to compensate for different lighting conditions (e.g. daylight, clouds, fluorescent, incandescent).

Whiteboard. A feature of videoconferencing systems that allows participants to write, draw images, and display other inputs during a conference. Whiteboarding and other collaboration functions are specified in the ITU standard T.120 and subsequent updates.

WHO. *World Health Organization.* A specialised agency of the United Nations that is concerned with international public health.

Wireless. Refers to a wide range of communications technologies along the radio frequency spectrum. Applications specific to Telemedicine and eHealth take advantage of wireless technologies including cellular telephony and wireless networking. Wireless networking has become increasingly common due to the implementation of the IEEE 802.11 series of standards, which allow wireless networking devices to easily interoperate regardless of manufacturer. Especially in rural areas, some companies are taking advantage of wireless technologies to provide broadband service where wired access is impractical or cost prohibitive.

References

1. Australian Government (2011). Health Insurance (Telehealth Services) Determination 2011 of the Health Insurance Act 1973, Federal Register of Legislative Instruments F2011L00954, 23 May 2011.

2. International Organization for Standardization, Interoperability of Teleheath Systems and Networks (2004). http://www.americantelemed.org/files/public/membergroups/technology/Technology_HealthInformatics1.pdf

3. Standards Australia, (2007). Technical Report TR 2961-2007. Telehealth standards scoping study. Retrieved from http://infostore.saiglobal.com/store/ViewDocument.aspx?saleitemID=733063&freeDownload=1

4. Standards Australia (2008). Technical Report TR 4887-2008. Call centre standards scoping study. Retrieved from http://infostore.saiglobal.com/store/...

5. Standards Australia (2009). Miscellaneous Publication MP 99-2009. Telehealth Session information required for health records. Retrieved from http://infostore.saiglobal.com/store/...

6. NICTA (2010). Telemedicine in the context of the National Broadband Network. Retrieved from http://www.nicta.com.au/research/rps?sq_content_src=%2BdXJsPWh0dHBzJTNBJTJGJTJGcHVibGljYXRpb25zLmluc2lkZS5uaWN0YS5jb20uYXUlMkZzZWFyY2glMkZzaG93JTNGaWQlM0Q0NDIxJmFFsbD0x

7. UniQuest Pty Limited, (2011). Telehealth Assessment Final Report. Retrieved from http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/connectinghealthservices-techandclinical

8. UniQuest Pty Limited, (2011). Telehealth Business Case, Advice and Options Final Report. Retrieved from http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/connectinghealthservices-techandclinical

9. Australian Government, Department of Health and Ageing (2010). Connecting health services with the future: Modernising Medicare by providing rebates for online consultations. Retrieved from http://www.mbsonline.gov.au/internet/mbsonline/publishing.nsf/Content/256BA3C38B7EEA22CA2577EA006F7C42/$File/Telehealth%20discussion%20paper.pdf

10. National E-Health Transition Authority, (2011). NEHTA Telehealth Report.

11. Department of Broadband Communication and Digital Economy. NBN. Empowering Australia. Canberra: Australian Government; 2011 [cited 2011 1st June]. Retrieved from www.nbn.gov.au/health-and-aged-care-2/government-initiatives/medicare-benefits-schedule-expansion

12. National Health Information Advisory Council, (2001). National Telehealth Plan for Australia and New Zealand. Retrieved from www.health.gov.au/internet/hconnect/publishing.nsf/content/.../teleplan.pdf

13. The Hon Nicole Roxon MP. Media release. Telehealth fees unveiled. 6 June 20112011: Retrieved from http://www.yourhealth.gov.au/internet/ministers/publishing.nsf/Content/mr-yr11-nr-nr116.htm?OpenDocument&yr=2011&mth=06