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## **Optimization of nursing care through time saving in routine hospital work**

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**The following study discusses whether the process of the daily measurement and documentation of “pulse, blood pressure and temperature” parameters in nursing care can be optimized through the use of technical appliances, giving more time for personalized, individual care. During the autumn and winter of 2006 the time required for measuring these parameters was determined at the Aachen RWTH University hospital by comparing the conventional method with the “Spot Vital Signs® LXi” appliance (Welch Allyn company).**

### **Introduction:**

Constant financial restrictions in health care leading to the increasing need to economize also make their mark in nursing care. Time resources for a desired patient-oriented care (Tauber, 1994) are in increasingly short supply (Hauser et al. 1998).

Pleasant and not so attractive activities are – as in all jobs – part of the manifold responsibilities of nursing staff. Thus in addition to the (pleasant) individual work with the patient relating directly to health care, there are many other routine (not so pleasant) tasks that are necessary, such as

waking or washing the patient, serving food, transporting the patient, and documentation. Then the daily or twice daily measurement of pulse, blood pressure and temperature – including their documentation as part of the care and monitoring of the patient's condition, as well as ensuring the course of treatment – are also indispensable aspects. In these days where economic (and forensic) constraints have arrived on the scene in all hospitals, almost all tasks performed on the patient are documented and the time taken for these activities is recorded.

**Material and methods:**

Over a time of eight weeks (November/December 2006) comparative time readings for manual and technical measurements were conducted on two wards (each with 30 beds) in the Interdisciplinary Standard Care Clinic at the Aachen RWTH university hospital. In a time comparison the parameters pulse (beats per minute), blood pressure (systolic, mmHg / diastolic, mmHg) and body temperature (°C) were measured manually and by means of the Spot Vital Signs® LXi, and the time for each method was recorded. One measurement – mornings or evenings – was done manually and the other with the Spot LXi. Two nurses on each ward had been instructed in the use of the equipment by the company. All measurements were carried out by nursing or auxiliary staff proficient in the methods of measuring. Only patients of 18 years of age or over were included in the study.

The width of the blood pressure cuff used in both methods was identical.

Patients not in the room at the time of measurement (examinations, operations, out with relatives) were not included in the measurements at this particular time.

**Manual measurement:**

After the blood pressure cuff had been wrapped around the upper arm, the time was measured by means of a stop watch. The cuff was inflated manually, and systolic and diastolic blood pressure measured in the conventional way with a stethoscope on the inside of the elbow. The results were recorded manually.

The radial pulse was then measured in the typical way for 15 seconds, and after multiplication was noted in the same way.

The body temperature was measured either by means of an ear thermometer from Tyco (Genius 1 model) or was taken sublingually.

At the end of these tasks the time was measured with the stop watch and documented.

**Spot LXi measurement:**

After the blood pressure cuff had been wrapped around the upper arm, the stop watch was started for time measurement and the appliance for measuring the parameters was then set in motion. Inflation of the cuff, measurement, and deflation all take place automatically with the appliance. Whilst pulse and blood pressure were being measured, the temperature was taken either sublingually or in the ear by the thermometers integrated in the appliance. At the end of the measurement the time was read once more and all values shown on the display were documented.

**Results:**

A total of 1909 measurements were carried out on the two wards. 892 were performed manually and 1017 by means of Spot LXi. The average pulse rate was 71 beats per minute in manual measurements and 77 beats per minute in the automatic measurements. The average temperature in manual measurements was 36.8°C and in automatic measurements 37°C. Average blood pressure values were not calculated as they are not relevant for the results of the study.

On one day no measurements could be taken on one ward due to an appliance malfunction.

	number of measurements	beats per minute	temp °C
manual	892	71	36.8
Spot LXi	1017	77	37.0
total	1909		

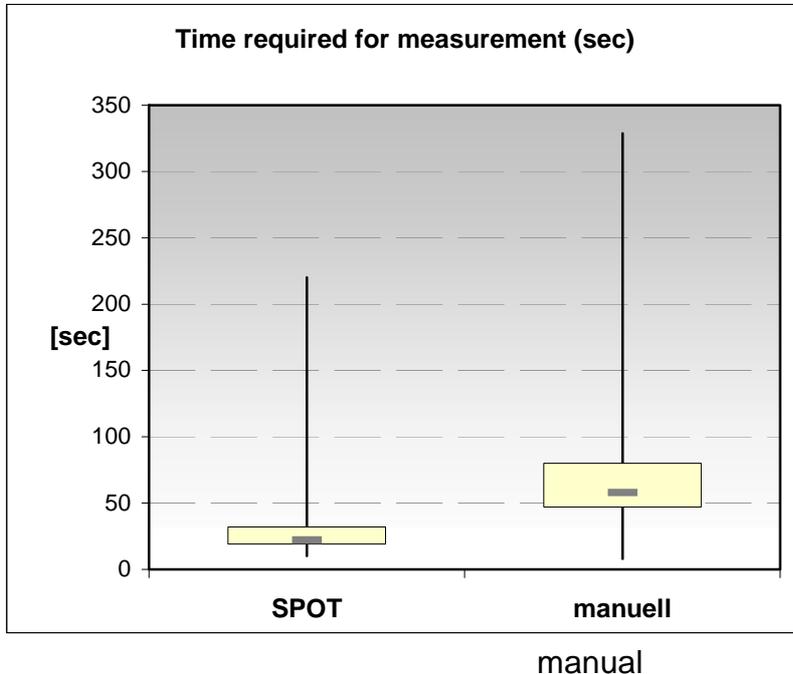
**Chart showing average values for pulse rate and temperature**

