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Championing Telemedicine in New Zealand: The Case of Utilizing Video Conferencing in Psychiatry and Dermatology

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CHAMPIONING TELEMEDICINE IN NEW ZEALAND: THE CASE OF UTILIZING VIDEO CONFERENCING IN PSYCHIATRY AND DERMATOLOGY

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Abstract

This research explores the factors that could influence telemedicine success in two hospitals involved in a rural setting in New Zealand. Findings from the cases revealed that telemedicine utilising the video conferencing technology (TMVC) was adopted based on its cost-benefit to the hospitals. This is necessary but considering the impact of other factors, specifically the compatibility factor could have made the adoption decision more effective earlier on. The administration manager was the primary instigator of TMVC in psychiatry in one of the hospitals, whereas in the other hospital it was the dermatologist. Therefore, this research emphasises the importance of the tight coupling between the roles of both the management and the clinical champions for TMVC to succeed in New Zealand. However, the research results suggest the limited use of the technology in the cases.

Keywords: Telemedicine, rural patients, video conferencing, dermatology, psychiatry, product champion, New Zealand

Introduction

Diminishing government funding and cost control in most of the world's developed countries including New Zealand has led to the need for alternative and more cost-effective means of providing care (Edelstein, 1999; Neame, 1995). Within these challenges, telemedicine emerges as one viable solution to New Zealand and other health providers facing similar circumstances. Telemedicine means medicine from a distance where distant and dispersed patients are brought closer to their medical providers through the means of telecommunication technologies (Charles, 2000; OTA, 1995; Noring, 2000; Perednia & Allen, 1995; Wayman, 1994). Telemedicine can assist in reaching out to rural patients (Charles, 2000; Harris, Donaldson, & Campbell, 2001) and to areas where patient volumes for certain services are limited (Edelstein, 1999). It can also assist in implementing administrative and clinical meetings (case discussion), in providing different health-awareness courses to patients (smoke treatment centres), and in delivering training courses to physicians (discussing research-based journals), nurses, and other medical staffs (Perednia & Allen, 1995; Wayman, 1994). Telemedicine covers a wide spectrum of benefits in health care utilising the video conferencing technology (TMVC) in areas such as consultations, diagnostics, therapeutic, transfer of patient related records, case management, training, and meetings. In a rural setting, telemedicine could help New Zealand health providers in supplying quality, fast, and economical medical services to rural patients and hence, saves doctors and patients valuable time wasted in commuting large distances. Specialists could utilise this extra time in seeing more patients at the main hospital.

This research explores the adoption and use of telemedicine in Health and Hospital Services (HHSs)[1] in New Zealand. Therefore, the following research question is posited, *What are the factors influencing telemedicine success in hospitals and how do these factors influence its adoption and use in New Zealand?* Identifying the factors that could accelerate or hinder telemedicine adoption and its use in HHSs in New Zealand is the first objective of this research. The second objective of this research aims to depict the experience of two HHSs in New Zealand with TMVC in the areas of dermatology and psychiatry. These objectives

[1]Recently, hospitals are now the provider arm of the District Health Boards, e.g., Waikato District Health Board (W-DHB).

are of importance to other HHSs in New Zealand and elsewhere that are interested in adopting telemedicine as well as to researchers and policymakers interested in identifying the factors that could influence telemedicine success in hospitals.

