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# Effectiveness and efficiency of training in digital healthcare packages: Training doctors to use digital medical record keeping software

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**The effectiveness and efficiency of training in digital healthcare packages: Training doctors to use digital medical record keeping software**

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**Abstract**

**Objective:** Fiona Stanley Hospital (FSH) is the first hospital in Western Australia to implement a digital medical record (BOSSnet). Formal training in the use of the digital medical record is provided to all staff as part of the induction program. The aim of this study was to evaluate whether the current training program facilitates efficient and accurate use of the digital medical record in clinical practice.

**Methods:** Participants were selected from the cohort of junior doctors employed at FSH in 2015. An e-learning package of clinically relevant tasks from the digital medical record was created and, along with a questionnaire, completed by participants on two separate occasions. The time taken to complete all tasks and the number of incorrect mouse clicks used to complete each task were recorded and used as measures of efficiency and accuracy respectively.

**Results:** Results revealed most participants used BOSSnet more than 10 times per day in their clinical roles and self-rated their baseline overall computer proficiency level as high. There was a significant increase in the self-rating of the participants' proficiency level in successive tests. In addition, a significant improvement in both efficiency and accuracy for all participants was measured between the two tests. Interestingly, both groups ended up with similar accuracy on the second trial, despite the second group of participants starting with significantly poorer accuracy.

**Conclusions**: Overall, the greatest improvements in task performance followed daily ward based experience using BOSSnet rather than formalised training. The greatest benefits of training were noted when training was delivered in close proximity to the onset of employment.

**Keywords;** education and training, e-health, performance and evaluation, health systems, information management

## Key Question Summary

### What is known about the topic?

Formalised training in the use of information computer technology (ICT) is widespread in the health service. However there is limited evidence to support the modes of learning typically employed. Formalised training is often costly and there is little other than anecdotal evidence that currently supports their efficacy in the workplace.

### What does the paper add?

Assessment of accuracy when using the BOSSnet system over time revealed that daily use rather than formalized training appeared to have the most impact on performance. Formalised training was rated poorly and this appeared to correlate to time between training and use. This study suggests that formalized training, if required, should be delivered close in time to actual use of the system to benefit end-users. The study also shows that daily experience is more effective than formalized training to improve accuracy.

### What are the implications for practitioners?

Formalised training for ICT needs to be scheduled in close proximity to end-user use of the ICT. Current scheduling may be beneficial for ease of delivery but unless it is delivered at a suitable time the benefits are minimal. Formalised training programs may not be critical for all staff and all staff improve with contextualised experience given time. Training may be better suited to optional rather than compulsory delivery programs with ongoing delivery to suit user schedules.

## Introduction

Rapid progression of technology has resulted in a range of new Information Communication Technology (ICT) programs available for use in the healthcare sector, with the digital medical record (DMR) increasingly becoming the primary mode of non-verbal communication[1]. The use of electronic health information is thought to improve communication and the development of electronic health records with shared access is expected to facilitate continuity in care [2-3]. With new technology comes the need to adequately train staff in its capabilities[4], and the consequences of poor implementation and training of ICT can be significant[5-6]. Tertiary hospitals typically employ thousands of staff with varied levels of computer proficiency and a major challenge is ensuring that all staff can efficiently and accurately use the relevant ICT.

Fiona Stanley Hospital (FSH) is Western Australia's newest tertiary teaching hospital and was opened in February 2015. FSH is a 'paper-light' hospital and has commissioned various ICT packages which were not previously used in Western Australia (WA). FSH was the first hospital in WA to implement a DMR, with the chosen DMR being BOSSnet – an electronic record management system already used in over 80 Australian hospitals.

