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Research Article

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Quality Improvement Project: Post-Implementation Evaluation of an electronic requesting system for diagnostic tests in George Eliot Hospital

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Abstract

In George Eliot hospital, pathology and radiology requests were traditionally made via paper. Paper forms can be lost, filled in and signed incorrectly, leading to delays in obtaining test results and compromising patient safety. Thus, a transition from paper requesting to an electronic requesting system for diagnostic tests was necessary. Such an electronic requesting system was initially launched in the Acute Medical Unit of George Eliot hospital. This enabled optimization of the electronic system in a controlled and small, but busy clinical environment. Once so optimized, this would facilitate a more successful roll out to the rest of the organization. The post implementation evaluation of the electronic requesting system was conducted using the Plan- Do- Study- Act cycle model for quality improvement. Business processes for both radiology and pathology were updated to ensure patient safety and improve workflow. The project team was only funded for the implementation phase and therefore human resources were limited to drive the post implementation phase of the project. Overall, the implementation of an electronic requesting system for diagnostic tests in George Eliot Hospital was safe. In addition, the quality of the diagnostic pathway improved because of better documentation and transparency. This increase in quality came at a cost of reduced time efficiency of clinical workflow. Generally, the post-implementation phase is neglected in the planning phase of any NHS Health IT projects and this has to be addressed.

Keywords: Evaluation, Review Order Communication, Information Technology, IT, Phased Roll Out, Electronic Requesting, Time Motion Studies, Questionnaires, Acute Medical Unit (AMU)

Introduction

A dynamic and paperless vision for the future of the NHS services has emerged; aiming to radically reshape the way data is stored, managed and used. The Five-year forward view was published by the Department of Health in 2014 and stated that the NHS should "harness technology to drive down variations in quality and safety of care", showing commitment to a paperless electronic patient record by 2020. Ultimately, digitalization of the NHS will improve patient safety and outcomes, ensure continuity of care and involve patients directly into their care through access of their clinical care records.

In supporting the vision of the EPR Strategy and committing to the requirements of the Five Year Forward View and Personal Health Care 2020, a project team was tasked by the GEH Executive Board in 2016 to implement an electronic order comms solution (EMIS tQuest) across the hospital. The transition from paper to electronic requesting system was a matter of urgency to our organization due to the occurrence of an adverse incident. Specifically, a patient died due to a radiology request being lost and scan being delayed.

Overall, the initial project in 2016 was designed to achieve the following targets within 1 year:

1. an electronic requesting system for all radiology modalities, pathology investigations (excluding transfusion and blood products) for inpatients, out patients and A+E attender, aiming to improve patient safety, achieve earlier investigation and earlier diagnosis and commencement of treatment with a positive impact on patient outcomes
2. Develop, sign off and train new standard operating procedure for ways of working
3. An improved process for inpatients identifying discharge dependent patients allowing prioritisation of sample collection and investigations ahead of other non-discharge requests that are not required as urgent completion. This would lead to reduction of delays in the scheduling of tests and investigations, contributing to a reduction in length of stay and positive impact on patient flow throughout the Trust.
4. Significant contribution to the digital maturity of the organization and delivery against the agenda of Personal Health Care 2020 and The Five-Year Forward View.

Initially, the project was designed to be a one-year project extending from 2016 until 2017.

Unfortunately, there were inordinate delays in the implementation of the electronic order communication requesting system mainly due to the Winery subsequent supplier issues. On October 2018, the electronic requesting system for pathology and radiology requests

was launched in AMU. The AMU pilot was the first step to phase rolled out that eventually extending to the rest of the wards.

The aim of this study was to evaluate the post- implementation phase of the electronic requesting system and specifically:

1. Monitor for safety issues, identify and resolve barriers to implementation
2. Improve user satisfaction
3. To achieve 100% paperless requesting of diagnostic tests

Methodology

The plan- do- study- act (PDSA) cycle methodology was used for this quality improvement project.

Two PDSA cycles were completed.
It was decided that user satisfaction should be evaluated using validated questionnaire that included both qualitative and quantitative questions. The initial questionnaire was taken from the AHRQ website.

For each PDSA cycle, user satisfaction questionnaires were handed out two weeks after the system was launched to make sure that everyone was familiar with the electronic requesting system.

The questionnaire was simplified in the second PDSA cycle to increase the number of user responses. Emoticons were added in order to make the process of filling questionnaires more fun and offer a more accurate representation of the end user feelings [1].

A statistical analysis to compare the average user ratings for the most important questions was performed. The two- tailed Mann-Whitney U test was used to compare the average user ratings of the two PDSA cycles, as the data were nonparametric, continuous and unpaired. An online calculator was used. In order to evaluate the speed of the new electronic requesting system time motion studies were performed [2].

