Use of PDAs in a wireless telemedicine system

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ABSTRACT

Objectives: To see if senior emergency nurse practitioners can provide support to inexperienced ones in a Minor Injuries Unit by using a wireless LAN system of telemedicine transmitting images to a PDA when they were on duty. In addition, whether such a system could be sufficiently accurate to make clinical diagnoses with a high level of diagnostic confidence. This would permit an overall lower grade of nurse to be employed to manage most of the cases as they arrive with a proportionate lowering of costs.

Methods: The wireless LAN equipment could roam in the Minor Injuries Unit -and the experienced emergency Nurse practitioners could be at home, shopping or even at a considerable distance from the centre.

Thirty pictorial images of patients who had been sent to the Review Clinic were transmitted to a PDA various distances of one to sixteen miles from the centre. Two senior emergency nurse practitioners viewed the images and opined on the diagnosis, their degree of confidence in the diagnosis and their opinion of the quality of the image.

Results: the images of patients were sharp, clear, and of diagnostic quality. The image quality was only uncertain, as was the level of confidence of the diagnosis if the patient was very dark skinned.

Conclusions: The wireless LAN system works with a remote PDA in this clinical situation. However there are question marks over the availability of enough

experienced emergency nurse practitioners to staff a service that provides senior cover for longer parts of the day and at weekends.

KEY WORDS: PDA, personal digital assistant, wireless LAN, wireless local area network, wireless telemedicine, minor injury unit, waiting times, out of hours care.

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Introduction

The most frequent use of telemedicine is a videoconference link between a generalist in one hospital and a doctor elsewhere.[1-3] Teleconsultation may ultimately turn out to be the fastest evolving branch of Telemedicine, constantly embracing new technologies to make health care delivery faster and more accessible. A system using wireless technologies represents one of these new trends in the teleconsultation field and has been described before.[4]

There is now greater emphasis on managing all cases quickly and effectively due to the UK governments waiting time directive that demands 90% of Accident & Emergency department patients are treated and discharged or admitted in four hours.[5] This will now been expanded to include Walk In Centres and Minor Injuries Units. It is likely that other countries in Europe will follow and establish similar guidelines for timely care.

We had used telemedicine extensively at the Minor Accident and Treatment Centre [6] but the equipment was not being used after the consultant offices at the main hospital were rebuilt.

Material & Methods

Permissions:

The main and subsidiary projects were approved by the Ethics Committee in 2002. If patients, their images, or any other information was used for transmission, permission was sought from the patient.

General description of Wireless LAN with PDA system

The system consists of two main parts: A wireless LAN enabled laptop computer with a high end video or still camera captures images of patients and transmits them via an access point in the ceiling to the unit's wireless LAN system. Wireless LAN is

a local area network which is established without any wires. Because the laptop and the camera have their own power sources, there is no need for either bulky equipment, which is difficult to transport from one place to the other or lengthy cables that would run in the hospital floor.

An experienced ENP carries a wireless enabled PDA (personal digital assistant) with her when on duty. Still images along with video and sound can reach the ENP's PDA on which she can view images and discuss details on a mobile phone with one of her juniors. It will also be possible for her to use a combined phone and PDA if she prefers. She can also roam very considerable distances of miles from the hospital were she to be on duty; the only caveat would be that she would need to be near a hot-spot for wireless LAN connectivity. She would be contacted initially on her mobile phone and told to stand by for receiving images by moving close to a wireless LAN hotspot. She would receive images on the PDA and would advise her junior on the basis of what she saw on the screen by talking to the junior on her mobile phone.

The Minor Accident and Treatment Centre

The Minor Accident and Treatment Centre was started in 1996 at a community hospital. The function of the centre is to provide easy access to injured persons with minor and moderate injuries and also to patients who would generally have gone to see their GP but who have failed to obtain an appointment sufficiently quickly. The construction poses few problems for the wireless LAN.

The receiving points

One of us would carry the PDA at distances of one to sixteen miles from the unit and in theory the person could have been in Scotland if they so wished. The only caveat is that they would have to be near a wireless LAN hot spot. These are now profusely distributed in stations, cafes, restaurants, cinemas and shops.

The experienced ENPs:

Two ENPs with many years' experience of seeing injured patients and of giving advice to junior nurses.

Pictorial Images:

Thirty pictorial images were used of patients who had been referred to the accident & emergency consultant's Review Clinic by the junior nurses. The A&E consultant had made his own diagnosis in the face-to-face consultation. Images were captured by one of the consultants with a digital camera connected to a laptop and transferred via the wireless LAN to another of us at a variable distance of 1 – 16 miles from the unit. The images were captured and stored on a wireless enabled PDA in the pictures folder. At the next opportunity, these images were shown to one of the experienced ENPs.

