Integrating A3 Reports and the House of Quality: Improving Workflow in the Recovery Room Using Information Technology

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Abstract. In this paper, we provide a methodology for integrating the House of Quality (HOQ), a process tool, with Toyota A3 reports to effectively identify the priorities and root causes of poor efficiency in a Post Anesthesia Care Unit’s (PACU) workflow. The A3 report allowed us to identify the workflow waste, and the HOQ helped us to identify and prioritize the critical root causes of poor workflow that could be improved by technology.

Keywords. workflow management, A3 report, House of Quality (HOQ), Root Cause Analysis (RCA)

1. Introduction

Toyota lean A3 methodology is an approach used to improve the efficiency and effectiveness of workflow by eliminating waste, and uses a set of tools that identify and eliminate waste, while at the same time improving the quality of goods and services and reducing production times and costs. This methodology uses A3 reports to identify activities that would benefit from workflow changes (involving technology). However, statements used in A3 reports are often based on quality improvement team subjective opinions and may focus upon time and cost rather than problem solving to identify waste. Therefore, the time and budget needed to reduce waste is uncertain and we do not know what activities best address patient needs. To address these problems, this paper integrates the House of Quality (HOQ) with A3 lean methodology and demonstrates how priorities and root causes of inefficiency can be identified while improving workflow in healthcare organizations.

2. The Methodologies

The A3 Problem Solving Report. A3 problem solving entails examining activities with “new eyes”. Initially, problems are identified through observation or experience. A3 structures the problem-solving process by defining the issue from a customer’s (e.g., patient, physician, nurse) perspective. A3 provides a framework where problems are thought about, documented and solutions are identified [1, 2]. The A3 template includes the following:

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• Theme – clearly points out and states the problem.
• Background – clarifies the problem or theme and establishes its significance.
• Current Condition – depicts how the system currently works. Data used from direct observation is used to develop a diagram. This prevents deviations from general or hypothetical conceptions of the current state of the process.
• Root Cause Analysis (RCA) – Ascertains the root causes of problems. The “5 Why’s” method is a common technique for RCA.
• Target Condition – is a hypothesis. Suggests a better way of doing work that eliminates waste, and is closer to the ideal workflow.
• Countermeasures – describe changes (from the current to the new condition).
• Implementation Plan – determines the actions needed to achieve the new condition, including the process steps, completion times, and individual responsibilities.
• Follow-up Plan – indicates when to measure and how to measure the improvements.

The House of Quality (HOQ) Methodology. The structure of HOQ includes six matrices. The functions of each matrix are described as follows [3]:

• Customer Requirements Matrix – documents a structured list of the voice of the customer (VOC) (information is gathered from customers about their needs).
• Planning Matrix – qualifies the customers’ requirement priorities and their perceptions of the performance of existing products.
• Technical Requirements Matrix – describes the technical characteristics or the voice of the organization. The QFD design team generates information by identifying measurable characteristics of a service that meets the customer requirements.
• Inter-relationship Matrix – translates the requirements as expressed by the customer into product technical characteristics. Each cell in the matrix combines an individual customer and a technical requirement.
• Roof Matrix – is used to identify the technical requirements that characterize the product, support of how they may impede one another.
• Weight of voice of the engineer (VOE) Matrix – summarizes conclusions drawn from data from the entire matrix and the quality team’s discussions.

3. A Post Anesthesia Care Unit (PACU) Case Study²

An orthopedic surgeon has a wait list that extends care for six weeks. He feels five joint procedures could be completed a day, but is being limited by a bottleneck in PACU. Patients are spending 95 minutes in the PACU before transfer to the ward. Patients receiving spinal anesthesia should be awake in 30–40 minutes. Efforts could be made to improve workflow, and reduce length of stay from 95 to 40 minutes.

The Process Problems. In the case study, PACU nurses only spend 18 minutes caring for the patient, and 77 minutes on wasteful activities (i.e., non-patient care related) (see Figure 1).

² The case study was adopted from as real case presented in HINF551 (May 20, 2008), University of Victoria, BC, Canada
Process measurements. The A3 report can be used to document PACU bottleneck issues as follows [4]:

- **Theme and Background** – Patients receiving spinal anesthesia should be fully awake within 30-40 minutes. However, there is a huge time gap (on average of 95 minutes) from the time the patient is awake to the time they are transferred to the ward.

- **Current Condition** – The recovery room nurse is frequently being taken away from her primary duty – patient care (see Figure 1). The root causes of the problems are:
  
  **Problem 1**: Nurse must leave patients to retrieve X-rays from the viewing box. *Why?*
  
  Inefficient layout of PACU.

  **Problem 2**: Nurse must take X-rays to the surgeon. *Why?* Surgeon does not go to PACU to read the X-rays. No means to communicate remotely.

  **Problem 3**: Frequent trips to the supply room are made. *Why?* Supply room is far from the point of care.

  **Problem 4**: Frequent telephone calls are made. *Why?* Lack of remote communication to convey information.

  **Problem 5**: Delay in transferring patient reports at hand-over. *Why?* The nurse is busy on the ward. There is a lack of means to communicate remotely.