In order to compare the results of the time motion studies (time of electronic vs paper requesting) the two tailed paired Student's T test was used as the data were parametric and as the same doctors performed both the electronic and paper requests. An online calculator was used.

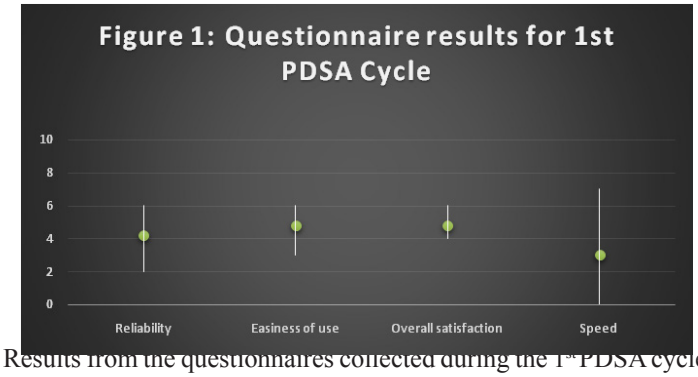
During the 1st PDSA, cycle junior doctors working in the AMU were selected to perform the time motion studies, observed and timed by one of the main authors.

During the 2nd PDSA, cycle a senior clinician in the outpatient department volunteered to perform the time motion studies, observed and timed by the same author that timed observed the time motion studies of the 1st PDSA cycle.

Results

In the 1st PDSA cycle, questionnaires from 5 house officers, 7 senior house officers and 3 registrars were gathered and analyzed in the first cycle (total 15 questionnaires).

The results of the most critical questions are summarized in figure 1:

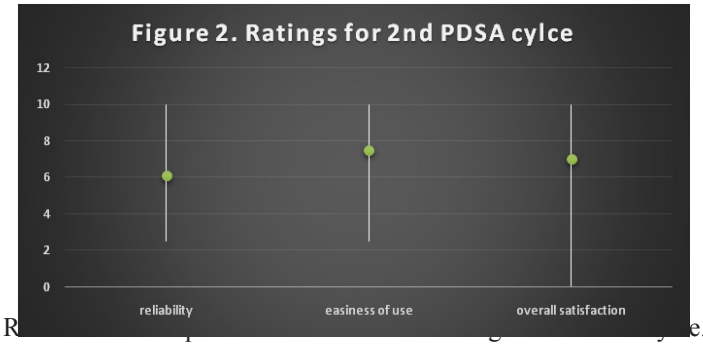


Results from the questionnaires collected during the 1st PDSA cycle

The reliability of the system scored 4, 2 on average. On further questioning, the main issues seemed to be that on occasion the computers were not working, or the software was freezing and crashing and thus the requester had to found another computer and restart or at the worst make a paper request. This could be frustrated on a busy ward round.

The average score for easiness of use was 4, 8. This could reflect the fact that more information needed to be provided when making an electronic request in comparison with paper requesting. The need to retrieve and provide all necessary information improved the quality of requesting. As per the speed of the system, a score of 3, 1 meant that there was a lot of opportunity for improvement there.

The questionnaires on the second cycle-included behavior type questions such as whether doctors are still using paper, or the electronic requesting system has become a default choice for them. 11 questionnaires were gathered and analyzed in total.



R e.

Reliability of the system rose from 3.9 to 6.1 after the software was update in May 2019. Still, the software continued to crash in several wards, though improvement was seen in other wards.

Easiness of use rose to approximately 7.5. The creation of test groups and the fact that doctors became more familiar with the system and probably started to gather the information they needed before starting the request could have led to this improvement.

Overall user satisfaction rose from just below 4 to 7.

- The reliability of the system showed a statistically significant improvement after the actions of the 1st PDSA cycle. (P= 0.008)
- The users also felt that the system was easier to use during the 2nd PDSA cycle after they had used the system for

approximately 6 months (P= 0.005)

- The overall user satisfaction on the other hand did not show a statistically significant improvement (P= 0.013)

Time motion studies

1st PDSA cycle

7 requesters for radiology requests and 5 requesters for pathology requests volunteered to participate in the time motion studies in the AMU.

The results of the time motion studies can be found in Table 1.

Table 1: Time motion studies of the 1st PDSA Cycle

N	Radiology electronic	Radiology paper	Pathology electronic	Pathology paper
F1 20- 30 M	82 sec	68 sec	42 sec	26 sec
F1 20-30 F	95 sec	47 sec	49 sec	31 sec
SHO 20-30 F	67 sec	53 sec	50 sec	24 sec
PA 20- F	100 sec	64 sec	44 sec	28 sec
PA 20- 30 F	91 sec	70 sec	47 sec	27 sec
SHO 20-30 M	93 sec	76 sec	-	-
REG 30-40 F	84 sec	52 sec	-	-

Radiology electronic requesting was more time consuming than paper and this was statistically significant, mean Δt= 26 sec CI 95% 13.98- 38.02, p= 0.0018.

