

The Handheld Computer for Surgeons Helper or Handicap

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Abstract: The demand for documentation is increasing. Modern information technology led to pocket size computers. Our aim was to develop an affordable system to improve documentation quality. Personal digital assistants with dictation function were tested and compared to digital dictation devices. Dictation was easier to learn with digital dictation devices than with PDAs. There were no significant compatibility problems with the hospital network. The use of PDAs may be a further step towards real time and complete documentation. In our setting the PDA showed little advantages for improvement of documentation and was less favoured by users.

Key words: Documentation, PDA, handheld computer, surgery, handicap, helper

INTRODUCTION

Modern healthcare is characterised by increasing bureaucratic demands, the induction of standardised quality management, rational decisions and economic goals. Considering the introduction of a Diagnosis Related Groups (DRG) system in Germany, the importance of thorough medical and surgical documentation will grow. Additionally, patient care could be optimised if diagnostic and therapeutic strategies were documented clearly and decisions were made transparent.

Therefore, affordable and safe systems for documentation are needed that are easy to use and time saving. This goal might be achieved with the use of portable electronic devices that are communicating with an existing stationary network and allow real time documentation (Gillingham *et al.*, 2002; Goldblum, 2002; Harris, 2001).

Portable pocket size computers are increasingly used in the last few years thanks to new developments in the computer industry. They are called handhelds or Personal Digital Assistants (PDA). Koop and Mosges (2002) showed that mobile computers can be helpful if certain conditions are met.

The aim of our trial was to implement high quality bedside documentation by using handheld devices without purchasing an expensive system especially developed for

hospitals. We wanted to evaluate the advantages and disadvantages of the small computers alone without a complete soft- or hardware extension. We tried to involve staff that was less electronically skilled by choosing PDAs that can be used for dictation, too. These devices seemed to be ideal since dictated text could be read on the display during the next days without printout. We also used digital dictating machines for comparison.

We assessed both methods for their practicability on a surgical ward and their cost effectiveness. Both devices allowed the storage of large sound files. However, in contrast to conventional dictating machines PDAs can communicate with intranet based hospital computer systems and Patient Data Archiving Systems (PACHS) when the required interface is available. Furthermore, PDAs can display text and notes on screen.

Important aims of our trial were to assess the quality of documentation, the integration of accumulated data into the digital medical record, the compatibility with our existing hospital network and the cost effectiveness of each system.

MATERIALS AND METHODS

We used two Windows-based PDA-devices. They were produced by Compaq (model ipaq pocket-pc 3130, operating system Windows CE Version 3.0) with touch

screen-display and 16 Megabyte (MB) memory. The digital dictation machine was manufactured by Olympus (model DS 150) with 8 MB flash memory. Each PDA cost ca. 500, the digital dictating machine ca. 170. No additional software but the basic configuration was used for financial reasons.

Both devices can record a dictation of several minutes length and store it using the formats *.wav and *.dss. The handheld computer saved the files under Notes of the Windows-CE operating system. No external microphone was needed for the PDA's or the dictating machine as they had an integrated microphone. Additionally, surgeons can enter progress notes in the PDA by using their handwriting or a display keyboard. Predefined text blocks can be used.

Records were kept the following way:

- A patient's condition or progress notes were documented using the PDA or the dictating machine.
- The PDA was connected to the hospital computer network.
- The voice files were transferred to the typing service department.
- The text files were saved.
- The text files were transferred back to the PDA devices.
- The notes were integrated into the electronic medical records.

After finishing the dictation of the progress notes the voice files were transferred to the hospital computer network using commercially available docking stations for the PDA's. The transferred files were then sent by e-mail (Microsoft Outlook) to the typing service department where they were typed. The text was saved in the Patient Data Archiving Systems (PACHS) and integrated into the electronic patient record. Each record was updated daily by adding new progress notes. The typed progress notes were also send back to the handheld device. The surgeons had access to this record on each hospital computer that was connected to the network. At the time of discharge from hospital all progress notes were printed and archived in the patients file.

We used 2 PDAs and one digital dictating machine to assess the practicability of the concept above. One handheld was used by doctors in training with good computer skills, the other was used mainly by senior surgeons with only little interest in computers. In a second phase both groups used the digital dictating machine. No doctor received intensive training before

using the devices. This enabled us to assess the need for such a preparation based on pre-existing knowledge.

All devices were used for the documentation during daily ward rounds and on-call patient assessments. They were tested on a 30 bed unit for general and abdominal surgery. There was no parallel hand written documentation during the trial period.

The devices were synchronised with the stationary network several times a day: In the morning, at the beginning of the working day, the updated progress notes of the PACHS database were transferred to the PDA's. After the ward round all dictation was transferred to the network. During the day PDA's were synchronised when their memory capacity was reached.

