

Benefits Measurement from the Use of an Automated Anaesthetic Record Keeping System (AARK)

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Abstract

HYPOTHESIS: Automated Anaesthetic Record Keeping Systems (AARKs) can reduce clinician recording time, are easy-to-use and produce clearer, more accurate records than a manual system.

BACKGROUND: Studies over the last twenty years have identified potential benefits from the use of Automated Anaesthetic Record-Keeping systems, but have not proved the benefits. A review of the literature indicates that AARKs have been in use for many years and have progressively improved specifically in terms of their usability. Advances in technology have improved the usability and the measurability of AARK systems. This study, conducted by Communio Pty. Ltd. at two Queensland Health (QH) hospitals measures critical changes resulting from the introduction of Winchart (by Medtel Australia) into the perioperative environment. This system is designed to capture clinical information from patient monitoring equipment and other devices, in addition to clinician input. It uses a state-of-the art touch screen interface for rapid input of data, thus addressing the anaesthetist-machine interface issues of earlier systems.

METHOD: The full study compared the data gained from the set of baseline measurements with the data gained from a set of post-implementation measurements, to provide details of changes, plus identification and measurement of benefits, from the use of an automated system. To achieve this objective, a two-phased measurement approach was adopted, within both the baseline study and post implementation study, embracing both quantitative and qualitative data capture. This paper primarily focuses on: one quantitative aspect of the study, clinician recording time; and those qualitative aspects related to ease-of-use and quality of the record produced.

RESULTS: The results of this study, confirmed that with progressive use of the system ease-of-use improves and user satisfaction levels increase, along with improved quality and accuracy of data as confirmed by clinicians during the survey periods. The quantitative results show that the hypothesis has been proved and that time savings are achievable for clinicians with an average reduction for clinician recording time in the range of 48-93% for OTs and 93% for PACU environments.

Keywords: anaesthetics; automated medical records system; benefits measurement

1. Hypothesis and objectives

The hypothesis of this paper was that the introduction of the Automated Anaesthetic Record Keeping System (AARK) would reduce the time spent by clinicians entering anaesthetic and related clinical data. For the purposes of this paper the term clinician includes anaesthetists, anaesthetic technicians, anaesthetic nurses and other

nurses in perioperative environment. The change in clinician recording time was measured by comparing the time taken to record data in a range of selected operating theatre surgery case types using the currently existing systems (old anaesthetic-monitor based record-keeping systems), and comparing those times with the time taken to record data using the AARK.

The AARK Project Team in conjunction with the Directors of Anaesthetics in the participating hospitals developed a set of project benefit measurements. These provided the framework for the study. The objective was to provide a set of performance indicators against which observations and grouped comments could be recorded. This would enable future comparisons after the change to an automatic anaesthetic record keeping system was completed. Clinician recording time was just one of the quantitative performance indicators chosen for the benefits study; ease-of-use and quality of the output were the two of the qualitative measurements. It is this subset of measurements that forms the focus of this paper.

2. Background and concise literature review

Background studies have recognised the potential benefits that automated anaesthetic record keeping systems can provide by way of: greater accuracy [1, 2]; legibility [3]; consistency [4]; reduced record keeping times [5]; improved quality assurance and risk management in anaesthesia [6, 7]; as an aid for medico-legal defence [8]; as well as providing data for research [9]. It has also been recognised that user acceptance of such technology in the peri-operative environment can pose problems [10-12]. Some early studies found that the time saved by record keeping systems was often offset by the time consumed by the anaesthetist-machine interface [13]. Progressively, the user interface has been improved via the use of increasing advances in technology. The ease-of-use of the Winchart interface is vastly superior to many of its predecessors. Data is entered into Winchart through the use of touch screen interfaces using drop down boxes to remove the need for typing vast quantities of data. For this reason, it was anticipated that this study would therefore not encounter the same difficulties as that of Allard et.al.