Theoretical Framework

While searching for a guiding theoretical framework that could assist in explaining factors influencing telemedicine success, the classical innovation diffusion theory model (Rogers, 1983; 1995) appeared to be the most widely accepted framework in identifying critical characteristics for technological innovations (Moore & Benbasat, 1991; 1996; Premkumar & Roberts, 1999; Thong, 1999). Rogers' (1995) framework comprised the following factors: relative advantage, complexity, compatibility, observability, and trialability. Rogers' (1995) compatibility characteristic is highly envisaged here as past studies (Austin, 1992; Austin, Trimm, & Sobczak, 1995) have considered the problem relating to physicians accepting information technology (IT) for clinical purposes. Tornatzky and Klein (1982) examined the relationship between innovation characteristics and adoption. Their findings are still valid and endorsed by recent research in IT adoption literature (Premkumar & Roberts, 1999; Thong, 1999). They emphasised the importance of Rogers' (1983,1995) model. Cost was outlined as an important factor by other researchers (Bacon, 1992; Elliot, 1996; Tornatzky & Klein, 1982). The image factor was found important to the adoption of technologies in the health literature (Little & Carland, 1991). Even though Rogers (1995) highlighted the importance of the image factor on IT adoption, he suggested that it could be studied from within the relative advantage characteristic. However, Moore and Benbasat (1996) stressed the image factor as an independent factor on its own.

Research Methodology

This research is exploratory in nature in the sense that there is no prior research in New Zealand to guide this endeavour. Case studies are appropriate for the exploratory phase of an investigation (Yin, 1994). Case studies are the preferred strategy when the research questions were "how" and "why" questions (Wynekoop & Conger, 1991), the researcher has little control over actual behavioural events, and the focus was on contemporary phenomenon within some real life context (Yin, 1994).

Accordingly, this research adopts Yin's (1994) multiple-case (comparative) design in studying two single units of analysis (holistic) represented here by two HHSs in New Zealand. As the research questions were directed at the organisational level (the unit that adopted telemedicine), a single organisation was the unit of analysis. It was emphasised that interviews were an essential source of primary data for both the outside observer and the action researcher within interpretive case studies (Walsham, 1995). Main interviewees involved in telemedicine adoption in both cases were interviewed through open-ended and focused (structured) interviews by the same researcher to minimise the investigator's bias. This approach provides perceived causal inferences (Yin, 1994). In one case, interviews were conducted with the general manager, clinical director of psychiatry and one psychiatrist registrar of KiwiCare during the period March-October 1999. In the second case, interviews were conducted with a consultant that was involved in the adoption phase of the telemedicine project utilising the video conferencing technology project at Health Waikato, a dermatologist,[2] and a dermatologist registrar during the period December 1999 and April 2000. Interviews were recorded on audiocassettes and notes were taken. The interviewees reviewed a draft of the research (during the composition phase) to validate interpretations and conclusions made. Ensure issues of external validity (i.e., the accuracy of the cases, generalisation) were not possible from two cases only.

Research Analysis

Relative Advantage, Cost, Complexity, Observability, Trialability, and Image

KiwiCare Mental Health Services (KMHS)

Late 1995, KMHS identified the need for a solution to the rural community mental health needs and the various options available in establishing a rural mental health services. The general manager of KMHS had shown keen interest in the project. He and the clinical director identified various benefits that would accrue by introducing TMVC. KMHS is one of the largest providers of mental health services in New Zealand and the general manager indicated that KMHS also desired to be a leader in the use of

[2]Now a clinical director at HW.

TMVC in mental health services in New Zealand. The rural centre is a one-hour drive from the main hospital and psychiatrists regularly visited the rural mental health patients. To provide an effective mental health services to the rural area, KiwiCare has to either establish a full psychiatric centre or ensure regular visits by the psychiatrists. KiwiCare has decided on the latter course due to financial constraints.

The general manager saw an opportunity in adopting TMVC and presented a TMVC project to the top management, which highlighted the financial gains along with other advantages. The general manager indicated that he had to present a successful business case to the top management otherwise the management would have rejected the project. The introduced business plan anticipated annual savings of NZ$ 100,000 on psychiatrists' time and on travelling expenses. The plan envisaged the implementation of the project on a lease-to-buy basis rather than requesting the whole amount of money in advance from the top management. The supplier of the video conferencing technology (VC) demonstrated the basic features of the system to the clinical director and to two psychiatrists by dialling into the regional head office of the supplier in Australia. The general perception gained was the system was not complex and was easy to operate with minimal training.

The TMVC project was finally adopted in mid 1996. Three VC systems were installed in the two hospitals and in the rural community centre using a 128 kbps ISDN link. Each system was placed in a separate room equipped with electrical and data points and a good lighting system.