Similarly. Pathology electronic requesting was more time consuming than paper and this was statistically significant, mean Δt= 19.20 sec CI 95% 15.33- 23.07 p= 0.0002

2nd PDSA Cycle

4 Outpatient electronic radiology requests were collected during a urology clinic in the outpatient department. The results from the times studies of the 2nd PDSA Cycle can be found in Table 2.

Table 2: Time motion studies of the 2nd PDSA cycle

N	Electronic request	Paper request
US KUB	90 sec	95 sec
MRI Prostate	80 sec	74 sec
CT Urogram	91 sec	116 sec
CT KUB	53 sec	94 sec

During the 2nd PDSA cycle time motion studies for radiology requesting were performed. The mean Δt=-16 sec. CI 95% (-49.83 to 17.83). Time to complete electronic and paper requests did not differ when a senior clinician completed the requests.

Discussion

According to the ancient Greek philosopher Heraclitus ''change is the only constant''. Even after 2000 years, Heraclitus quote remains contemporary. Professor Kotter, a world-renowned change management expert, described a systematic eight step methodology for change in his book ''leading change'' in 1996 [3].

According to Kotter, a sense of urgency needs to be developed; a spark of initial motivations to initiate the process. In our case, both an adverse event (death of a patient due to a paper radiology request being lost) as well as the need of our Trust to keep up with the five-year NHS plan gave rise to a sense of urgency to implement an electronic requesting system and get rid of paper. Unfortunately, the infamous ''WannaCry'' cyber-attack as well as supplier issues led to inordinate delays as the project was about to be completed from 2016 to 2017.

In 2018, a new team was tasked to restart the project. According to Kotter, a successful team needs leader representatives of all the different stakeholders if a strong coalition is to be build. Our team lacked strong leadership from the pathology and radiology departments. Despite that, the IT team in cooperation with both junior and senior doctor representatives managed to create and successfully communicate a vision for change. This happened through frequent discussions in planned meetings and in the ward, where there were plenty of opportunities to train the clinical staff to make online requests.

It is widely recognized that obstacles may arise during the process of change. These obstacles need to be recognized and dealt with promptly. This is especially true in the complex sociotechnical environment of healthcare where the human factor plays a major role (ref sociotechnical environment paper). It has also been shown that big bang roll outs have jeopardize patient safety and increased patient mortality (ref paper with CPOE in pediatrics with increased mortality) so phased rolls out are preferable, especially in small district hospitals [4].

In our case, when the system was implemented in the outpatient department, we found out that 16 CTCA requests made from the OP cardiology department were not vetted and patients did not have their scan in time.

This raised a safety concern and a DATIX (incident report form) was completed. After investigation of the issue by a team of senior clinicians, it appeared that patient safety was not compromised. Nevertheless, the standard operating procedures of radiology were updated to include a safety key for future similar events, which could compromise patient safety. An automated alert was put in place to catch missed/erroneous requests to go to the Picture Archiving and Communication System team as well as the IT architect and depending on circumstances, the integration team.

It is widely accepted that the implementation of healthcare IT systems comes at high financial cost and yet the benefits of healthcare digitalization have been limited so far. Paradoxically, despite large investments in healthcare IT, productivity has not increased and many physicians are frustrated by the increase of workload, arising from electronic healthcare systems. The gain in efficiency and productivity may be delayed for one to two decades as it has happened in the past in other industries [5].

Similarly, in our case, it was noted that the process of feeling in an electronic request was more time consuming than filling in a paper form when junior doctors made the requests in the 1st PDSA cycle. It was also evident that requests made by junior doctors in paper lacked important clinical information.

On the contrary, electronic requests could not be submitted if any of the relevant information was missing. When a senior clinician placed the requests in the 2nd PDSA cycle, electronic requesting took equal if not less time than paper.

In this case, it is evident that increase in the quality of request came at a cost of time for junior doctors and despite increase in the quality of the requests; they had to spend more time to complete a request.

In order to reduce delays in placing requests and improve user experience more portable computers- VDIs were provided by the Trust to the AMU team after presenting the results of the 1PDSA cycle to the Trust audit day.

Additionally, during the 2nd PDSA cycle the computer software was updated to resolve the issue of ''frozen screen'' that appeared during occasionally during electronic requesting. After the software update, this issue was partially resolved.

Another barrier to implementation was the fact that locum doctors could not initially place electronic requests. It was agreed that as long as locums would provide their GMC number, they would be able to place electronic requests. Without the GMC number, any request would be rejected.

In the UK only, the National Patient Safety Agency (NPSA) estimates that around 850.000 errors and incidents occur in the NHS each year. Computerized provider order systems (CPOE) can lead to reductions of such errors, by ensuring the legibility of all requests, the completion of all the necessary clinical information and by making sure that no requests are lost or forgotten, as could easily happen with paper forms.