The average time taken for the manual measurements was 79 seconds (minimum 37 seconds, maximum 343 seconds). The average for the Spot LXi measurements was 31 seconds (minimum 18 seconds, maximum 220 seconds).

	Manual measurement	Spot LXi measurement
minimum (seconds)	37	18
maximum (seconds)	343	220
average time required (seconds)	79	31

**Chart showing the differing measurement durations**

The average difference in time between manual measurements and automatic measurements with the Spot LXi was 48 seconds.



**Chart: Box plot (Box and Whisker Plot) showing the statistical spread of all measurements with Spot LXi in comparison to manual measurements.**

The durations of measurements with the Spot LXi lay very close together between the upper and lower quartile, whereas the manual measurements demonstrated a much wider spread. An average of 22 seconds was required for measurements with the Spot LXi, and 58 seconds for manual measurements. For all measurements, the maximum duration with the Spot LXi was 220 seconds, and 329 seconds for manual measurements. The maximum durations with the Spot LXi and manual acquisition are a result of repeat measurements due to artefacts during measurement.

1017 measurements using Spot LXi during our study time resulted in a time saving of 13 hours 40 minutes.

**Discussion:**

A time saving of 48 seconds per routine measurement of patient blood pressure, pulse and temperature may at first seem insignificant. Yet if this time is extrapolated – as carried out by economists in hospitals today – to a 500 bed hospital with 80% of beds occupied (400 beds), then the following time saving for these routine tasks results:

With two measurements per day = 800 measurements x 48 seconds = 640 minutes or 10 hours 40 minutes. Even if measurements were taken only once daily, nursing staff would

have 5 ½ hours longer for individual, patient-oriented care. The large spread of measuring times with the Spot LXi is due to the level of patients' blood pressure: the higher the systolic pressure the longer the time needed for measurement. Measuring a systolic pressure of up to 120 mmHg takes approximately 15 seconds, whilst measuring pressures of up to 220 mmHg takes approximately 25 seconds.

Whereas mistakes can be made in manual measurement through false positioning of the stethoscope, by releasing pressure too quickly or through different acoustic results from different staff, these sources of false measurements are not present with automatic measurement (AAMI standard). Furthermore, in our study 21 re-measurements were necessary (re-inflation of the cuff) in manual measurement. The Spot LXi carried out a total of 11 re-measurements automatically.

When taking the pulse manually it is sometimes difficult to find the radial pulse. This does not apply for measurements with the appliance. Little experience is required for operating the appliance. This can be done by auxiliary staff (student nurses, nursing assistants etc.) after instruction.

As automatic measurement does not require much concentration and the results are shown automatically on the display, conversations can easily be held with the patient during measuring.

Nursing staff showed a very high acceptance of automatic measurement of the parameters and after two days at the most, nurses preferred measuring with this appliance. Nursing staff felt they had been included in the technical progress of medicine, as equipment had also been provided for them, making their activities easier and more effective.

We were not able to use the appliance's data storage function (50 data sets), printing labels to a printer or wireless (bluetooth) transfer of measurements to patients' electronic records because of an incompatibility with the EDP system used in our hospital. This, however, promises still further labor and time saving in the documentation of measurements. Manual transfer of data to the patient records by nursing staff is no longer necessary if digital transmission is used.

The large footprint (approximately 1 m<sup>2</sup>) of the device that is mounted on a mobile stand is a disadvantage both for storage when not in use, and in the patient's room.

In this present study only the parameter of time saving for nursing staff was investigated. A cost-benefit analysis (comparison of cost-saving / appliance costs, leasing charges, maintenance costs) was not the aim of the study.

Time saving for nursing staff, unproblematic handling, user acceptance, accuracy of measurement and the possibility of automatic documentation are the most important results arising from the study on the use of Spot Vital Signs® LXi.

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