Health Waikato (HW)

In 1994, HW identified the need for a solution to rural health needs. Some of HW's staff visited a few telemedicine sites in the US including the Mayo clinic in Minnesota. HW appointed a consultant to assess the feasibility of introducing the TMVC into HW. The consultant identified many advantages for TMVC in different clinical areas but pursued only psychiatry and dermatology, as they were the only departments that showed interest in TMVC. HW went through an exhaustive cost-benefit analysis to justify the investment made in TMVC. HW anticipated saving at least NZ$ 175,000 on clinician time and travelling expenses. The consultant along with the head of the dermatology department "clinical director" participated in the assessment of the TMVC system and conducted a few trials with the vendor's branches in Australia. He included clinicians during the assessment phase but their involvement was limited and not conclusive. The general perception developed that the system was not complex and with basic training it could be easy to operate.

In September 1995, three TMVC-ISDN (integrated systems digital network) systems were leased (the third one was only used for a few weeks and was returned), one of which went to a rural Taumarunui Hospital, 100 miles (160 km) south of HW, where there was a single specialist physician and a number of medical officers. The rural hospital offered no specialist surgical services at the time the TMVC system was installed but employed a specialist physician and medical practitioners. The TMVC systems were not identical at the time of adoption, e.g., the unit in dermatology was upgraded in 1998 to ISDN 128 kbps bandwidth. Two years later, another TMVC unit running at 384 kbps was installed in the main hospital for educational purposes. The initial pilot studies involved experimenting with the TMVC in conducting dermatology and psychiatry sessions. However, it was pursued in dermatology only and even that was not directly implemented. The departure of the head of the psychiatry department and the reluctance of the psychiatrists to move to another building to make the TMVC consultations lead to the failure of TMVC in psychiatry. Therefore, the system was not used directly in dermatology for a period of time until one of the dermatologist showed keen interest in the telemedicine technology and in using it. This suggested a separation between the pre-adoption and the post-adoption phases of telemedicine in HW, as the people who were involved in the pre-adoption stage were not involved in the post-adoption stage.

The dermatologist participated in the UK Multicentre Teledermatology trial run by the Institute of Telemedicine and Telecare at Queen's University in Belfast in assessing the effectiveness and the financial feasibility TMVC. HW's studies (Oakley et al., 1996; 1997; 1998; 2000) were adapted from the UK Multicentre Teledermatology studies. This networking activity allowed HW to benefit from the experience of early adopters in dermatology. These initiatives have further encouraged the use of TMVC in HW. HW considered TMVC to be an image enhancer. It would project HW as technology leaders in the region and could be approached by other HHSs in New Zealand for guidance and for consultation, as indicated by the consultant.

Complexity, Compatibility and Cost: Implications in Telemedicine Adoption

KMHS

After adopting the system, a variety of difficulties were highlighted by clinicians. The clarity of the images and the sound weren't acceptable to the psychiatrists in seeing their patients. Consequently the bandwidth was upgraded from 128 kbps to 384 kbps, where the clarity of the images had been enhanced, although the sound quality did not improve to acceptable standards. At times, the TMVC encountered many blackouts due to the unreliable ISDN connection and related equipment such as a network-bridge, which crashed when overloaded. Likewise the telecommunication company and the VC suppliers encountered difficulties in finding solutions to such technical problems. There was no dedicated staff for the installed TMVC system. Also, the lack of a dedicated help-desk facility to attend to psychiatrists' urgent technical calls created frustration.

KMHS relied on psychiatrists to move to the TMVC room in the main hospital to operate the system and to establish the connection with the rural centre. However, psychiatrists found it burdensome to leave their office and conduct a session. They had to learn to remotely manoeuvre the camera to interview the mental health patients and their families who were accompanying them. Getting patients to look at the camera rather than at the television screen was another problem. Fear of the technology (i.e., fear of touching the VC and damaging expensive equipment) and the dislike of seeing one self on the screen were witnessed among the computer-illiterate clinical staff and even among the elderly doctors. In one instance one of the nurses in the rural community centre almost fainted when she saw herself on the screen.

