Automated Devices in Taiwan's Telemedicine Industry

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(Received 28 January 2013; Published on line 1 March 2013)

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DOI: [10.5875/ausmt.v3i1.184](https://doi.org/10.5875/ausmt.v3i1.184)

Abstract: Telemedicine generally refers to the application of media technology to overcome temporal and spatial limitations in the provision of interactive professional medical consultation and advisory services, allowing doctors to provide a full range of medical care to patients in remote areas via video conferences and tele-consultation. It also allows healthcare workers in remote areas to access professional training opportunities without incurring the expense or inconvenience of travel. This study investigates and analyzes the automation of processes by which doctors diagnose and treat patients via telemedicine applications to point out the limitations of current telemedicine practices and to highlight the potential of automation to increase the overall quality of telemedicine services. In this AHP-based study, a survey of healthcare professionals regarding the need for telemedicine process automation respondents suggested that automation technology should focus on improving the transmission of medical information and the retrieval of medical information.

Keywords: Telemedicine; automation; analytic hierarchy process

Telemedicine generally refers to the application of media technology systems to allow healthcare workers to remotely interact with patients. According to the definition provided by World Health Organization (WHO), telemedicine is “the use of interactive video and information and communication technologies to engage in healthcare behaviors including diagnosis, treatment and consultation, as well as to transmit health education and medical information.” Current telemedicine practices integrate computer science, communications technology and medicine, enabling doctors to provide a full range of medical care via teleconference to patients in remote areas, while giving healthcare professionals in these remote areas access to important training opportunities. In general, telemedicine integrates various data formats, such as text, quantitative data, graphics, images, audio and video, etc. It processes and transmits a wide range of information to enable timely patient treatment, including patient histories, examination reports, physiological parameters and signals, various medical imaging results, heart sounds, breathing sounds and consultation

discussions. Telemedicine provides patients and healthcare professionals in remote areas with ready access to the professional expertise of doctors based in urban medical centers, hence easing the burden of constant travel to and from hospitals.

Telemedicine Process Automation in Taiwan

Typical telemedicine operations require workstations located at both locations connected by a telecommunication link.

The digitization of medical information is quite complicated and medical data is produced in a wide range of formats, types and quantities, and effective telemedicine requires users to be able to quickly and efficiently access, store and transmit this information for real-time use. Currently, the following formats and methods are used in Taiwan for medical information and its retrieval:

Figure 1. Telemedicine Process Analysis (Source: Compiled by the IEK, February 2012)

1. Text:

e.g. basic data, examination reports and test reports. The data can be automatically retrieved through PC input or through integration with hospital management information systems and examination/analysis devices.

2. Graphics:

ECG, EMG and EEG results can be input via scanner. Static image data, such as the images generated from radiological devices, including traditional X-ray radiography, computerized radiography (CR), computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine radiography (NM) and ultrasound radiography.

3. Audio data:

e.g., heart and respiratory sounds used in patient diagnosis. Audio devices and microphones can be used to obtain and record patient sounds directly to a range of digital formats.

4. Videos and other subsidiary data:

e.g., video recordings of consultations, interviews, presentations and dynamic examination radiography (e.g., ultrasound, endoscopic consultants, etc.).

Moreover, software packages such as Microsoft's "Virtual Hospital" allow for the integration of various data formats (e.g., text, numbers, graphics, images, and audio and video), enables users to rapidly input or acquire the data needed for treatment, diagnosis, discussion, consultation or instruction.

Network infrastructure and conditions for telemedicine need to consider four factors: quality, popularity, economics and level of interactivity. Currently, Taiwan's telecom providers offer connectivity via integrated services digital networks (ISDN) and high-speed data exchange networks, such as frame relay and asynchronous transfer mode (ATM), which can transmit text, numbers, images, audio data and various signal data. The difference between them is bandwidth. The ISDN, data network leased line, ATM and Direct Broadcast network meet the quality requirements, while ISDN which provides greater bandwidth is the optimal choice to meet the requirements for popularity, economics and interactivity. Telemedicine entails the transmission of large amounts of data, requiring higher bandwidth allocations. Therefore, the pilot experimental project reported here used a high-bandwidth ADSL connection from the National Information Infrastructure (NII) and National Health Information Network (HIN) (Huang, 2002)

As seen in Fig. 1, this study investigates and analyzes the automation of telemedicine processes used by doctors to diagnose and treat patients in remote areas, with the aim to highlight the limitations of current state of process automation in telemedicine and to explore the potential of new automation devices to improve the overall quality of telemedicine services.

An Assessment of the Need for Telemedicine Process Automation in Taiwan

This AHP-based study administered a survey of healthcare professionals engaged in telemedicine in Taiwan regarding the need for telemedicine process automation.

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Figure 2. Assessment of the Need for Telemedicine Process Automation (Source: Compiled by the IEK, February 2012)

Respondents emphasized the need for improved process automation in “transmission of medical information” (38.96%) and “retrieval of medical information (37.91%). Respondents cited inadequate network transmission rates as presenting an obstacle to the provision of effective telemedicine services, and expressed hope that process automation could improve the performance and efficiency of network transmissions. In addition, the efficiency of medical information retrieval could be improved through the use of networked examination/analysis devices or radiography devices which can automatically retrieve images, video, examination and graphics.

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