INCREASING PATIENT ACCESSIBILITY TO A SURGERY DEPARTMENT THROUGH OPERATIONS MANAGEMENT PRINCIPLES

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Abstract: This paper investigates how the application of operations management principles can be used to increase patients' access to an inpatient care facility that supplies acute and non-acute care, in a Swedish University Hospital. This paper also identifies problems and solutions related to patient flow, as well as facilitators and barriers to implementation process. The study shows that patient accessibility can be increased by using operations management principles such as separated flows. The implementation was facilitated by short term gains, management support, and visible leadership. The barriers to implementation were identified as lack of operations management knowledge, deficiencies in improvement work and regulations.

Keywords: Operations management, Accessibility, Lean healthcare, Implementation

1. INTRODUCTION

The Swedish healthcare system is being challenged by the demands of an increasing elderly population (Stockholms Läns Landsting, 2009). The costs of healthcare have increased from an amount corresponding to 9.1% of Sweden's GPD in 2005 to 9.6% in 2010 (Statistiska centralbyrån, 2012). Economic constraints make additional resources infeasible, necessitating increased efficiency in healthcare supply. Molin and Johansson (2005) in an international comparison show that the quality of the Swedish healthcare is sufficient, but that patient access is insufficient. Long waiting times result in patient dissatisfaction and an increased risk of aggravated medical conditions with negative economic consequences for Swedish society as a whole. In recent years, there has been increased diffusion of the lean philosophy in Swedish healthcare (Rognes and Svarts, 2012). Spear (2005) argues that there are advantages to be gained from implementing TPS (Toyota Production System) in healthcare, and there are examples of the introduction of lean providing good results (Rognes and Svarts, 2012). However, there is some resistance to this idea, with sceptics arguing that people do not equate to products, making the concept of lean inapplicable to healthcare (Fillingham, 2007; Papadopoulos, 2008). Proponents of lean claim that lessons have been learned from these critiques, in line with one of the pillars of the concept: that of continuous improvement. Research shows the success of implementing lean and operations management principles to improve patient flows. However, research is needed to explain why there are not more lean and operations management solutions in healthcare to improve accessibility. In reality, the impact of these solutions has been limited (Jacobsson, 2010). This paper is based on a study of a Swedish University Hospital surgery ward alpha, which is an inpatient facility supplying both acute and non-acute care. Surgery ward alpha is one of four units that constitute the surgical department. At the beginning of the study, patient accessibility to ward alpha was insufficient, and patients arriving at the ward were often forced to wait until a bed became available. During 2011, the ward had 104% occupancy, meaning that when some patients were out of the ward, for example in surgery, their beds were sometimes occupied by other patients. The high resource utilisation combined with inevitable variations caused longer lead times (see e.g. Hopp and Spearman, 2000). Referral queues were undesirably long and several patients awaiting surgery could not be guaranteed treatment within the

time frame specified by the healthcare system, which forced the ward to purchase care from external actors. The nurses also experienced excessive workloads and were concerned about patient safety. However, the statisticians considered the available resources to be adequate but not optimized. This paper identifies problems and potential areas for improvement related to patient flow on the ward. It contributes to research in the field of lean principles application by addressing the question of *what problems does surgery ward alpha experience regarding patient flows, and what improvements might be made that would increase patient access to the ward?* The study identifies and describes factors that affect the implementation of process flow improvements. Several works investigate flow efficiency in healthcare but implementation of the theory has not been successful. By addressing the question of *what should be considered when implementing process flow solutions, and what lessons can be learned from the process of their implementation*? This paper aims to contribute to knowledge in this field.

2. METHOD

The study was conducted in two main phases: problem-solving and implementation. The main study was performed over a period of 16 weeks, starting in January 2012. Both qualitative methods (similar to clinical methodology, see e.g. Åhlström, 1997), and quantitative calculations were used to tackle the research questions. Mapping of the organisation and data collection were performed using qualitative methods consisting of participant observations, interviews, and informal conversations. Participant observation in this case refers to a member of the project team following and monitoring a member of the ward staff during performing their daily routines during a work shift. The observations were passive; the project team member did not intervene or disturb the normal routines. Participant observations lasted between five and eight hours and included opportunities for informal conversational exchanges. The interviews with department personnel were both semi-structured and unstructured. Informal conversations took place with personnel in other hospitals to obtain additional knowledge. Quantitative methods were used to measure the effects of the improvement proposals, and three performance measures were chosen as most appropriate: percentage of patients discharged before noon, percentage of patients relocated, and patient throughput times. These measures taken together can be considered as indicators of accessibility for patients. In total, the project team spent 400 hours on the ward, including participant observations, interviews, informal conversations, meetings, as well as office hours. During the problem-solving phase, 21 observations took place and were described in short notes, 26 interviews were conducted, and 85 valuable conversations were documented. The majority of the conversations were with nurses and surgeons, but also included exchanges with other key staff members such as assistant nurses, coordinators, the head nurses and the chief of surgery. Follow-up questions were posed via telephone and email, particularly with the ward's assistant head nurse.