In order to provide proper treatment to psychiatric patients it was essential to see them in person (one-on-one). Visual images of the patients' facial reflections, hand movements, and their voices were essential and could not be compromised. The use of other technologies like audio conferencing alone or video images or photos were inadequate. However, basic follow-up techniques utilised by KMHS psychiatrists had relied heavily on telephone conversations[3] (e.g., whether patients were taking their drugs regularly). TMVC was seen as the only acceptable solution for psychiatry purposes in seeing patients and for follow-up. Seventy percent of KMHS psychiatrist activities were based on home visits (one-on-one) to their mental health patients, where the actual examination took place; patients could be seen in their real environment: where they live, the people surrounding them, etc.

Psychiatrists developed a strong opinion about TMVC (one-to-one) interfaces as being inappropriate in psychiatry. Issues concerning patients' reactions, hand movements, and facial reflections and above all the home visits and the one-on-one basis were quite prevalent among psychiatrists. The clinical director emphasised that seeing new patients always had to be one-on-one and in person, and locating junior psychiatrists in rural areas supported by TMVC uplinks was not recommended and was quite risky clinically and legally. Hence, a telemedicine uplink between a psychiatrist in the main hospital and the rural area, even with the presence of a resident junior psychiatrist, was deemed unacceptable. The clinical director indicated that tele-psychiatry is successful in Australia as the Australians are ahead of New Zealand in TMVC by many years and have developed hands on skills in going along with the technology.

One year after adopting the TMVC system KMHS was able to attract a donation from the local telecommunication provider to sponsor a psychiatrist-registrar for one year to manage and to empower the TMVC initiative within KMHS, that is, to implement and execute a protocol that would coordinate TMVC sessions and schedules. Adopting and implementing a protocol in coordinating TMVC sessions and schedules is of paramount importance to the success of the TMVC project as it allows for better cost control and efficient time-allocation and management. At the same time, the psychiatry registrar explored other opportunities where TMVC could be further utilised. KMHS was not able to have the donation renewed and the registrar had to go back to his earlier duties as a psychiatrist. The registrar indicated that he spent most of his time in responding to technical queries from psychiatrists who were using the system and in coordinating the technical visits for the TMVC supplier. The registrar concluded that TMVC should be "fast, intuitive, robust, stable, and trustworthy (FIRST)" before it could be relied on for clinical purposes.

HW

After adoption, the TMVC system was not used immediately. It was the emergence of a dermatologist with initiative to adopt the new technology that resulted in the success of TMVC in HW. The dermatologist was a "product-champion" in embracing the technology and in overcoming the various hindrances highlighted earlier. For example, technological problems proved frustrating

[3]One of the earliest forms of telemedicine.

as the TMVC encountered many blackouts due to unreliable ISDN connections and TMVC equipment. This resulted in the cancellation of several TMVC consultations. The 128 kbps connection and single chip video camera was not sufficient to produce high quality images. There were concerns regarding the accuracy of clinical diagnosis made with the TMVC compared to face-to-face consultations. The dermatologist could diagnose skin diseases in person, by biopsy, and/or choose a watch-and-wait policy to make an accurate diagnosis. Replacing this traditional practice, in light of the observed technological complications concerned the dermatologists. Later on, other dermatologists were trained to use the technology and reported no difficulties in using the system for clinical purposes or in familiarisation with the implemented protocol. The dermatologists indicated that it was possible to overcome some of these technological barriers by developing experience with the TMVC system. Also, the study of Oakley et al. (1997) concluded that TMVC could be used with a reasonable degree of accuracy in dermatology. Thus, proving its effectiveness as a follow up tool such as seeing patients with known skin diseases where the TMVC is used for interview rather than detailed diagnosis. TMVC in the remote site was situated in a room that had not been specifically prepared for telemedicine. The lighting was poor and the wallpaper was disturbing. This resulted in having poor quality images and consultations.