QH is in the process of implementing an Automated Anaesthetics Record Keeping System that is expected to deliver to Queensland Health a clinical data management solution which supports improved consistency of data recording and clarity of the patient information. The aims are to replace outdated electronic record keeping services and remove the use of manual systems employing a paper based approach through the introduction of a new consistently deployed, automated AARK system. The implementation of AARK will provide a clear, consistent and legible record, will reduce clinician recording time and allow more time for patient care. In theatre the system automatically collects the patients vital signs every ten seconds and graphs these on the patient record together with drug and dosage information, fluids in and out that are recorded by the clinician. Patient demographics and case details can be automatically loaded from compatible theatre booking systems. In the post anaesthetic care unit the vitals are likewise collected automatically and nursing staff can enter

nausea, pain and sedation scores, medication and fluid entries and notes relevant to the recovery environment.

As part of a benefits measurement initiative Communio Pty. Ltd., a health care and human services consultancy, was engaged to conduct a benefits measurement study for the AARK project. They commenced a detailed analysis of the current anaesthetic record keeping system at a tertiary level QH hospital (hospital one) to formulate a baseline measurement prior to the introduction of the new AARK system. 'The Baseline Measurement Study- Interim Findings Report' provided a detailed analysis of the findings of the review for the QH AARK Project Team in April 2008. Hospital one, at the time of the study had been using an old automated system (that was no longer supported) as the standard system in the Operating Theatres (OTs). The Post Anaesthetic Care Unit (PACU) was entirely manual using a paper-based system.

The Post-implementation Measurement Study represented the second part of this initiative, commissioned within the AARK Project, and was aimed at providing a comparative study to the initial baseline measurement study. One study was conducted at the same site to enable post-implementation changes to be measured. A second study was conducted at another QH hospital (hospital two) that had been using the AARK system (Winchart) for some five years. Both post-implementation studies used an identical suite of measurements and identical surveys to those used in the baseline study to facilitate comparison with the new system and to determine associated benefits.

3. Methods

The period of the AARK study spanned over eight months from commencement of the baseline study to finalisation of the post-implementation study, conducted in November 2008. The time frame was designed with a six month delay between the implementation of the new AARK system and the conduct of the post-implementation study. This ensured that the anaesthetists and other staff using the system had received training and were experienced in the use of the system.

The study consisted of three stages as outlined below.

3.1. Stage 1 - pre-observation

Stage 1, the Pre-Observation Stage involved a range of pre-planning activities: confirmation of pre-trial indicators; orientation meetings at hospital one; participation in consultative forums involving the Project management team, Communio consultants and key OT and PACU staff to determine both the quantitative and qualitative data collection requirements.

This resulted in the selection of quantitative measurements based upon specific workflow related milestones that were deemed important within key process events in each working area. These defined measures were included in a formal template for measurement capture, subse-

quently used in each of the observational studies in both the baseline and post-implementation studies.

These forums also assisted with determining qualitative assessment measurements for the survey design and requisite questions for the baseline and post-implementation measurement surveys. Questions covered four domains that relate to the efficiencies of existing systems and perceived satisfaction levels associated with: ease-of-use of the system; accessibility of the system; related health and safety criteria; and training.

The Communio measurement team worked with the Directors of Anaesthesia within each participating hospital to: select appropriate short, medium and long cases; to confirm participation of various OTs in the study; and participated in the pre-trial survey deployment of staff and resources.

3.2. Stage 2 - observation

Stage 2, the Observation Stage, involved a range of observation activities in a number of OTs and associated PACU at both hospitals one and two: These observation activities involved timed measurements of particular record keeping activities in which the OT and PACU staff participated. The specific observations were confirmed by and in accordance with the measurement recording templates. Further observation activities were conducted in a short case theatre environment to record the associated baseline measurements taking into account an increased change-over process and possible impact of clinician recording time on theatre utilisation.

The Communio measurement team worked with the Directors of Anaesthesia within each participating hospital to facilitate data input into the measurement templates during the arranged observational sessions.

A two-phased measurement approach was adopted, within both the baseline and post-implementation studies, to enable both quantitative (phase one) and qualitative (phase two) data capture.

Phase one involved a set of observations that were measured in the various OTs and in the related PACU. Timings were measured using a stopwatch. Measurements were taken for selected project-related cases, categorised according to expected case length: short (up to 1 hour); medium (1 to 2 hours minutes); and long surgical cases (upwards of 2 hours). The number of cases selected for the sample size was determined in conjunction with the Project Team to ensure selection of a representative sample across short, medium and long surgical cases. For the purposes of the study, the researchers held initial consultative discussions with anaesthetic consultants around categorisation of cases. Their suggestion for short cases included case mixes such as cystoscopies, eye cataract removals, and skin biopsies, generally less than one hour. This was followed by a range of case selections for medium cases such hernia repairs, laparoscopic cholecystectomies, thyroidectomies and breast excisions, generally cases with a well circumscribed process between 1-2

hours. The long cases selected covered more complex case selections such as organ resections and Hartmann Hook – up procedures that generally took more than 2 hours and were often compounded by other morbidity factors.

