

# From semi-mobile to mobile work? Possibilities and constraints for hand-held computer use in home health care

Hughes T, Karsten H, Konttila J, Järvi S.  
eija.karsten@cs.utu.fi  
thomas.hughes@cs.utu.fi  
Finland

**Abstract:** This paper discusses the possibilities and constraints for using mobile computing in home health care by examining the work of home health care nurses in the city of Turku, located in the southwestern part of Finland. Home health care differs from other forms of health care by being 'semi-mobile'. Approximately half of a nurse's day is spent making visits to the homes of patients and the other half is spent at a shared office. While in the office, the nurses, among other things, enter information into a patient information system and communicate with other nurses present. By following the work of nurses, we found several possible applications for mobile or hand held devices. Mobile access to a variety of information sources and improved communication possibilities seemed valuable and appeared to offer possibilities for both improving the quality of the nurses' work and allowing the nurses to spend more time with their patients. In our study, however, we also found that the special nature of the work of home health care nurses sets many important constraints which must be taken into consideration before the work of home health care nurses can become truly mobile. Among other things, we found that the visits the nurses make to the office are more than just mandatory visits required for entering patient information and reporting the day's events to other nurses.

**Keywords:** home health care, mobility, hand held computing

## 1 Introduction

In the last years, information technology has been introduced to support or even enable mobile work in several professions (e.g. journalists: Fagrell [Fag00], and delivery van drivers: Kakiyama and Sørensen [KS02]) and as a result, the concept of mobility has been explored and expanded by numerous researchers. Fagrell [Fag00] argues that all work can generally speaking be seen as mobile, since all employees move around their workplace, meet customers and other workers, and often also travel between different work locations, such as offices. This geographical perspective to mobility has also been explored by Luff and Heath [LH98], who have approached the issue by dividing mobility into micro, local and remote mobility (see Table 1).

This kind of classification according to geographical movement, however, is just one way

Micro mobility	The mobility of objects, for example papers within an office or even around a shared desk
Local mobility	Mobility within rooms, an office or between floors or buildings
Remote mobility	Mobility where the participants interact remotely using some form of technology

Table 1: Levels of mobility (Luff and Heath [LH98])

to approach mobility. Kakahara and Sørensen [KS02, KS01], for example, examine mobility using three interrelated dimensions: spatial, temporal and contextual. With these dimensions, they argue that the concept of mobility can be expanded to encompass much more than just geographic movement.

In this paper, we look at the work of home care nurses, or home visitors as they are called in some countries. The work of these nurses can be divided into two different activities: home visits to see patients and work carried out at a fixed office. Using the definitions given above, the nurses' work can be categorized as mobile according to several classifications. The nurses' work is unquestionably mobile from a geographical perspective, and using the definitions by Kakahara and Sørensen, it can be classified as mobile in other ways as well. For this paper, however, we have chosen to describe the nurses' work as 'semi-mobile'. The main reason for this is that we want to make a distinction between the nurses' work as it is now, where the nurses spend up to half of the day at the office, and work as it might be with the help of hand held computers, where the nurses might spend considerably less time at the office and correspondingly more time on the field. It appears that in the case of the nurses, true mobility can be achieved only when they no longer need to visit the office as a part of their day, but instead can work in the field for at least the majority, if not the entirety of a day.

The data for this paper was collected during 2001 in three nursing districts in the city of Turku in the southwestern part of Finland. The data was mostly collected using group interviews and by closely observing the work of home care nurses. Observation was chosen as a means for data collection, because it was essential for the study to see in detail how the nurses carry out their office work, how they communicated with each other and how the various papers and other tools were involved in this communication. The names of the people in this article have been changed to protect their privacy.

## 2 The work of a home care nurse

The work of a home care nurse can be divided into two different activities: home visits and work carried out at the office. Time is divided evenly between these two activities. Tuomisto [Tuo97] found that on weekdays approximately 45% of the nurses' working time is used for nursing patients at home and 49% is used for office work such as reporting, planning and organizing work. In the following description, we have divided the work of a home care nurse in to three areas: patient allocation, home visits, and office work and

reporting.