The problem analysis was the starting point for suggested improvements, which were further developed within the theoretical framework. Analysis of the qualitative data was based on an issue tree, used to map the causes and the effects of the problems identified on the ward. The quantitative data were analysed using the three performance measurements identified. Several activities, such as report writing, data collection, and analysis were iterative due to their interdependence. The nature of the qualitative data involved its simultaneous analysis with data collection (Miles and Huberman, 1994), while the quantitative data could only be analysed after data collection was complete (Bryman, 2002). To validate the findings, discussions were held within the project group and continuous comparisons made with the original notes. Workshops were held with department personnel to validate the findings from the problem analysis. After the proposed improvements had been presented, the surgery department prepared for the change and its implementation which started in January 2013 and was led by the department's management. Follow-up visits were conducted in January 2013 (discussion with the chief of surgery), September 2013 (discussion with chief of surgery and head nurse) and November 2013 (additional group interview involving the head nurse and the team leaders). The purpose of the follow-up visits was to identify facilitators of and barriers to the implementation process. Additional quantitative data related to the identified performance measurements was collected in January 2014. The data from 2013 was compared with data from 2011 and 2012 (i.e. before the change) in order to investigate potential improvements.

3. THE SURGERY DEPARTMENT

The surgery department employs approximately 200 people and its turnover in year 2011 was around SEK 300 million. The department comprises a surgery reception and three surgical wards; alpha, beta and gamma, each specialized in different areas. Surgery ward alpha is in focus of this case study.

3.1. Surgery ward alpha

Surgery ward alpha is an inpatient care facility that supplies both acute and non-acute care, where patients that have had or are awaiting surgery are treated. The ward employees include surgeons, nurses, assistant nurses, coordinators, and medical secretaries. Two surgeons and six to eight nurses staff the ward during the day. In years 2011 and 2012 a total of 3,440 patients were treated in surgery ward alpha; 60% acute and 40% non-acute. The most common diagnosis group among non-acute patients constitutes 30% of total patients, while the second most common diagnosis group constitutes 25% of the total. The care process differs among diagnosis groups but throughput time, for example, for the most common diagnosis group is usually 2-3 weeks and for the second most common diagnosis group 2-3 days. Approximately 60% of total throughput time is related to acute patients and 40% to non-acute patients. Throughput times vary for patients with different diagnoses and variations also occur for patients being treated for the same disease. During 2011 and 2012 the average throughput time was 6 days but patients were hospitalized for between 1 and 122 days. Acute patients originate from different places, such as the emergency and other departments within the hospital. Arrival rates are relatively evenly distributed throughout the day and the year. There is a significant variation between acute patient diagnoses, where the most common diagnosis group constitutes 13% of the total number of patients, while the second most common diagnosis group constitutes 10%. Average throughput time for acute patients was 6 days during 2011 and 2012 but around 70% were hospitalized for 5 days or less.