FSH introduced a compulsory hospital induction and orientation program for all staff, which includes three and a half hours of ICT training. The ICT training session utilises a variety of educational styles including didactic teaching, demonstrations, e-learning and practical applications. Seventy-five minutes of the ICT training session is dedicated to training in the use of BOSSnet. The current model of ICT training at FSH is resource-heavy, with no clear method for establishing medical workforce competence and efficiency either before or following training. This type of training model begins with the assumption that each novice participant starts training at the same knowledge and skill level and that the goal of the training

session is to transmit sufficient information for each participant to undertake the required task independently.

Models of skill acquisition show that training novices requires more than imparting knowledge. It is important to provide training that is relevant in relation to preexisting skills and learning styles as well as providing an opportunity to discover the nature of the real context and its associated variability[7]. With practice the participant reduces the cognitive effort associated with performing the task by developing strategies to manage frequently occurring variables. Simulation based training or systematic approaches involving specific pathways and education plans for clinicians have previously been employed to teach ICT skill[8-9]. Such specialised training and education has been shown to be effective and improve clinicians' confidence. However, they are impractical when training large cohorts of staff.

The aim of this study was to evaluate whether the current model of ICT training enables the FSH medical workforce to use BOSSnet efficiently and accurately in the context of their clinical roles by using a combination of survey questions and competence assessment of medical staff.

## Methods

### Participants

All 125 interns (first year doctors) employed at FSH in 2015 were selected to participate in the study after completing the ICT training session during the hospital induction and orientation program. However, only 20 participants completed the entire study and were eligible to be included. Of the participants, 45% were female and 55% were male with an average age of 27 years (range 23-45 years old). At the time of the data collection, 10% of participants were completing surgical rotations, 20% of participants were completing emergency medicine

rotations and 70% of participants were completing medical rotations. Formal ethics approval was granted by the relevant institutional ethics committees.

**Data collection**

An e-learning package was created using the Adobe Captivate tool. The e-learning package required participants to complete 10 tasks within the BOSSnet platform that represented tasks that would be commonly encountered by junior doctors within the scope of their normal clinical duties (Table 1). The aim was for the participants to complete the tasks efficiently (in the shortest amount of time) and accurately (with as few clicks of the mouse as possible). Participants needed to complete each task independently (i.e. without assistance from the researchers or other participants) before they could advance to the next stage. In addition, a questionnaire was created and embedded in the BOSSnet task. The questionnaire used a 10 point Likert scale and dichotomous scale for the participants to rate their self-perceived skill level using computers in general vs BOSSnet, the usefulness of the ICT training session and their willingness to train others in BOSSnet (Table 2). The testing was performed on three separate occasions at an FSH computer lab during the participants' normal working hours.

The initial testing took place immediately after the participants had completed the ICT training session as part of the hospital induction and orientation program. The participants were then divided into two distinct groups to complete further testing at a future date; those who completed their first rotation at FSH (group one) and those who completed their first rotation offsite then completed their second rotation at FSH (group two). The learning management system that was used to interface the BOSSnet e-learning package suffered a malfunction during the initial testing, resulting in a significant loss of data. This caused the participants to disengage from the study which led to a large drop-out of participants. Therefore there is no data from the initial testing period.

Approximately two thirds of the total intern cohort completed their first rotation at FSH (group one). Of this group, only 14 participants returned 20 days later to complete the testing again (test one). Of those participants, 10 returned 30 days later to repeat the testing (test two).

Approximately one third of the total intern cohort completed their first rotation offsite, where BOSSnet was not used, then completed their second rotation at FSH (group two). Of this group, only 10 participants completed the testing again during the first week of their return to FSH (test one). All 10 of those participants returned 30 days later to repeat the testing (test two).

All participants used BOSSnet on a daily basis during the 30 days between test one and test two. Therefore, both groups had 30 days between testing (Figure 1). Despite the participants completing different rotations at the time of the data collection, all participants reported using BOSSnet more than 10 times per day.

**Data Analysis**

All data analysis was conducted in SPSS (IBM SPSS V.22). Comparisons between group performances across time was conducted using non-parametric Wilcoxon sign test and repeated measures analysis of variance. The coefficient of variation was calculated to quantify within group variability.