After adoption, HW implemented a cost benefit analysis – part of the UK Multicentre Teledermatology trial (Oakley et al., 2000). Findings revealed that TMVC consultations were less time consuming and were less costly for patients than hospital consultations. Further, the average consultation time was similar to traditional appointments. Waiting-time was reported to be less than traditional dermatology consultations (Oakley et al., 1998). Oakley et al., (2000) indicated that the economic benefits of TMVC favoured the patient rather than the secondary health provider. HW addressed other impediments. For example, the dermatologist highlighted that reimbursement is in fact a critical factor that has contributed to the lack of expansion of the telemedicine network. The "provider" (HW) depends on payment from the "purchaser" of health services - one of the difficulties in NZ is determining who should pay for remote consultations when these are in a location where HW does not offer a face-to-face service. This might be a problem in the long run. Licensure was not much of an issue until recently, when it has been necessary to introduce a credentialing system to each department and its medical staff. Credentialing extends to teleconsultations requiring appropriate training. The dermatologist further commented that the legal situation for telemedicine consultations is not clear here or anywhere else.

Cross Case Analysis and Discussion

This research suggests that factors such as relative advantage, cost-effectiveness, observability, trialability and image were contributors to the adoption decision of TMVC in the two cases. It could be suggested that the first two factors were the main drivers for TMVC adoption in the two cases and the other factors influenced the adoption decision but they were not significant. This substantiates Bacon's (1992) findings, which indicated that organisations adopt IT projects based on their support for explicit business objectives (e.g., relative advantage) and on their cost effectiveness. It was suggested by the literature (Perednia & Allen, 1995; Wayman, 1994) and from the cases that TMVC could provide different advantages to both HHSs in seeing rural patients and in integrating medical care delivery across the different dispersed rural patients and centres. This would encourage effective and quality medical care around the two HHSs. The return on investment (ROI) analysis seemed promising and this was essential to guarantee TMVC adoption by the top management level. Techniques such as lease-to-buy are well justified tactical strategies to hedge against the initial large investment on the TMVC technology.

It is suggested in this research that both the trialability and the observability are important determinants. However, they were not examined thoroughly in both cases. For example, the results of using telemedicine and enthusiasm that surrounded TMVC (Grigsby & Allen, 1997) in other countries such as Australia, Ireland, and the U.S were "observable" to the cases. However, only HW attempted to benefit from the experience of earlier adopters in the dermatology area in furthering its TMVC initiatives but this step came only after adoption. As for the trialability factor, neither case experimented (trialled) extensively with the TMVC equipment before adopting it. This process could have assisted in spotting some of the incompatibilities of the technology in health care delivery in both cases. Image played a role in the adoption decision but was not a significant one. There are more important and urgent clinical issues (e.g., cost/benefit, ROI) to consider than enhancing the organisational image. The image factor might play a role at the initial stages of adoption and as a driver for adoption but it was not an essential one.

This research found that the two main drivers of adoption (relative advantage and cost) and other accelerators (image, trialability and observability) were not sufficient to guarantee TMVC use in both cases. The compatibility of the technology with the specialists' practices seemed to introduce a serious challenge. The complexity of the technology at that time (mid 1990s) further aggravated the effective use of the TMVC technology. The TMVC equipment, the bandwidth, and the technical support have failed HW and KMHS on several clinical occasions. Although HW used the TMVC system more than KMHS, the adoption of TMVC and its subsequent utilisation in health care delivery was limited in both cases. The failure of the TMVC equipment in