  **Problem 6**: Unnecessary charting. *Why?* There is a lack of automated systems such as the patient monitoring devices and electronic medical records (EMR).

  **Problem 7**: Congested traffic flow at PACU. *Why?* Inefficient layout of PACU.

- **Target Condition** – There is a need to: minimize/eliminate time spent outside the PACU, improve processes, and streamline communication to support workflow.

- **Countermeasure** – Implement PACS/RIS so that surgeons can remotely review and interpret X-rays, implement Computerized Physician Order Entry (CPOE) to enter orders from the PACU, redesign the layout to minimize wasteful movements, streamline workflow, introduce Blackberries so nurses can communicate remotely, and implement an EMR to reduce the need for synchronous verbal communication.

- **Implementation Plan** –

<table>
<thead>
<tr>
<th>What</th>
<th>Who</th>
<th>When</th>
<th>Outcome(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install wireless phone</td>
<td>Nurses and biomedical department</td>
<td>See Figure 2.</td>
<td>- Nurses spend more time at the bedside</td>
</tr>
<tr>
<td>Re-design PACU layout</td>
<td>Physicians, Nurses, Physical plant</td>
<td>See Figure 2.</td>
<td>- Frequently used supplies are at the bedside</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Nurses spend more time at the bedside</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Improved traffic flow in the PACU</td>
</tr>
<tr>
<td>Implement PACS/RIS</td>
<td>All stakeholders</td>
<td>See Figure 2.</td>
<td>- Remotely view X-rays with reduced interpretation time</td>
</tr>
<tr>
<td>Investigate EMR system</td>
<td>All stakeholders</td>
<td>See Figure 2.</td>
<td>- Decreased need for synchronous verbal communication, improved verbal hand-over and decreased time spent on charting</td>
</tr>
</tbody>
</table>
Follow-up Plan –

<table>
<thead>
<tr>
<th>Target</th>
<th>When</th>
<th>How</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACU length of stay less than 45 minutes.</td>
<td>Once/3 months</td>
<td>Monthly reports of a mean length of stay with repeated value stream mapping</td>
</tr>
<tr>
<td>40% increase in time of direct bedside care</td>
<td>Once/1 month</td>
<td>Time-motion analysis</td>
</tr>
<tr>
<td>35% decrease in wait time for surgeries</td>
<td>Once/1 month</td>
<td>Wait list reports</td>
</tr>
</tbody>
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4. Applying HOQ to Process Change

After waste has been identified (as described above), strategies were developed to address the waste. The House of Quality (HOQ) was used to prioritize root causes that require changes to improve workflow (see Figure 2). HOQ uses a planning matrix to map the needs of nurses to actions that meet those needs [5]. PACU staff requirements (the voice of the customers, VOC) are gathered through interviews where staff is encouraged to express their needs and problems. After case analysis, the main requirements were identified: \( R_1 \): Minimize time spent outside of PACU (e.g., retrieving X-rays, supplies, etc.), \( R_2 \): Eliminate disruptions to the care processes (e.g., phone call), \( R_3 \): Eliminate over charting of patient care information, \( R_4 \): Enhance X-ray interpretation processes by medical doctors, and \( R_5 \): Streamline traffic flow in the PACU. The technical requirements for satisfying those needs were found to be: \( T_1 \): Investigate EMR, \( T_2 \): Implement PACS and RIS, \( T_3 \): Install wireless phones in PACU and \( T_4 \): Re-design PACU layout.

![Figure 2. House of Quality for PACU](image-url)
technical requirements (e.g., investigate EMR), are entered into the technical requirements matrix. This determines whether they support or impede other requirements. They are documented in the triangular roof matrix of the HOQ, where “+” = the technical requirement is supported, and “–” indicates that it is an obstacle. Each matrix cell is used to indicate inter-relationships between customer and technical requirements in the body of the HOQ. The level of inter-relationship is weighted on a ten-point scale (0~10), and is entered into the matrix cell. Finally, the technical property (weight of VOE) matrix records the priorities assigned to technical requirements. A specific technical property value is obtained by summing the scale of inter-relationship times and the overall weight of customer requirements (e.g., the technical property value for investigating an EMR system is: 0×0.28 + 0×0.22 + 8×0.19 + 0×0.15 + 2×0.18= 1.72). The matrix output is a set of values and priorities that identify the importance of each technical requirement in meeting customer’s needs. In this case study, the installation of wireless phones in a PACU is a main priority. Installation of an EMR is a lesser one. The final workflow is shown in Figure 3.

5. Conclusion

Improving the efficiency of PACU is important. This paper combines A3 problem solving reports with the HOQ to enhance the workflow processes in a PACU using technology. The A3 report allowed us to identify activities that could be changed to reduce waste and improve quality. The HOQ helped us to identify and prioritize the critical root causes of poor workflow that could be improved by technology. A case study illustrated the benefits of using the methodologies together.

References