**Results**

The participants rated their overall level of computer proficiency as high in both test one ($x = 7.15$) and test two ($x = 7.5$), suggesting that the participants had a consistent appreciation of their skill level. A Wilcoxon signed rank test revealed a significant ($p = 0.002$) increase in self-rating BOSSnet proficiency from fairly poor in test one ($x = 4.85$) to fairly high in test two ($x= 6.83$).

At the initial testing, participants felt that the formal training had poorly prepared them for their clinical roles (x = 4. 26). However, a Wilcoxon signed rank test revealed a significant improvement ($p = 0.04$) to a moderate rating when participants were asked the same question after test two (x = 6.3).

Despite an improvement in self-perceived BOSSnet proficiency by test two, participants still reported that they would only be moderately comfortable teaching another staff member how to use BOSSnet (x = 5.7).

As well as a self-perceived improvement in performance rated by participants, a significant improvement in efficiency (measured by the time taken to complete the tasks) and accuracy (measured by the number of wrong clicks) was found for all participants between the two tests (Figure 2).

Accuracy, measured as the number of wrong clicks improved for both groups of participants between test times ($F (1, 19) = 14.29$, $p < 0.01$). Interestingly, both groups ended up with similar accuracy on test two despite group two starting with significantly poorer accuracy. This interaction between test time and group was significant ($F (1, 19) = 8.097$, $p = 0.01$) (Figure 2a).

An analysis of variance with one between factor (group) and one repeated measure (test) was conducted to determine if efficiency, measured as speed or time to complete the task, improved significantly and similarly across tests by group. Despite high levels of participant variability within groups, across test time all participants showed a significant improvement in speed from test one to test two ($F (1, 29) = 127.264$, $p = 0.00$). We also observed that group 2 initially took longer to complete the task by an average of 103 seconds when compared to group 1. In test two, however, there was an average of 18 seconds difference to complete the task where group

one took marginally longer than group two (Figure 2b). However neither of these differences were statistically significant.

The coefficient of variation (CV) was calculated to determine the proportion of variability within groups across tasks and tests. It was clear that participants often found the task frustrating. Group one showed a CV of 21% in test one, which increased to 38% in test two.

The seconds per click were recorded as a measure of how participants approached the task. For instance, to improve the degree of efficiency, one might ponder the task prior to acting (therefore increasing the time per task component) whereas another method may be to use multiple clicks in quick succession with the hope of making a correct click (therefore increasing the number of wrong clicks). A repeated measures analysis of variance showed a significant increase in seconds per click between test times ($F(1, 19) = 8.02$, $p = 0.01$) and a significant interaction between test and group ($F(1, 19) = 4.74$, $p = 0.43$). For group one, there was significant difference between the seconds per click (26.93 sec vs 21.82 sec). However, group two took significantly longer the second time they did the task (35.80 sec vs 89.88 sec). This suggests that the interns in term two approached the task with more caution overall. However, a Box test of equality of variances was significant, which is likely the result of a high degree of variability between how participants approached the task as well as the small sample size.

**Discussion**

The key findings from this study suggest that the timing of training relative to use of the ICT system is important in determining the level of benefit of the training to end users. In addition, the study suggests that daily use of the system provided rapid improvements in performance.

Overall, both groups of participants improved in their performance of the BOSSnet tasks over time. This improvement was assessed subjectively by participants (through the questionnaire) as well as objectively (through the measurements of efficiency and accuracy). This

improvement occurred over a relatively short period of time (30 days). This improvement was, however, in the context of the participant cohort who rated themselves at the initial testing as having a fairly high level of general computer proficiency. This may be related to the young demographic of the participants (mean age of 27 years), which anecdotally is usually associated with greater comfort in ICT, as well as their job role, which requires high level of computer proficiency in daily practice. Formal training was reported by the participants to be inefficient and of little value, and the results of this study show that, in itself, daily exposure to BOSSnet alone improved the performance of the participants.