## **2.1 Patient allocation**

Two to four nurses work for each district, each nurse taking care of approximately 5-7 patients a day. Before the nurses leave the office for the home visits, the nurses allocate the patients for the day between themselves. Each morning or during the previous day, a visit list is printed from the Pegasos health care information system. The patients are allocated to nurses according to several different criteria, including the qualifications of the nurse (a muscular injection can only be conducted by a nurse, not a nursing assistant), where the patients live (how close the patient is to other patients), how demanding the visit is (physically and mentally), how much reporting or writing is involved, and which nurse last visited the patient.

## **2.2 Home visits**

The home visits take place mainly during the mornings. The nurses carry with them visit lists, which contain the patients' names, addresses, and information about what treatments each patient should be given. When a nurse is with a patient, she chats with the patient and carries out the required treatments, measurements and some miscellaneous tasks. The following is an abbreviated list of the patient visits conducted by one nurse during one morning.

- 1. visit:** Measured blood sugar, made porridge
- 2. visit:** Treatment of varicose ulcer
- 3. visit:** Gave medicine to a couple. The Marevan-card [used to record the thickness of blood], was missing (was later found at the office).
- 4. visit:** Low pulse rate because of which the patient was taken to see a doctor by a friend. Could not find the number for the handicapped taxi and had to call a regular taxi.

## **2.3 Office work and reporting**

After completing all the home visits for the day, the nurses return to the office. They then enter information about what they did with each patient into Pegasos and possibly also adjust the care plan and update the patient's case record. On weekdays all districts have one hour during which patients and their relatives can call the nurses and ask about issues relating to the care and health of the patient. When at the office, the nurses also plan the future care of patients, make appointments for example with a doctor and a laboratory, check

laboratory results, consult doctors and participate in various meetings. The other nurses are good sources of information, supplemented by reading various magazines, books and manuals. These are used for example to check the correct dosage of medicines and the normal range of values of various measurements.

The reporting or “rapso”, as the nurses called it in Finnish, is an informal, but still important event, during which all the district’s nurses present sit together in a room and chat about the events of the day. Each nurse describes in their own words the patients they handled that day, telling how their patients have been feeling and how their ailments have been developing.

In addition, those nurses who share much of the same patients can share their information while they work near each other. In the following, two nurses, Maija and Kaija, sit in their room after the patient visits for the day. They have already had lunch and are in the middle of the phone-in hour. In between the phone calls, the nurses discuss the events of the day. Both of the nurses are holding their patient list for the day, and the discussion follows the order of the lists.

M: “Then I went to see this Järvinen. He no longer had pains in his leg, but the wound was not really any smaller than when I last saw it. . . It was about this big (uses fingers to show the length), and covering tissue had formed on it. That does not really seem to be working . . .hmm. . . Should we try something else, maybe?”

K: “Well? What if we visited him in the morning and removed the bandages and then went to visit the homes in between. Then at the end of the day we could go back and put the bandages back on. That way at least we could air the leg a few times a week? That’s what we did before. . . we could at least try it?”

If a nurse discovered something new or unordinary during a patient visit, then describing the find could take several minutes. Working like this, all the patient cases are discussed in sufficient detail, leaving out only the most routine procedures. Often the nurses discuss and plan together the care of a patient. It is common that the nurses describe the patient case by showing or drawing important things about the patient, for example the size of a patient’s varicose ulcer.

### **3 Possibilities and constraints for mobile work**

By studying the work of the home care nurses, we found several possible applications for mobile devices, such as hand held computers. We also discovered various constraints posed by their work. In the following, we have attempted to take both of these perspectives into consideration, focusing on the key possibilities and constraints.

### **3.1 Possibilities**

#### **3.1.1 Entering and reading information**

One of the most evident possibilities for mobile devices in the nurses' work is facilitating the entering and reading of information from the Pegasos information system. At the moment, information has to be written down twice; first, on paper when visiting the patient, and then a second time when information has to be entered into Pegasos. In addition, the nurses must rely a lot on their memory. If the patient asks for earlier laboratory results, the nurse must remember to look them up from Pegasos when returning to the office and then remember to give them to the patient the next time she visits.

