

# Nurses behaviour pre and post the implementation of data capture using tablet computers in a rural clinic in South Africa

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**Abstract.** This Time and Motion study was part of a larger Open Source Development Project to evaluate the use of Tablet computers for collecting patient data in rural clinics in the OR Tambo District, Eastern Cape, South Africa. The intention was to determine if there were any differences in the activities and workloads between the two methods of data capture. The main difference between the Phases was that the number of activities undertaken per patient decreased in the second phase. More time was spent on each activity.

**Keywords.** Nurses Informatics, workload, tablet computers, Time and Motion study, South Africa

## Introduction

Primary health care (PHC) in South Africa is provided mainly by nurses at community health centres (CHCs) and clinics in the public health sector [1]. For monitoring and evaluation, data at CHCs is handwritten in registers by nurses and aggregated for submission to the District Health Information System (DHIS). Previous work by the authors in rural clinics in OR Tambo District, Eastern Cape, South Africa [2-7] identified a poor quality of health data and a perceived high work burden by nurses associated with manual data entry. Jamin et al in 2014 also concluded that “ensuring data accuracy is a significant problem in the Eastern Cape Province” [8]. However, the authors also found positive perceptions by nurses to tablet computers and electronic medical records as a means of improving data quality [5].

The aim of this study was to observe the use of tablet computers by nurses to record routine data at a rural CHC to determine if it reduced or changed their observed workload overall. In a previous study one of the authors found that there is often a shift in activity rather than saving of time per se when introducing new technologies and exploring nurses workload [9], particularly in those services which are understaffed and have large workloads. Campbell [10] supported this view and reported that “direct patient care activity counts showed a statistically significant increase for nurses” when

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introducing electronic recording of patient data. These two studies were conducted in hospitals, however, the authors can find no studies of this nature in rural health clinics.

## 1. Methods

A time and motion (T & M) methodology was used as it is accepted as the gold standard for measuring clinical workflow [11; 12]. Time and Motion (T&M) studies came out of the movement to produce cost saving in the industrial world. Many consultancy companies have undertaken studies in the health domain particularly with the aim of reducing the cost of nursing and other healthcare staff [13]. This project explored nursing activity over a three month period to reduce the Hawthorn Effect [14]. During the first 5 weeks nursing activities were recorded in the clinic whilst nurses were completing paper based records. In the second six weeks the nursing activities were recorded whilst the nurses used a tablet based data record. The intention was to determine if there were any differences in the activities and workloads between the two methods of data capture.

### 1.1. Ethical Considerations

Ethical clearance was obtained from the Health Research Ethics and Bio-Safety Committee at Walter Sisulu University (No. 020/011). Permission to undertake the study was obtained from the Eastern Cape Department of Health.

### 1.2. Data Collection

A specific set of observation categories was required to capture the activities of the clinic nurses who operate in a similar consultative mode to doctors. To develop this list of activities a research nurse, a family physician and a computer scientist recorded the activities of the nurses during consultations in a clinic. These were then included in the observation categories developed by the Health Informatics team. The team also reviewed the literature to inform the design of a Java based form for collecting the data.

A Java based T&M application developed by the team sat on an Apple server in the CHC. A Master Patient Index was also on the server on which the reception staff could record the patients' demographic details during Phase 2 of the project, which would reduce the nurses' workload. Research assistants recorded the observation categories (activities) using Sony Xperia Tablets during the nurses' consultations. The Tablets then transferred the results via Wi-Fi to the server. Each of the activities was timed automatically within the consultation period by starting a task that ended when the next task began, or the consultation ended.

Observed nursing activities were grouped into observational categories which were: Hand Hygiene, Talking Only, Phone, Reading Paper, Help to others, Writing, Retrieving Files, Nursing activity on patient, Help from others, Writing Computer. In the initial study to define the activities it was seen that nurses multitasked. The data collection tool was designed to allow multitasking to be recorded in that tasks could be paused and resumed whilst recording other tasks during the one consultation. This allowed for changes in activity and interruptions to the consultation. Westbrook [15] commented that 11.8% of observed nursing behaviour was multi-tasking.