providing accurate and clear images raised doubts about the success of the technology as a suitable medical tool. The cases concluded that TMVC is adequate as a supplementary medical tool to the existing medical practices (e.g., follow-up). Although the dermatologist in HW emphasised such shortcomings could not be detected easily by experimenting "trialability" with the equipment before adopting it and pointed to the fact that training and developing experience with TMVC takes a long time. Even if the HHS opted to lease the TMVC equipment and not to buy it immediately, still, the TMVC is a large project and there are other costs involved in allocating resources, staff and time to trial and to assess the technology. The task of integrating the TMVC into core clinical practices to witness its true effectiveness is indeed a very challenging task and therefore, a long trial period is needed to judge the true effectiveness of this technology. However, this does not mean ignoring the trialability perspective completely as it could assist in capturing some of the TMVC incompatibilities prior to adoption (e.g., unsuitable images). Interestingly, the clinical applications in both cases (dermatology, psychiatry) differed drastically; this might raise issues pertaining to practice-specifics. However, both practices needed clear images (and sounds in the case of KMHS only) to make accurate diagnoses and thus, TMVC did not progress beyond this point to raise any specifics. It is worth investigating the preceding assertion by examining the experience of other advanced adopters in the world in these two clinical areas at least.

This research emphasises the importance of having a "product-champion" for the successful uptake and use of TMVC. According to the research analysis, two forms of "product-champions" emerged in this research (Figure 1).

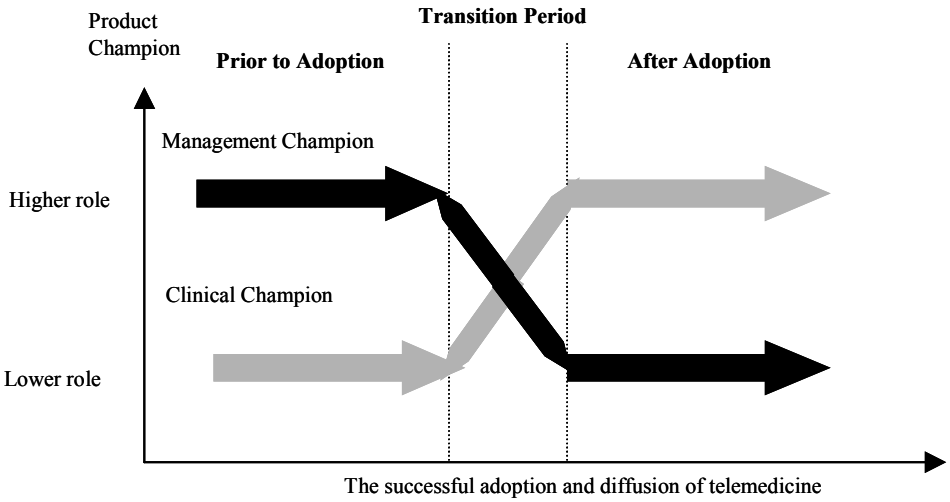

Figure 1. Product-Champion and Telemedicine Adoption and Diffusion.

Firstly, the managerial champion, represented here by the significant role of the general manager of HW and KMHS specifically, who identified the idea and embraced it to the end. This role is very important as a significant precursor to the adoption decision. Preparing a rigorous business case could lead to telemedicine adoption (Table 1). As demonstrated in this research creating this business case is not an easy task due to the scarce resources available to hospitals and to the novel nature of the TMVC technology, which could raise many questions about its viability in health care delivery. Without the administrator's financial and managerial skills in HW and above all, had he not retained that strong enthusiasm for the TMVC technology, the management could have easily rejected the project. However, this manager still needed vital clinical information and endorsement from specialists and clinicians (Table 1). Secondly, the clinical champion after adoption represented here by the significant role of the dermatologist in HW specifically. Without this clinical champion in HW the project would have failed to progress after its sharp fall immediately after adoption. After adoption, the dermatologist joined the UK trials in order to benefit from their experience with dermatology and replicated their studies within HW. This dermatologist showed keen interest in the technology and in using it and this has resulted in several research studies (Oakley's research, references section) addressing different clinical and financial areas in relation to this technology in HW. This dermatologist strived to upgrade the system and to make it work professionally in a clinical setting. Even with such upgrades, the system failed to provide accurate images and colours of skin-diseases. The dermatologist worked with these shortcomings in the technology and attempted to develop her expertise in dealing with such colour variations. This process is important to health providers, as it points to the importance of overcoming such incompatibilities and of working around such shortcomings. The role of the dermatologist in HW in embracing the TMVC technology was more apparent than the role played by either the psychiatry-registrar or the clinical director in KMHS. Indeed, more work is needed to understand the key distinguishing features of the TMVC-champion in greater detail, e.g., personal drivers.