Using a hand held computer or a similar device, the nurse could enter information directly into Pegasos and the reliability of the nurse's memory would no longer be an issue. In addition, the nurse could check the patient's case data directly from Pegasos when with the patient. Reserving appointments with doctors and making laboratory reservations could also be done on the spot with the patient. In addition, the long questionnaires the nurses use from time to time to evaluate the health of a patient could be filled directly on the device, thus again avoiding entering the data twice.

Carrying out the treatments and procedures would also become easier, since the nurse could read the care plan or the patient list directly from the device and check what treatments are required for each patient (e.g. measure blood pressure / inject insulin) and then enter the corresponding results directly on the device. This way the results would be immediately available in Pegasos, and other interested parties such as other nurses, or doctors would be able to access the data fast. If the patient for example had to visit the hospital one hour from the visit, estimating what had happened after the nurse's visit would be easier.

Having real-time access to all of the patient's data should also assist the interaction with the patient. For example, answering the questions of the patient or his or her relatives would become easier (e.g. "When was I last given this medicine? How many weeks did this treatment take the last time?"). Exact statistics and other information relating to the patient's health would also be available directly, instead of the nurse looking them up for the next visit. As the care plan could be updated directly, the patient would be able to participate more actively in what his or her treatment will involve in the future. In addition, entering information there and then directly into Pegasos, the likelihood of entering incorrect information would be smaller than if the information was entered later at the office. In similar situations in Norway, researchers observed that when a laptop computer was used to record information, the patient was involved in a different way. The patients had more influence over their own care plans and generally could participate more in what information was entered about them [Rot01].

#### **3.1.2 Facilitating communication**

At the moment almost all of the home care nurses have a mobile phone. The nurses have discovered that these phones are invaluable for communication between the nurses and the

office. Nurses at the office can reach nurses on the field easier, and nurses can for example agree on re-scheduling the remaining patients if a visit to a particular patient has taken longer than expected. The mobile phone can also be used for real-time consultations with doctors in some cases. In many cases, however, this kind of there-and -then consultations are not possible, because doctors and other experts cannot always answer the phone. In these cases, sending email directly from a mobile device would make communication with doctors, hospitals, pharmacies and physiotherapists faster and easier, even though it still would not be immediate. Making appointments with the doctor or the laboratory can sometimes be difficult also with the mobile phone, when the lines in the health centre are busy. Mobile email would also facilitate more effective communication between the different home care offices, homes for the elderly and other communal services.

In addition, various email attachments, such as sound, images and video would provide the nurses with many new possibilities. When consulting a doctor, a nurse could take a picture of a patient's ailment using a digital camera and send the image along with the consultation request. Using the images and other information about the patient, such as EKG-graphs, the doctor would be able to gain a more comprehensive picture of the patient's condition than if he or she had to rely solely on the comments of a single nurse. If an earlier example of a similar consultation had been stored on the device, the nurse could also in some cases possibly refer directly to these instead of consulting the doctor again.

## **3.2 Constraints**

### **3.2.1 Patient contact**

One of the most important constraining issues for the use of mobile devices in home health care is the nature of a patient visit. The single most important element of any patient visit should be the patient. In contrast to the positive experiences in Norway [Rot01], some of the nurses felt that entering and reading data from a mobile device during a patient visit would disturb the patient and disrupt the presence of the nurse.

“If we would enter things in the home of the patient, then we are not with the patient. We are there physically, but your mind is somewhere else. And that's the reason why we go there that for the short time that we are there, we are there both in mind and body with the patient. Even answering the mobile phone [when with the patient] is really one thing that I feel is a bit. . .”

The invoicing structure of home health care in Turku poses an additional constraint. The duration of a visit determines the amount invoiced, which is why the visit should be used for taking care of the patient. If the majority of the visit is used for entering and reading information instead of interaction with the patient and taking care of him or her, justifying the invoicing could be difficult. It appears that rethinking what is invoiced would be necessary.

### **3.2.2 Security**

One of the advantages of mobile work is the possibility to work anywhere and at any time. For home health care, this means that, in theory, nurses could enter information whenever and wherever necessary, and also communicate with doctors and other experts. Mobility, however, does not come without cost. Leaving the safety of an office always means some loss in security.