RESULTS

One to four weeks were needed to gain experience with the handheld computers and dictating machines. The users were able to use the devices for dictation and could synchronise them with the network.

No user preferred to enter data into the PDA's by using the hand writing recognition function. Even computer skilled user judged this method to be less feasible for daily work.

The handheld computers could be used to create to do lists by using the handwriting recognition. The devices transformed handwritten text into a Microsoft Word-Document that could be printed off after synchronisation. Additionally, the PDAs could be used to write e-mails using a mobile version of Microsoft Outlook. Furthermore, medical literature, drug lists, laboratory reference values and guidelines for medical coding could be installed. The infrared interface allowed direct data transfer between the devices. However, after the novelty effect had worn off these functions were not used anymore.

In comparison with handwritten documentation in the patient's notes the dictation method was significantly less time consuming and improved the quality of the data at the same time. All progress notes were detailed and well legible since they were printed.

The PDA's dictation function did not include a fast forward or fast rewind option. This fact was criticised by the users. Once a text had been recorded it could not be corrected but only replaced by a new dictation. The standard memory of the 179 g heavy, palm sized handheld computers was limited to 16 MB which was relatively small capacity, according to the amount of data that was produced daily on a regular surgical ward.

The PDAs used a mono format (8000 Hertz, 8 Bit, minimal 8 KB/sec.) for dictation. This led to notably reduced quality of the voice files. The high quality recording (11 KB/sec.) used up the memory capacity more rapidly. Ward rounds had to be interrupted for synchronisation when the memory capacity had been reached (5 MB of 16 MB could be used for voice files). Thus we had to compromise between sound quality and memory quantity.

The 70 g heavy digital dictating machines were used without difficulties. The device is compressing the digitalised sounds into a more compact format (*.dss) using its 8 MB flash memory. Thus, the voice files occupied only 102 KB/min in standard operating mode and 47 KB/min in the memory saver mode. There was no memory overload at any time. Furthermore, the sound quality of the DS-150 dictating machine was clearly superior to that of the PDA's in standard mode. The fast forward and rewind functions were very useful. Each dictation contained an 8 figure number code. Four of these could be used for the patient identification. The total time available for dictation was 160 min.

The main disadvantage of the digital dictating machine was that software was required to synchronise and replay the *.dss-files. This program allowed the typist to use pedals for replay similar to those used for analogue machines. In general, using the dictating machine required less training than using the PDAs. We did not encounter any difficulties installing the software and hardware needed for synchronisation of the mobile devices with the Windows NT network. Equally, sending voice files via e-mail (Outlook Mail attachment) was easy to handle. The secretary in charge of typing the voice files into the PACHS database (software: OpenMed by GWI) could use the software required for replaying *.dss-files without problems. Other software that was used (Outlook and Windows Media Player) were familiar to the typist already. The software for digital dictating machines was similar to analogue machines and was preferred to the PDA's sound files by the typing staff. The integration of the progress notes into the medical record posed no problem. The PDA as well as the digital dictating machine allowed a frequently updated, real time documentation of information relevant to the patient's hospital admission.

The use of PDA enabled the surgeons to view previous progress notes immediately during the daily ward round. When using a dictating machine these notes had to be printed every day, creating a large amount of paper waste (Table 1).

Table 1: Advantages-disadvantages of handheld computers for medical documentation

Disadvantages	Advantages
Insufficient memory (dependent on handheld type; dictating machines have sufficient capacities)	Good documentation
Handheld dictation function not user friendly	Reduction of workload (no handwritten documentation)
Difficult to type (replay function of handheld inferior to dictating machine)	Legible progress notes
Need for training	Integration of progress notes into digital patient record
Few software installations in basic configurations	Memory functions for appointments and dates (hardly used)
Network connection for handhelds more difficult than for notebooks	

DISCUSSION

We reached our aim to improve the speed, quality and quantity of surgical documentation. We succeeded in integrating the progress notes from PDAs or digital dictating machines into the general medical record. In contrast to handwritten notes digital notes were easily legible, more detailed and showed fewer gaps. Furthermore, the notes could be viewed on every stationary computer linked to the hospital network and more patient specific information was available for referrals to other departments (endoscopy, radiology, etc.). Additionally, writing discharge letters was easier when using the digital progress notes. In summary, we were able to improve the quality of documentation with a conventional set of devices on a low-budget base and did not need any expensive software extensions.

These advantages of portable computers have been described previously. Blackman *et al.* (1999) claims a PDA based system for processing patient data and schedules to be superior to conventional methods.