Table 1. Product-Champion's Role in Telemedicine Adoption and Diffusion

	Prior to Adoption	After Adoption
Management Champion	1- Implement cost-benefit analysis 2- Identify other non-medical benefits 3- Identify intangible benefits and attempt to quantify them. 4- Identify risks and consequences: legal, re-imbursement, privacy & security, finances and future costs 5- Prepare successful business case Including finances. 6- Empowerment & leadership	1- Compare actual costs with planned ones 2- Assess the encountered risks 3- Plan for future upgrades & replacement 4- Is the system profitable or provide high medical value? Take a decision 6- Continuous empowerment
Clinical Champion	1- Identify clinical area and medical benefits 2- Assess the medical environment & Staff 3- Trial with the system to identify complexity & compatibility issues 4- Identify risks: legal, re-imbursement, licensure, privacy &security, and usability by staff. 5- Plan for integrating telemedicine in the clinical area and put a protocol in place. 6- Put some medical expectations and measures 7- Empowerment	1- Assess clinical results & outcomes against the devised measures & benchmarks - modify accordingly. 2- Usability in the different clinical areas: diagnosis, treatment, follow-up, etc. 3- Is telemedicine beneficial to physicians, staff, hospital, patients? Take a decision 4- Plan future expansion and integration, e.g., join a network 5- Continuous empowerment & leadership

As shown in Figure 1 and Table 1, the suggested intertwined role of both the administrator/manager and the clinician is very important for TMVC adoption and diffusion. Initially the administrator/manager should play a leading role supported by the clinical-champion to guarantee telemedicine adoption. After adoption the clinician-champion should take the lead in activating the TMVC system, supported by the administrator-champion. As a business model, telemedicine will always need continuous financial support and justifications.

Despite the reported technological impediments, this should not have led to its ultimate rejection in the case of KMHS and to its limited use in the case of HW. Having concluded the importance of TMVC as a supplementary medical tool in both cases, it should have been used extensively in that context. However, it could be suggested here that the one-hour trip to the rural area and the small rural population served by KMHS would not justify this approach. Further, the clinical director believed that the TMVC technology was inappropriate in seeing psychiatry patients in the first place. HW's trials showed that the scope of the TMVC system was not financially justifiable. This will not convince the management of HW in investing any further in the technology, as they would have other prioritised issues. It was suggested from the research analysis that TMVC was experimental and that KMHS was unable to use the system and HW was unable to progress its TMVC system any further.

The developed technological innovation framework has assisted this research in explaining key issues pertaining to the adoption of complex technology such as TMVC in two cases in New Zealand. Rogers' (1995) compatibility characteristic has revealed essential social and cultural implications within the psychiatry and dermatology practices in HW and KMHS specifically. The research findings support the literature in that few patients were seen through the telemedicine for medical purposes (Perednia & Allen, 1995). The literature reported that the majority of the online time is used for medical education and administration (Wayman, 1994; Perednia & Allen, 1995; Hassol, 1996). However, this research reported the limited use of TMVC in these areas as well in both cases. Further, this research was able to substantiate that the important unresolved issues revolve around how successful telemedicine can be in providing quality health care at an affordable cost and whether it is possible to develop a sustainable business model that would maintain profitability over time (Hassol, 1996).

Telemedicine could be very important to HHSs in New Zealand in providing considerable savings in money and time and in solving the shortage of specialist staff in rural areas specifically. This could only be realised if telemedicine starts to generate autonomous momentum and economies of scale. This entails networking with other HHSs in New Zealand to build such foundation of speciality services. The problem for the New Zealand perspective is the lack of coordination and cooperation amongst the different HHSs (NZHIS, 1995). This research highlights the importance of bridging this gap and calls for the direct involvement of the different stakeholders in health care delivery in New Zealand, including the purchasers, in crossing this chasm.

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