Disappointingly, while the researchers initially had access to a large number of participants, the malfunction of the learning management system resulted in a significant loss of data. This caused the participants to disengage from the study which led to a drop-out of participants. Participants completed the activity during working hours which also meant there was difficulty in recruiting staff from busy departments. Despite this, the data did show significant changes, but the effect of natural variation in skill level was more prominent due to small participant numbers.

Initial participation was excellent as the task was included in a mandatory computer education session that interns completed for orientation. However, engaging doctors in research can often be difficult due to limited time, competing clinical roles and lack of interest. Improving participation may be helped by providing quarantined time for these activities, which would require hospital administrative support. However the value of this quarantined time could be justified through enhanced research outcomes that facilitate improved practice. In addition the use of case studies highlighting poor patient outcomes and the associated moral and legal liability issues to illustrate the importance of the task/research might improve engagement and participation.

The BOSSnet task was kept identical between tests in order to compare performance and despite a 30 day lapse, recognition of the task could contribute to performance. Other confounders related to the participants may include a degree of collaboration between participants, despite being instructed to perform the task independently or recalcitrant participants who deliberately did not try to complete the tasks as efficiently and accurately as possible.

The healthcare sector is increasingly using ICT programs, and with this comes the need to adequately train the ICT users in the applications to improve their user interactions[4]. User satisfaction with electronic health records shows a high degree of variation, with low satisfaction commonly related to poor experiences with ICT whilst high satisfaction correlated strongly to support provided and usability and reliability[10-14]. In addition the successful implementation of new ICT is closely related to ease of use, perceived benefits and familiarity[15], all of which can be enhanced through training. Therefore adequate training and support is important for the effective use of ICT in the health system. The annual cost of ICT training in a cohort of 125 interns at FSH is over $18,000. With the total number of doctors employed at FSH being over 1320, the training cost is significant; however time and financial resources are limited. This necessitates detailed evaluation of the efficacy of training modules and their implementation. In this study, the efficacy of the current training module was limited and timing relative to use was critical for user benefits. The study suggests changes to the timing and structure of training will significantly benefit the clinicians using ICT.

**Conclusion**

The results of this study suggest that medical staff benefit from formal training only when it occurs in close proximity to their employment commencement, as with group one. However, following 30 days of ward-based experience, all staff ultimately exhibit a similar skill level, taking into account natural variability in skill level. Therefore, future workforce coordinators

and educational staff should schedule formalized ICT training in close-proximity to the time of end-user use of the relevant ICT. This will facilitate the greatest impact on performance and knowledge acquisition.

## References


1. Enrico Coiera Do we need a national electronic summary care record? *Med J Aust* 2011; 194: 90-92.

2. O'Leary KJ, Liebovitz DM, Feinglass J, et al. Creating a better discharge summary: improvement in quality and timeliness using an electronic discharge summary. *J Hosp Med* 2009; 4: 219-225.

3. Mandl KD, Kohane IS. Tectonic shifts in the health information economy. *N Engl J Med* 2008; 358: 1732-1737

4. Coiera E, Aarts J, Kulikowski C. The dangerous decade. *J Am Med Inform Assoc* 2012; 19:2-5

5. Han YY, Carcillo JA, Venkataraman ST, Clark RS, Watson RS, Nguyen TC, Bayir H, Orr RA. Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. *Pediatrics* 2005; 116:1506-12

6. Sittig DF, Ash JS Zhang J, Osheroff JA, Shabot MM. Lessons from Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. *Pediatrics* 2006; 118:797-801

7. Dreyfus, S. The Five-Stage Model of Adult Skill Acquisition. *Bulletin of Science Technology & Society* 2004; 24:177 - 181.

8. Vuk J, Anders ME, Mercado CC, Kennedy RL, Casella J, Steelman SC. Impact of simulation training on self-efficacy of outpatient health care providers to use electronic health records. *Int J Med Inform*. 2015; 84:423-9.