The nurses we studied traveled from the office to the patients and from patient to patient using a variety of means of transportation. Some walk, some cycle and some use public transportation, such as busses. Approximately half of the nurses travel using their own car. Entering and reading patient information on a bus or in public spaces can be considered risky, since reading the private information of a patient from the screen of a mobile device is fairly easy. With phone calls, the risk is even greater, because a phone call for example in a bus can be heard by a number of people, if not the whole bus. The nurses themselves are well aware of these risks and at the moment are very cautious of even talking inside a private car. Therefore, speaking in busses and other public spaces is completely out of the question. When with a patient, the privacy of the patients and the above mentioned invoicing problems mean that all work should relate to the patient in question, and not, for example, the previous or the next patient, even though the partial privacy of the home would make this possible, i.e. another room in the patient's home could be considered private to some extent.

In addition, the mobility of the device itself is a security threat. A small, valuable device such as a hand-held computer is a tempting target for thieves. Human errors are also always possible, and the device might be forgotten somewhere, possibly leaving the private information accessible to anyone.

### **3.2.3 Interaction between nurses**

A surprising finding was that the nurses' work at the office means much more to them than just the mandatory entering of data into Pegasos. The reporting situation involved considerable interaction between the nurses and it is invaluable for problem solving and knowledge transfer. An important factor is that the nurses felt their work was mentally demanding and lonely, especially if a nurse had to take care of several so-called 'demanding' patients. Visits to the office and the interaction with the other nurses play an important role in releasing the pressures caused by the work and thus in the mental well-being of the nurses. One of the nurses explains:

“Especially that we can let it out, when we have had one of those really bad days, demanding patients, then we all get together for our afternoon coffee, and it's really a lifeline that you can let it all out, all the things that took place during the day. So that's another reason why it's good that we share an office.”

## 4 Discussion and conclusions

Transforming the work of the home care nurses from semi-mobile to mobile, as defined by Luff and Heath [LH98], appears to offer a number of tempting benefits, such as improved sharing of information and improved communication in general, but it does not come without cost. By studying the nurses' work, we discovered that the semi-mobile nature of their work is not just a limitation set by technology and the nurses' work environment, but instead is an integral and even enjoyable part of their work.

Many of the tasks the nurses take care of at the office, such as entering data and reporting to others seem like the result of technical limitations. However, it appears that even if all the technical challenges, such as the question of network reliability and bandwidth could be solved, many important questions would still remain. Since reporting, chatting and just the simple presence of another person all appear to be important parts of the nurses' work, changing any of these is likely to have some impact on the nature of the nurses' work. Therefore, the advantages to be gained from mobile work should be weighed against the likely downsides of changing integral parts of the nurses' work before implementing such changes.

However, we would like to acknowledge that the possibilities and constraints presented in this paper are possibly not applicable to all cases of home health care, since the allocation of patients between the nurses differed from day to day. In cases where each nurse has a fixed set of patients, the findings might be different.

## Bibliography

- [Fag00] H Fagrell. *Mobile knowledge*. PhD thesis, Gothenburg, Sweden: Viktoria Institute, University of Gothenburg, 2000.
- [KS01] M Kakihara and C Sørensen. *Mobility Reconsidered: Topological Aspects of Interaction*, 2001.
- [KS02] M Kakihara and C Sørensen. *Mobility: An extended perspective*. In *Proceedings of the 35th Hawaii International Conference on System Sciences*. IEEE Los Alamitos, California, USA, 2002.
- [LH98] P Luff and C Heath. *Mobility in Collaboration*. In *Proceedings of CSCW 1998*, pages 305–314, Seattle, Nov 14-18 1998.
- [Rot01] G-H Rotvold. *Home Care telemedicine in Alta*. IT in home care-seminar, 7.-8.6. 2001.
- [Tuo97] R Tuomisto. *Kotisairaanhoidossa työskentelevän hoitajan työn sisältö ja työajan käyttö*. [Work contents and use of time by the home health nurses] Turun yliopisto, Hoitotieteen laitos, Pro gradu -tutkielma. (in Finnish), 1997.