Additionally, CPOE improve the communication between different departments (in our case radiology and pathology) with clinicians and reduced steps in workflow (eg junior doctor taking the form down in radiology or porters delivering the forms to the relevant department).

Despite all of these benefits, CPOE has been shown to give rise to a range of unintended consequences [6]. An important unintended consequence is non-engagement with the system by end users. In our study, we discovered during the 2nd PDSA cycle that only 64% and 31% of the total radiology and pathology requests in the AMU were made online.

This could reflect the high turnover of doctors in the AMU, as doctors are rotating every four months. New doctors coming from other Trusts where the still use paper might have been unaware of the process and not trained to place online orders. Using paper when online requesting is available to save time is an unintended workaround that compromises the quality of requesting in the Trust. Other workarounds in our case where the add on tests. As electronic add ons were not accepted by the lab it was agreed that paper forms would still be in use for add ons. Although, a harmless workaround it still undermines our effort for a paperless organization [7].

Apart from a project's long-term goal, it is suggested that short term goals should be set and also celebrated by the team when achieved. This promotes bonding of the team, increases motivation and improves results. This was not done by our team most likely due to lack of time and possibly because a strong coalition was not achieved from the start of the project (Creswell) .

According to Cresswell, continuous cycles of quality improvement are necessary to monitor and optimize IT systems in healthcare [8].

Due to limitation in time and resources only two PDSA cycles were performed. These were enough to make the transition from the AMU to the rest of inpatient wards and outpatient department but not in the accident and emergency department. More PDSA cycles could have been useful. On the other hand, a decision must be made as to how much time, efforts and PDSA improvement cycles are required before paper requests are not acceptable anymore and all pathology and radiology requesting becomes electronic. All our current doctors and nurses have been officially trained to request online and all new staff and locums that join the trust will have formal induction and training. Additionally, online requesting has been proven safe, efficient and practical.

At this point, a firm decision to get rid of paper requesting would achieve sustainability of the change and avoid workarounds arising from the complexity of the existence of two methods of requesting. The success of the implementation of electronic requesting will boost our organization's faith in healthcare IT and motivate our team to proceed to the digitalization of other processes, such as electronic prescribing. Establishing a paperless culture within our Trust will be a small but important step towards the digitization of the whole NHS. It will also help to create a ''learning health system'' where all the digital information can be utilized for auditing the requesting process and maybe identify over requesting and reduce over investigation, improving the quality of care provided to our patients.

Conclusions

The implementation and the success of new electronic communication systems in healthcare is not an easy task and is not always achieved without problems. Time, effort, funding and a multidisciplinary team approach are vital in order to make a health care organization go paperless safely and smoothly, respecting the readiness of the staff to embrace these changes.

Sociotechnical factors such as understanding of workflow, managing people's emotions and providing end user value should always be considered both during the planning phase but also during the post implementation evaluation phase. We suggest that phased out rollouts are ideal for small district general hospitals in order to maintain functionality and not disrupt workflow during the transition phase.

Continuous quality improvement cycles using the PDSA methodology would be strongly advised as they provide a systematic and credible way of monitoring and optimizing an IT initiative during the post implementation phase. Overall, people and organizations need time and efforts to change and good leadership skills are needed to ensure motivation, inspiration and sustainability of the implemented changes.

References

1. Young RA, Burge SK, Kumar KA, Wilson JM, Ortiz DF (2018) Ortiz A Time-Motion Study of Primary Care Physicians' Work in the Electronic Health Record Era. Fam Med 50: 91-99.
2. Tim Benson (2019) Digital innovation evaluation: user perceptions of innovation readiness, digital confidence, innovation adoption, user experience and behaviour change. BMJ Health Care Inform 26.
3. Kotter JP (1996) Leading change. Boston, MA: Harvard Business School.
4. Peute LW, Aarts J, Bakker PJ, Jaspers MW (2010) Anatomy of a failure: A sociotechnical evaluation of a laboratory physician

order entry system implementation. International journal of medical informatics 79: e58-e70.
5. RM Wachter, MD Howell (2018) Resolving the Productivity Paradox of Health Information Technology A Time for Optimism. JAMA 320: 25-26.
6. JS Ash, M Berg, E Coiera (2004) Some Unintended Consequences of Information Technology in Health Care: The Nature of Patient Care Information System-related Errors. J Am Med Inform Assoc 11: 104-112.
7. Elaine H Ferneley, Polly Sobreperez (2006) Resist, comply or workaround? An examination of different facets of user engagement with information systems. European Journal of Information Systems 15: 345-356.
8. Cresswell KM, Bates DW, Sheikh A (2013) Ten key considerations for the successful implementation and adoption of large-scale health information technology. J Am Med Inform Assoc 20: e9-e13.