9. Nicklaus J, Kusser J, Zessin J, Amaya M. Transforming Education for Electronic Health Record Implementation. *J Contin Educ Nurs*. 2015; 46:359-63.

10. Nguyen L, Bellucci, Nguyen LT. Electronic health records implementation: An evaluation of information system impact and contingency factors. *Int J Med Inform*. 2014;83:779-796

11. N. Menachemi, Barriers to ambulatory EHR: who are 'imminent adopters' and how do they differ from other physicians? *Inform. Prim. Care* 2006; 14:101–108.

12. R. Miller, Sim, Physicians' use of electronic medical records: barriers and solutions, *Health Affairs* 2004 23:116–126.

13. S.F. Al-Azmi, N. Al-Enezi, R.I. Chowdhury, Users' attitudes to an electronic medical record system and its correlates: a multivariate analysis, *Health Inf. Manage. J.* 2009; 38:33–40.

14. T.B. Jensen, M. Aanestad, How healthcare professionals 'make sense' of an electronic patient record adoption, *Inf. Syst. Manage.* 2007; 24:29–42.

15. Gagnon MP, Desmartis M, Labrecque M, Car J, Pagliari C, Pluye P, Frémont P, Gagnon J, Tremblay N, Légaré F. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. *J Med Syst*. 2012;36: 241-77.

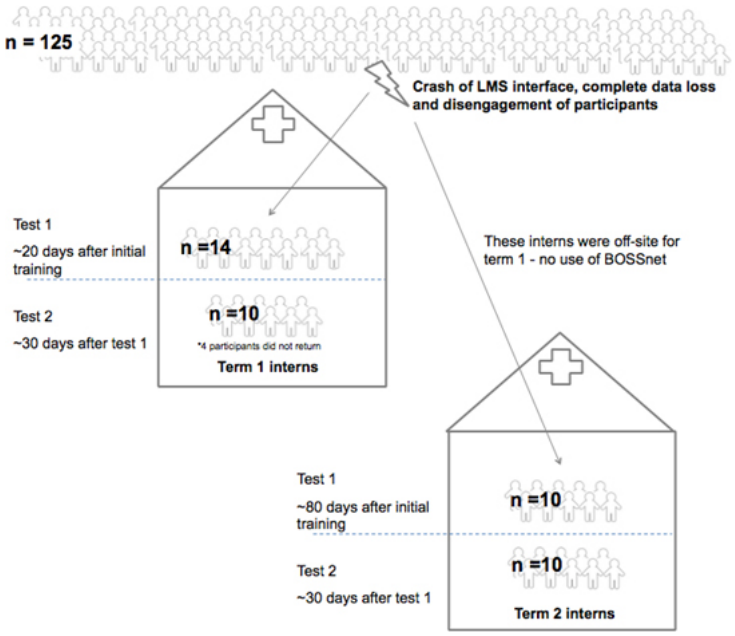
**Figure legends**

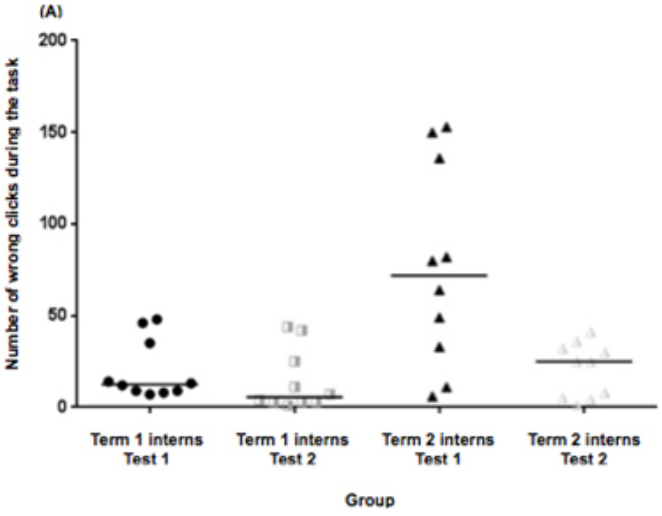
**Figure 1: Participant groups and timeline of testing**