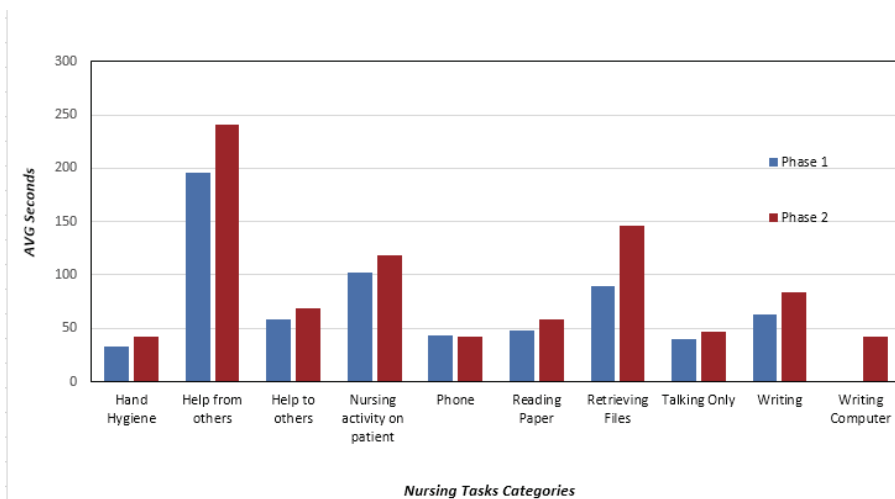
The work-study data expressed as timings per category were recorded into an SQL database and the complete dataset was exported into excel for analysis. For the first 5 weeks, (Phase One), data was collected on nurses recording patient data in a variety of paper-based registers over 21 working days. The data for the first 4 days during training were discarded. For the second 6 weeks, (Phase Two), the same nurses were trained, over one day, to use data collection forms on Tablet computers. The initial data was also discarded and observations were recorded over 22 working days. The Clinic Nurses captured the collected patient data using Xforms on the Open Source Solution Open Data Kit (ODK) on the Tablet computers.

Research Assistants were recruited from graduates of the Departments of Computer Science and Health Promotion because they had the basic skills to undertake observational studies. There were four consulting rooms from which to collect data, so five assistants were employed and scheduled to ensure that four were always available. The observers were trained over 2 days and data was discarded for the first four days.

## 2. Results

### 2.1. Change of focus of activities from data collection to patient care

The number of activities per patient changes from an average of 5.70 in Phase One to 4.68 per consultation in Phase 2. In Phase One there were patients who had 31 activities recorded whereas in Phase Two 23 activities were the maximum recorded. The redistribution of time, in seconds, spent on activities within categories is shown for Phase One and Phase Two on the figure below.



**Figure 1.** Showing shift of average time spent on activities within categories

The main difference between the Phases was that the number of activities undertaken per patient decreased in the second phase. More time was spent on each activity. The research assistants commented that the nurses in Phase One tended to talk to the patient whilst undertaking activities and write in the registers between each activity thus giving the perception that the focus of the consultation was on writing in

the books. In Phase Two the nurses captured the data on the Tablet at the end of all activities or the consultation. This change of the nurses' behavior as reported by the research assistants from focusing on writing registers to conducting a patient focused consultation requires further study.

It should be noted that the nurses in Phase One had to ask the patient for their demographic details and record them on the register(s). In Phase Two the reception staff had already entered demographic data thus changing one of the writing activities for the nurses. However the introduction of a Master Patient Index was part of the technology implementation within the project and therefore is considered a consequence of the technology change.

In a focus group interview with five nurses at the end of the project, they said that it took them 3-5 minutes to learn to use the Tablets and a working shift to learn all of the menus. One nurse also said it took her less than a minute to be able to learn the Tablet computer as she owned a smart phone. The nurses commented that using the Tablet was "just like" using their touch screen mobile telephones. It would appear that this group of nurses adapted to using tablet computers easily because of their familiarity with telephone technology.

The nurses reported that they had no difficulty following the navigation system and did not need to ask for help, as it was easy to use. They said that they had no problems entering data and that it was easier than writing in the registers and that they had more time to spend with the patients. On analysis of the captured patient data it was noted that there were no missing data items and therefore all patient data collected on the Tablet computers was complete. Previous studies [7; 8] have highlighted missing and incorrect data capture using written registers.

### 3. Discussion

In conclusion, this small study in a health clinic indicates that introducing technology is no longer the issue that it was in the past because according to Pillay the "penetration rate for cellular phones in South Africa is fast approaching 100% of the adult population" [16]. South Africa has leapfrogged desktop computer adoption hence users are familiar with telephone technology. It appears that nurses in this study understood the principles of the application more quickly than when desktop technology was first introduced into European hospitals. However, as with previous studies [10; 17; 18] the introduction of technology has not significantly reduced nurses' workload, giving them time to spare, but rather redistributed it, giving them more time for patient contact, care and interaction. This in itself must be considered a positive benefit for the introduction of technology in any health care facility.

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