The use of a digital dictating machines was easier to learn than the use of PDAs. Although the additional features of the PDAs were initially interesting the enthusiasm to use them wore off after some time due to the lack of practicability to use these features in the daily routine. Considering the small size of our project we did not encounter major difficulties.

A variety of advantages of portable computers have been noted by Embi (2001). However, they don't seem to be applicable to our setting as the data entry for regular documentation is slow and awkward.

Although the accumulated data is of high quality it is only useful to the surgeon if they are available for the daily routine at the bed side (e.g. on ward rounds). Regular printouts don't solve this issue but create a vast amount of paper filled with redundant information that might differ by two lines at the bottom of the page only.

For that reason, we initially favoured the use of handheld computers. These devices can display text on their screen. Thus, all information can be carried by the surgeon in his pocket. However, realizing this concept was more challenging than expected and the PDA was hardly used for this purpose. The limited memory capacity of the PDAs hardly allowed the storage of all documented data. Only when using the low quality recording mode the data of all patients of our 30 bed unit could be stored and synchronised on a PDA without interfering with the memory needed for dictation. Unfortunately, in this mode the dictations were difficult to understand on replay. Furthermore, text that was edited by the typist for the digital medical record could not be transferred to the PDA directly but had to be copied and transferred using the PDA communication software. Integrating PDAs into the PACHS database will only be possible when new interfaces are introduced. This, however, would have required a significantly higher budget, what we wanted to avoid in this trial (Waegemann and Tessier, 2002; Wilcox and La Tella, 2001).

The acquisition of PDAs was more expensive than buying digital dictating machines considering their use for dictation only (ipaq 3130 VP ca. 500, DS-150 VP ca. 170). The PDA dictation function was also less convenient due to the poor sound quality and the lack of a rewind function. Frequently, the stored data exceeded the memory capacity but memory extensions are costly. We were able to improve the quality of the documentation and to shorten the required documentation time. We preferred using dictated documentation, as it was easy for the surgeons to learn. For this method digital dictating machines are more feasible. They offer a cheaper option combined with higher quality. Handheld computers can not only be used for scheduling dates and appointments but also offer also Microsoft Office software, e-mail applications and internet access. However, these features were hardly used. Integrating the devices into the digital medical record would be expensive and difficult to realise without a special system.

Larkin (2001) mentioned in his study that handheld computers can be useful for healthcare professionals but emphasises that a wireless network is important for their implementation.

In our project the use of dictation device was preferred to reach the goal of a better documentation quality in less time. The use of PDAs for this purpose was more expensive, required more intense training or teaching with the device and needed more time for dictation than the digital dictation devices. The computer functionalities of PDAs were hardly used and the users would prefer the dictation device in the daily routine.

Perspective: Digital dictation can improve medical documentation and reduce the workload of doctors. Digital dictation machines can record and transfer voice recordings via a stationary hospital network to a typing service department where they are transformed into text files without time delay.

In our setting the use of PDAs was disappointing in some points, especially in assessing and updating the text data. In order to improve the availability of these text files during the daily routine we are thinking about the use of laptops on the notes trolley that are connected by a Wireless Local Area Network (WLAN). This could enable the surgeon to access a patient's record at the bed side without the need for expensive software or limitations of memory capacity. With this result the PDA failed to show advantages to make it a helper for the surgeon.

With special speech to text software for typing the dictations in text files, the use of laptop computer systems connected to the hospital network online and wireless will be favourable in the future in combination with digital dictation machines.

CONCLUSION

Today the need for extended documentation is obvious and new devices of modern information technology with pocket size computers seem to be helpful. The aim of this study, was to install an affordable system to improve the quality of documentation. The system was supposed to allow digital day to day documentation and to be compatible with the hospital network.

For this purpose commercially available Personal Digital Assistants (PDA's) were favoured and compared to digital dictation devices to demonstrate the possibilities of these machines. With the devices daily routine documentation was done on a surgical ward, the text files were saved for each patient on the PDAs and new data was added.

Within the study we found dictation to be easier to learn with digital dictation devices than with PDAs. There were no significant compatibility problems with the hospital network. The transfer of digital voice recordings to the network and the workstations was without major difficulty. Currently, the progress notes are sent electronically to the PC-workstation and are re-transferred to the PDA's later. This process, especially the synchronisation of PDA's was problematic. Additionally, the handheld devices were used mainly for dictation, the additional features of the PDAs were hardly used even by computer skilled users.

The use of PDA's may be a further step towards real time and complete documentation. However, we encountered greater difficulties than expected with regards to training and technical implementation and found simple digital dictation devices to be more helpful in our setting. The advantage of using PDA's for this purpose remains to be proven.

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