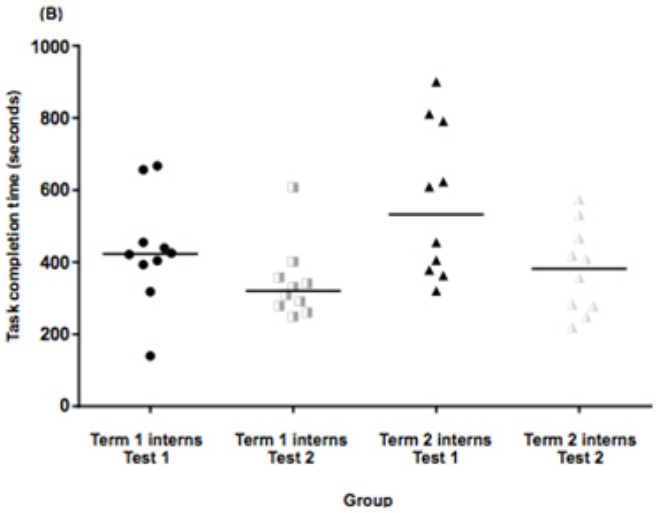
**Figure 2: Efficiency (A) and accuracy (B) of participants in BOSSnet task per group (group one vs group two) and testing occasion (test one vs test two).**

**Table 1. Defined tasks for participants using the BOSSnet training platform:**

**Table 2. Questionnaire completed by all participants before initiation of the task**


n = 125
Crash of LMS interface, complete data loss and disengagement of participants
Test 1
~20 days after initial training
n =14
Test 2
~30 days after test 1
n =10
*4 participants did not return
Term 1 interns
These interns were off-site for term 1 - no use of BOSSnet
Test 1
~80 days after initial training
n =10
Test 2
~30 days after test 1
n =10
Term 2 interns


(A)
Number of wrong clicks during the task
200
150
100
50
0
Term 1 interns Test 1
Term 1 interns Test 2
Term 2 interns Test 1
Term 2 interns Test 2
Group


(B)
Task completion time (seconds)
1000
800
600
400
200
0
Term 1 interns Test 1
Term 1 interns Test 2
Term 2 interns Test 1
Term 2 interns Test 2
Group

| | |
|---|---|
| **1** | Compile a list of all the inpatients on Ward 5A |
| **2** | Compile a list of all the outpatients booked for Doctor X's clinic on date 03/03/15 |
| **3** | Compile a list of all the inpatients admitted under Doctor X currently |
| **4** | Add a patient to the afterhours 'patient of concern' list (once completed then asked to remove them) |
| **5** | Make a draft inpatient progress note for Patient X |
| **6** | Identify the last correspondence letter from Speciality X |
| **7** | Find Patient X's heart rate on the most recent medical admission notes |
| **8** | Add an image to Patient X's note showing crepitations in the left chest base |
| **9** | Add a medical note to the medical handover page for Patient X |
| **10** | Identify the most recent admission and discharge dates of Patient X |

| Survey Question | Answer Choice |
|---|---|
| Participant details: date of birth and gender | freetext |
| Have you ever used BOSSnet before? | Yes or No |
| Have you ever accessed a BOSSnet e-learning package? | Yes or No |
| How many times a day, on average, would you use BOSSnet? | Likert scale 1-10 |
| What is your current hospital rotation? | freetext |
| How would you rate your overall computer proficiency? | Likert scale 1-10 |
| At this time point, how would you rate your overall proficiency using BOSSnet? | Likert scale 1-10 |
| To what degree did BOSSnet formal training prepare you for your clinical role? | Likert scale 1-10 |
| How comfortable would you be teaching another staff member to use BOSSnet? | Likert scale 1-10 |