

A Comparison of a Nursing Documentation Application for PDAs and Laptops

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Abstract

The use of PDA technology for medical applications is opening a new field to research in recent years. This technology appears to be very useful for collecting data and data entry at point of care.

This paper describes a usability study of two versions of a nursing documentation application. One of the versions was implemented on a PDA and the other on a laptop. For this study eighteen nurses were asked to perform typical documentation tasks on both versions of the application. The results of the study indicate that with the exception of writing notes nurses are as effective with a PDA as with a laptop performing typical tasks at point of care.

1. Introduction

Point of care data entry is an important part of a clinical information system. Unfortunately, most electronic patient record systems do not provide support for point of care data entry. The PDA technology is opening a new market for medical applications. PDA technology improves healthcare by providing facilities for rapid order entry, collecting clinical information and access the patient record via wireless communication at bedside. Some applications have been developed and tested that have demonstrated that this technology reduces the documentation time, makes documents easy to understand, reduces errors.

There are various PDA applications being developed to improve clinicians, residents, nurses and physicians' efficiency and productivity at point of care. One of these applications is Mobile Nurse [Choi00]. This is a PDA application developed for the Graduate School at Seoul National University of

Korea to help nurses at point of care. Mobile Nurse provides tools for:

- Managing the patient's demographic information,
- Checking physicians' orders.
- Nursing documentation of vital signs, intake and output, pain assessment and treatment results.
- Working with unit care plans involving discharges, clinical tests, consults, blood transfusions, operations, transfers and nursing notes.

This adoption of this application resulted in a reduction in documentation time and paper work.

The DISEM University of Italy is working to computerize the patient clinical record by providing wireless access to a central database [Ancona00]. This application called the Ward-in-Hand should collect all clinical and relevant information about patients. This application will provide a sophisticated solution for gathering clinical information at point of care, increasing hospital productivity and improving the quality of service.

The management of patient data at point of care is very important in every hospital area. That motivated the Pediatrics and Biomedical Health Information Division of Washington University and the Neonatal Medicine Division at Harvard Medical School to develop a software that provides the ability to enter and manage information at bedside [Carroll01]. The nurses and physicians will have access to: vital signs, feeds and fluids, laboratories and progress notes at point of care.

This paper describes a usability study of two versions of a nursing documentation application. One of the versions was implemented on a PDA and the other on a laptop.

2. Methods

2.1 The systems

Two versions of a nursing documentation application were used for the study. These versions are described in the following two sections.

2.2.1 The PDA version

The PDA version was implemented on an iPAQ 3835 running the Microsoft Pocket PC operating system. The user interface is shown in figure 1. The name of the patient, the age, weight and height appear at the top of the interface followed by five tabs (Vitals, I/O, Orders, Assessment, Assessment). By selecting the appropriate tab nurses can: view and enter vital signs measurements, view and enter intake and output measurements, acknowledge pending orders, enter an initial assessment, and enter a daily assessment. Nurses can also view labs and diagnostic studies results and enter notes through another user interface.

Mobile Record

File Edit View Help

Rivera, Wilmarie F 41 y 140 lb 63 in

Vitals I/O Orders Assessment Assessment

Period: none Add

☒ List ☐ Graph

Day	Hour	T	B/P	HR	RR
01/03	2030	97.2F	122/74	68	18
01/03	1600		132/60	66	16
01/03	0915	91.3F	160/84	80	16
01/03	0300	97.3F	142/79	71	18
01/02	2000	98.2F	142/78	84	16
01/02	1600	97.5F	140/58	86	16
01/02	0800	97.2F	138/70	71	16
01/01	1920		138/64		
01/01	1840		142/60		
01/01	1800		125/70		

Figure 1. The PDA Nursing Documentation User Interface

The pointing device used for this version was a small stylus. Text was entered by pointing with the stylus on a keyboard displayed at the bottom of the screen.

2.1.2 The laptop version

The laptop version was implemented on a laptop with touchpad running the Windows 2000 operating system. The interface for this version is shown in figure 2. The top portion of the window provides the patient's name, age, sex, weight, height, allergies and the primary care physician. Below the top portion there are nine tabs (Kardex, Pending Orders, Meds, Dx Tests, Vitals, Assess, I/O, Notes, Discharge). By selecting the appropriate tab nurses can: view the Kardex information, acknowledge pending orders, view and acknowledge medicaments administration, view labs and diagnostic studies results, view and enter vital signs measurements, enter a daily assessment, view and enter intake and output measurements, enter notes, and prepare a discharge plan.

The pointing device used for this version was a touchpad. Text was entered with the laptop keyboard.