Level of confidence in diagnosis:

This was described as: 5 = certain, 4 = 95% certain, 3 = 80% certain, 2 = 50% certain, 1 = uncertain.

Quality of image:

This was defined as: 5 = excellent, 4 = very good but not the same as face to face, 3 = somewhat attenuated but diagnosis still possible, 2 = poor image, 1 = very poor image.

RESULTS

The results are shown in Table 1.

The quality of the pictorial images was excellent except in one person who was very dark-skinned. The level of confidence of the readers was remarkably high. It was also gratifying that both the senior ENPs came to the same conclusions on all the pictures.

DISCUSSION

Methodology:

The system has been tested using 30 clinical examples on two experienced ENPs. The power of the study could have been increased by testing more ENPs against a larger sample of images. No images of radiographs were tested because the Centre has a system by which the radiographers mark x-rays, which they think show abnormal findings with a red dot; thus providing a considerable level of safety for the junior ENPs.

Performance Measures:

There are still no well-accepted methods of assessing the sound and images of telemedicine. A system for comparing telemedicine with face to face consultation had been devised in the accident & emergency department of Central Middlesex Hospital for conventional video conferencing equipment [7]. A system of evaluating the level of diagnostic confidence had also been described [8]. When images have to be read by the ENPs, a simple system has to be used. A practical system devised for one of the observers was used and is described above.

General performance level:

The ENPs agreed that the system worked well. It was easy to use in all areas because it avoided the problems of heavy equipment and trailing wires. The quality of the images was most often impressive. Diagnosis was feasible with the information available, although there were times when it would have been useful to be in physical contact with the patient. Looking at the images on the PDA could be a problem in bright sunlight so the senior ENP would need to move to a shaded area to be able to see properly.

Applicability:

ENPs felt that they could not derive as much benefit from the equipment because of the current level of staffing. However, when the PCT takes over the unit, it will be looking to reduce the level of experience of at least one of the ENPs. If junior nurses are employed, there is the possibility that further reductions in seniority can be managed with the system that has been described in this paper.

Managers saw the possibility of using the system late evenings on weekdays and the weekend. It is accepted, that there are not the number of senior nursing staff available in the specialty. It is also generally envisaged that the hospital service cannot suddenly slow down in the evening and on weekends when there are emergency cases that present all the time. Clearly there are going to be major changes in the workplace in medicine with the use of this type of technology and these have been discussed in another earlier paper [9].

Alternately the possibility of co-operative working between hospitals will have to be considered if the application of the technology is too expensive for the treasury or too onerous for the doctors. Such an example was shown to be possible in the management of the eclipse in Cornwall where a range of doctors in different parts of the country participated [10].

Wireless technology

Other groups have demonstrated the success of wireless LAN but none has done a comprehensive study to show its effectiveness in clinical diagnosis.[11-13].
It is inevitable that in many developed countries, there will the uniform use of digital radiology but the need to be able to see the patient or an ECG or other output will remain and so the wireless system that has been described will not become redundant. It will probably sit side by side with the digital radiology system.

The use of PDAs

Today, as PDA's technical characteristics improve, an increasingly large number of new applications emerge. With hardware specifications that can compete with an average desktop computer (CPUs running at 1GHz, memory of 256MB, TFT colour screens, internal support for wireless network and even fingerprint security), PDAs found their way into a large number of professional applications, including healthcare delivery.

However, within the healthcare sector, so far, they have been limited to conventional applications [14 - 17]. One of these is point of care trauma documentation by nurses [16]. It, like this application, needs to be assessed after it has been in use for some time.

- Support for patient database access for drug prescription: healthcare staff found PDAs a convenient tool for bed-to-bed survey and update of patient information and drug prescription.
- Wired or wireless view of medical imaging: Despite their screen size limitation, PDAs can still display efficiently a still medical image (x-rays, MRI, CT, etc). Zooming in and measurement abilities provide an extra tool for doctors or consultants while allowing for complete mobility.
- Support for general applications: These include appointment keeping, Internet access, network support, printing, etc.

We have shown a new and novel way of using PDAs, which may be adopted some time in the future. Our optimism is based on a recent international report that says that nurses are happier using telecare. [18]. It defined “telenurses” as any nurse who routinely uses information technology to deliver care over a distance. 75% of those surveyed called for a professional certification in telenursing, and 89% agreed that telehealth should be included as a matter of course in their nursing education.

CONCLUSIONS

The Wireless LAN system is capable of being used for clinical diagnosis from a remote area with an ENP using a PDA. In theory, this can be from anywhere in the land, which has a wireless LAN hotspot.

However, the issues of numbers of emergency nurse practitioners, rotas and cost of staff have not been addressed and in that sense this is just a beginning.

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