Case identification numbers were used to ensure privacy requirements were maintained during the observational studies while collecting measurement data and organising case studies.

A similarly constructed representative sample was used in the post-implementation study. In order to minimise individual differences and to ensure that measured data points were comparable, the same types of cases, same surgeons and same anaesthetists were selected for the second sample, where possible, to provide input into the comparative post-implementation study.

Phase two involved the distribution, completion and collection of results from a staff questionnaire distributed to OT and PACU staff.

3.3. Stage 3 - post-observation

Stage 3, the Post-Observation Stage, involved the comparative reporting of observations (baseline and post-implementation) through the compilation of notes, calculation of measures, analysis, evaluation and report-writing after the new AARK system was commissioned into hospital one. The Communio measurement team worked with the Directors of Anaesthesia within each participating hospital to export the data into excel for results compilation and quantitative analysis.

4. Results

4.1. Quantitative results

The result of the initial observations in OTs provided data for the analysis of clinician recording times spent on case based surgical procedures in relation to total OT time. The result of the initial observations in PACU provided data for the analysis of clinician recording times spent on post anaesthetic care periods.

OT cases were categorised and measurement summaries are presented within the following tables for each of the short, medium and long surgical cases. The following sections display the key results for each category.

4.1.1. Short OT cases - measurement results

The duration of clinician recording time for short OT cases demonstrated a progressive decrease in average clinician recording times measured with the implementation of the Winchart system, and a further decrease in average times measured where the system has been used in an established environment. From an initial average clinician recording time of 9.5 minutes (baseline) to 2.43 minutes (post-implementation) - an average saving of 7 minutes

per case is noted. The results from additional studies conducted at hospital two indicated there is potential to reduce the average clinician recording time even further with increased exposure to the system and achieve a recorded average for short theatre cases of 16 seconds, an average saving of 8 minutes per case.

The findings for the short case study across the two hospital sites indicated a potential time saving for clinician recording time for anaesthetic staff using Winchart.

Baseline (Hospital one)	Post-implementation (Hospitals 1 & 2)	
<i>Clinician Recording Time (Minutes per case):</i>	<i>Clinician Recording Time (Minutes per case):</i>	
Hospital one: Baseline	Hospital one: Post 6 months	Hospital two-:Post 8 years
Longest Duration = 15	Longest duration = 5.20	Longest duration = .19
Shortest duration = 4.0	Shortest duration = 1.30	Shortest duration = .15
Average duration = 9.5	Average Duration = 2.43 (74.22% reduction clinician recording time)	Average Duration = .16 (93.3% reduction clinician recording time)

Table 1: Short OT cases - clinician recording time analysis.

4.1.2. Medium OT cases - measurement results

The duration of clinician recording time for medium OT cases demonstrated a progressive decrease in average times recorded with the implementation of the Winchart system. From an initial average clinician recording time of

10.50 minutes (baseline) to 4.33 minutes (post-implementation) - an average saving of 6 minutes per case is noted.

The findings for the medium case study across hospital one demonstrated a potential time saving period of approximately 50% for clinician recording time by anaesthetic staff using Winchart.

Baseline (Hospital one)	Post-implementation (Hospital one)
<i>Clinician Recording Time (Minutes per case):</i>	<i>Clinician Recording Time (Minutes per case):</i>
Longest duration = 12.5	Longest duration = 8.30
Shortest duration = 8.0	Shortest duration = .58
Average duration = 10.5	Average duration = 4.33 (58.76% reduction in clinician recording time)

Table 2: Medium OT cases - clinician recording time analysis.

4.1.3. Long OT cases - measurement results

The duration of clinician recording time for long OT cases indicates a progressive decrease in average times recorded for clinical data with the implementation of the Winchart system. From an initial average clinician record-

ing time of 14 minutes (baseline) to 7.27 minutes (post-implementation) - an average saving of 6.30 minutes per case is noted.