Interface de l'Infirmière

Carter, Michelle
F 45 y 180 lbs 63 in
Infirmière 2004 Dr. Jorge Perez MD, Lung Infection
Dr. Perez

Kardex Pending Orders Meds Dx Tests Vitals Assess I/O Notes Discharge

List Graph

Date	Time	Temp	PR/S/L	P/S/G/H	P/S/G/O	P/S/G	O2 Sat	Pain
2003-01-01	15:30	37.2 F	83	143	24	22	96%	
2003-01-01	04:30	36.6 F	65	111	50	24		
2003-01-01	03:30	39.1 F	84	134	75	24		
2003-01-01	02:30	38	100	98	22	96%		
2003-01-01	01:30	38	100	98	22	96%		

Figure 2. The Laptop Nursing Documentation User Interface

2.2 Participants

Eighteen staff nurses from a teaching hospital in the Boston metropolitan area participated in the study. The participants were selected on a first-come first-serve basis from those that responded a call for participation. Their experience as staff nurses ranged from 0.1 to 22 years ($M=9.1$). Their experience with computers ranged from .1 to 20 years ($M=10.0$). On average they used computers on their job for 2.4 hours. None of the participants had prior experience with the systems used for the study or with any similar application. None had experience using PDAs

2.3 The tasks

Each participant was asked to perform on each version the following tasks:

1. Indicate the age, and weight of the patient.
2. Look for the most recent vital signs.
3. Read the result of a CHEST (PA & LAT) study.
4. Acknowledge a pending medication order as administered.
5. Enter set of vital signs.
6. Enter a set of I/O data
7. Enter a specific assessment information.
8. Enter a specified text as a note.

2.4 Experimental design

Two versions of an application for nursing documentation at bed site, a PDA version and a laptop version were used for the study. The participants were asked to perform eight tasks on each version. The tasks were the same in both systems. Nine of the participants performed the tasks first on the PDA version and then on the laptop version. The other nine participants performed the tasks first on the laptop version and then on the PDA version. All the participants were given a short tutorial session on the PDA version (about 6 minutes) and the laptop version (about 7 minutes). After performing the tasks on both systems the participants were asked to fill out a subjective user satisfaction questionnaire. The questionnaire asked the participants to rate 7 tasks on a 1-7 scale (1 being poor and 7 being excellent) for each version. The tasks were the following:

1. looking up vital signs list
2. reading results
3. acknowledging orders
4. entering vital signs
5. entering I/O
6. entering an assessment
7. writing notes

2.5 Statistical analysis

The dependent variables of the study were time to complete the tasks, number of task completed, and the subjective user satisfaction. A dependent-samples *t* test was used to compare the time to complete the tasks. A Wilcoxon sign-ranked test with an α level of .05 was used to compare differences in user satisfaction. Linear regression was used to evaluate the learning effect between the two systems.

3. Results

A dependent-samples *t* test revealed a significant difference on the average time it took the participants to complete all the tasks on the PDA version and the laptop version $t(17) = 3.88, p < .05$. The participants completed all the tasks in significant less time in the laptop version ($M=390.3, SD=86.4$) than in the PDA version ($M=468.2, SD=96.3$). Overall, the participants were 16.6% faster with the laptop version than with the PDA version.

With the exception of task 1 dependent-samples *t* tests revealed a significant difference on the average time it took the participants to complete individual tasks with the PDA version and the laptop version. For tasks 3, 5 and 8 the participants were faster with the laptop version than with the PDA version (see table 1)

Table 1. Means, Standard Deviations and Speedup for completion of tasks 3,5,and 8.

Task	PDA Version		Laptop Version		Speedup
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
3	39.6	6.4	32.2	4.5	18.0%
5	51.1	16.7	48.5	16.7	5.1%
8	179.3	36.0	80.2	25.7	55.3%

For tasks 2, 4, 6 and 7 the participants were faster with the PDA version than with the laptop version (see table 2).

Table 2. Means, Standard Deviations and Speedup for completion of tasks 2, 4, 6 and 7.

Task	PDA Version		Laptop Version		Speedup
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
2	4.7	2.8	9.0	4.0	47.5%
4	16.4	5.4	31.1	12.9	47.1%
6	31.9	22.9	37.9	17.1	16.7%
7	141.3	60.5	148.3	34.3	4.7%

Most of the participants were able to complete all the tasks. Table 3 shows the number of participants that completed each of the tasks for each version of the nursing application.

Table 3. Number of participants that completed each task.

	Task							
	1	2	3	4	5	6	7	8
PDA	16	18	18	18	18	18	15	18
Laptop								