3.2. Problem description

The main issue at surgery ward alpha, from a patient perspective, is poor accessibility to the ward. At the time of the study, both referral queue and time to surgery were higher than desirable, with patients forced to wait for an available care bed. Due to lack of space, patients might be relocated to other departments within the hospital. The poor accessibility to the surgery ward derived from demand for the treatments provided on the ward, patient throughput times, ward capacity in terms of number of care beds, and available surgery slots. It is mainly the number of available care beds that limits the accessibility to the surgery ward for acute patients. The ward has no influence over demand or capacity; throughput time is the focus of this study. Throughput time depends on the care and the discharge processes. A disorganised work environment and inadequate procedures related to replenishment of supplies, resulted in non-value adding activities for employees, with a further negative effect on throughput time. The care process, i.e. activities additional to medical care, includes the surgeons' routine rounds which involve the surgeon meeting his or hers patients and discussing with the nurses how the patients should be cared for on the ward. There was no fixed order of patients for the surgeons' rounds; it was usually random on the basis of which nurse was available. The round started with the surgeon responsible for that day's round to discuss certain patients with the first available nurse and formulate a care plan for the upcoming days. Then the surgeon and the nurse would visit the patients discussed. The procedure would be repeated with another nurse and another set of patients. The time required for a round varied, and the morning round occasionally ran over into the afternoon. This increased the waiting time for patients, and was most crucial for patients with serious conditions requiring a meeting with a surgeon. Inadequate procedures related to the rounds routine caused high workloads and a stressful work environment and delayed decisions about care and patient discharge. Time was wasted by nurses having to wait for an activity to be performed before the next activity could start. This waiting time prevented the ward from being flow efficient, since patients had to wait for the value adding activities. The problems described were characterised by lack of communication among staff and a general lack of routine, which complicated the coordination of activities. These problems taken together resulted in the non-value adding time of both surgeons and nurses increasing and discharge times for patients being postponed. The time of arrival of patients at the department was often before discharge times, leading to overcrowding at certain times of day, usually before noon. Patients waiting for admission often had to wait for an available bed. The discharge process was initiated by the surgeon informing the responsible nurse that the patient was surgically fully treated and ready for discharge. The activities related to patient discharge then started, including contact with the parties concerned, arranging a care planning meeting, compiling medication prescriptions, and providing medical certificates. The discharge process was characterised by lack of advance planning by staff, which derived from a lack of overview of the patient flow and absence of a plan of activities and their timing. The problems associated with the discharge process meant that in some cases, patients remained in the ward sometimes for several weeks after they were fit to be discharged. Most of the activities related to patient discharge could not be performed until the surgeon had decreed that the patient was surgically fully treated, although many of them concerned arrangements that could have been made a day or days before that. A delayed round, or lack of a responsible nurse to perform the activities during the day, could result in the whole process being delayed until the following day, correspondingly prolonging the patient's stay on the ward. Ward personnel did not have access to an overview of the patient's progress in the care process, which led to difficulties in forward planning.

3.3. Improvement proposals

In order to increase patients' accessibility to the care unit, a number of improvement ideas based on operations management principles were presented to the department personnel and the management. These included new routines for the rounds, with patients categorised according to their need for care. A red patient group with no care plan would be prioritised, followed by a yellow patient group ready to be discharged, a green patient group following a preset care plan, and a black patient group who do not need to be seen by the surgeon. The implemented categorisation system introduced a new structure for the surgeon's round, where each patient was considered separately which increased the possibility for the surgeon to make a correct evaluation. After seeing each patient, the surgeon would enter notes into the computer and define the next step in the care plan. If a patient was to be discharged or required a referral letter, these activities were performed before attending to the next patient. The non-value adding time of waiting, for patients ready to be discharged from the ward, decreased and contributed to a reduction in throughput times and earlier discharges. It enabled faster care decisions for patients, resulting in faster recovery, which further reduced throughput times. To ensure that all employees were aware of the current situation on the ward, and could plan and prepare their day accordingly, the round status and colour-coding of patients were displayed on a constantly updated whiteboard in the ward. To reduce patients' care time at the ward even further and achieve a necessary care time and reduce wasted time, a standardised discharge process was put in place along with a planning procedure prior to discharge. The improvement proposals included planning discharge at the time of admission to allow earlier performance of activities and a standardised way of handling discharges. Checklists at admission and discharge were introduced to increase visualisation of patient flow and facilitate the planning of these procedures. The nurses were able to predict the activities needed for patient discharge, which simplified the planning process. It would be possible to show the patients progress in the care process, expected discharge date, which activities linked to discharge were completed, and which had yet to be done. It would allow proposals for where the patient would go on leaving the ward and the contacts required. An expected discharge date makes it more likely that the discharge will happen on that date and will not be delayed. The proposals also included the ward implementing a standardised way of handling the discharge conversation in which the patient and the nurse could discuss any need for information, sick-leave, and medication. Finally, the ward was recommended to implement 5S, in order to decrease the material disorder, and to introduce an improvement board to encourage continuous improvement initiatives from ward personnel. The ward was recommended to separate patient flows so that acute and non-acute patients initially would be treated separately. It was also recommended to divide care beds into diagnosis groups which would usually involve similar care times and care processes.