The findings for the long case study across hospital one demonstrate a potential time saving period of approximately 50% for clinician recording time by anaesthetic staff using Winchart compared to the previous system.

<i>Baseline (Hospital one)</i>	<i>Post-implementation (Hospital one)</i>
<i>Clinician Recording Time (Minutes. per case):</i>	<i>Clinician Recording Time (Minutes per case):</i>
Longest duration = 21.0	Longest duration = 10.30
Shortest duration = 9.5	Shortest duration = 5.49
Average duration = 14	Average duration = 7.27 (48.07% reduction in clinician recording time)

Table 3: Long OT cases - clinician recording time analysis.

4.1.4. PACU cases - measurement results

The duration of clinician recording time for PACU cases indicate a substantial decrease in average clinician recording time with the implementation of the Winchart system. From an initial average of 19.8 minutes (baseline) to 1.25 minutes (post-implementation) - an average saving of 17 minutes per case is noted. The findings for the PACU case study across hospital one demonstrate a significant time saving period for clinician recording time using Winchart compared to the previous system. The comparison of clinician recording times between hospital one and hospital

two indicates that significant time efficiencies can be gained for nursing staff by transitioning from a manual recording system to a technology assisted system such as Winchart.

The Measurement Team observed that the time savings achieved through reduced clinician recording time in hospital two's PACU contributed to a strong patient focused environment and a sense by staff that additional 'quality time spent' was able to be achieved with the recovering patients.

<i>Baseline (Hospital one)</i>	<i>Post-implementation (Hospital two)</i>
<i>Clinician Recording Time (Minutes. per case):</i>	<i>Clinician Recording Time (Minutes per case):</i>
Longest duration = 37	Longest duration = 3.03
Shortest duration = 9	Shortest duration = .35
Average duration = 19.8	Average duration = 1.25 (93.6% reduction in clinician recording time)

Table 4: PACU Clinician Recording Time Analysis.

4.2. Qualitative results from staff surveys

The findings of the measurement team in relation to qualitative results were provided within the four domains of the issued questionnaire and are based on the comparison of the baseline questionnaire issued at hospital one (OT suite and PACU) and the post-implementation questionnaire issued at both hospital one (OTs) and hospital two (PACU unit). The 48 survey questions provided a comprehensive set of data capture points that related to efficiencies of the baseline and post-implementation system and perceived satisfaction levels. The results were

grouped based on the domains including: ease-of-use of the system; accessibility of the system; related health and safety criteria; and training.

The returned questionnaires indicated that across the range of indicators, positive results were generally noted with the use of the new AARK system, with progressive improvement described over time. Post-implementation survey results indicated increasing satisfaction levels with the system as use and familiarity improved, along with positive comments relating to the quality of the record.

For the purposes of the posited hypothesis, only the results related to the ease-of-use of the system are relevant

to this report. The baseline findings at hospital one generally showed that the existing system 'was not easy-to-use' across a range of indicators. The post-implementation survey results at hospital one indicated a perceived improvement, with a general response across the same indicators that the system 'was easy-to-use'. The comparative results in hospital two indicated a further level of satisfaction potentially can be achieved; the general response received in relation to use of the system across the same indicators was 'very easy-to-use'.

5. Discussion of the Implications

The results presented in this study support the hypothesis that the introduction of an AARK system will reduce the time spent by clinicians entering anaesthetic and related clinical data. While the potential benefits of AARK systems have been well articulated in the literature and relate to improving accuracy of data capture, more time with patients, enhanced legal positions and improved communications with other clinicians in the OT and PACU environment, we have demonstrated evidence of real time-savings as a measured benefit of the introduction of the AARK system.

The quantitative results relating to time savings by clinicians, anaesthetic staff and PACU nurses, in two Queensland hospitals support this hypothesis across a sampling of study environments and case studies, with more significant time savings to be gained when moving from a manual system to an automated system. The comparative studies also indicate, through the range of qualitative data measured, that user satisfaction with the 'ease-of-use' of the AARK system occurs within the first six months of using the system, but also can potentially increase even further as user experience increases.

The implications for the continued operation of the AARK system within these perioperative settings are that familiarisation, supported training and practical experience will enhance the confidence of users and over time as the user interface improves, the user will perceive an improved ease-of-use.

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