After the improvement proposals had been presented to the department management, preparation for implementing the proposals started within the department. Three information meetings were held to inform employees about the change and the new working procedures. The implementation began approximately eight months after the first part of the study. The improvement proposals were implemented simultaneously, in all the wards in the surgery department. In order to separate patient flows, surgery ward beta was transformed into a ward for acute patients, surgery ward alpha was responsible for non-acute patients with certain diagnoses with more than 3 days estimated care time, and surgery ward gamma took responsibility for non-acute patients with shorter estimated care times. Overcapacity in surgery ward beta would enable it to manage the variation in admissions and throughput times, common for acute patients. The reallocation of acute patients to surgery ward beta would reduce the variation in the other two wards. Patient registration before surgery was conducted in surgical reception and patients were directed to the appropriate ward after surgery.

4. RESULTS OF THE IMPLEMENTATION

The performance measurements were identified based on the overall problem of poor accessibility for patients. The quantitative results of the performance measurements indicate the effects of the improvement proposals, and consider all wards in the surgery department. The number of patients admitted to the department was 6,968 patients during 2011, 6,621 patients during 2012, and increased to 7,407 patients during 2013 after implementation of the improvement proposals.

- The first performance measurement is *percentage of patients discharged before noon.* During 2011 and 2012, 10.7% and 11.4% of the patients were discharged before noon, compared to 12.4% in 2013 after implementation of the improvement proposals.
- The second performance measurement is *percentage of patients relocated from the department* due to lack of hospital beds. According to Socialstyrelsen (2011), relocation of patients can imply severe safety risks for patients. During 2011 and 2012, 5.4% and 5.5% of the patients were relocated from the

department, compared to 3.0% after implementation of the improvement proposals. The need for fewer relocations suggests that access to the department had increased.

- The third performance measurement is *throughput time*. During 2011 and 2012, throughput time was 4.0 care days per patient, compared to 3.0 days per patient in 2013, after implementation of the improvement proposals. Thus, care time decreased by an average of 1 care day per patient. In 2012 surgery ward alpha had an average throughput time of 6.0 days with a standard deviation of 8.8 days, in 2013 the same ward had an average throughput time of 10.0 days with a standard deviation of 9.8 days. The increased throughput time and standard deviation is a result of ward alpha handling patients with longer estimated care time, and the high standard deviation is a result of the variation in diagnosis groups in the ward with some groups with an estimated care time of 5 days and some of 3 weeks. In 2012, surgery ward beta had an average throughput time of 3.0 days with a standard deviation of 5.2 days, and in 2013 the same ward had an average throughput time of 2.0 days with standard deviation of 2.7 days. The reductions in throughput time and standard deviation confirm that ward can handle the variation in arrival and care time for acute patients. Finally in 2012, surgery ward gamma had an average throughput time of 3.0 days with a standard deviation of 4.7 days, in 2013 the same ward had an average throughput time of 3.0 days with standard deviation of 3.5 days. Hence, the standard deviation decreased, which implies a narrower range of diagnosis groups with lower variation in care time.

The results of the implementation indicate an improvement in all the studied performance measurements. Since 11.9% additional patients were treated in the surgery department during 2013 compared to 2012, accessibility for patients has increased, which is a direct effect of the 25.0% average shorter throughput time. Due to the separated flows and overcapacity in surgery ward beta, the variation in diagnosis groups within each ward decreased, allowing resources to be planned more precisely, which led to a smaller number of patients being relocated. The percentage of patients discharged before noon decreased from 2012 to 2013, but there was a similar change between 2011 and 2012, thus it cannot be assumed that the reduction is a direct effect of the implementation. However, since surgery reception handles all registrations, the number of patients in the surgery wards at noon has been reduced and earlier discharge is less important.

5. FACILITATORS OF AND BARRIERS TO THE IMPLEMENTATION PROCESS

Based on interviews with department personnel a number of facilitators and barriers were identified. The facilitators included short-term gains, visible leadership, strong leaders, and continuity. The barriers were identified as lack of knowledge of operations management, deficiencies in improvement work, and government regulations.

5.1. Short-term gains

Short-term gains and rapid and concrete improvements motivated staff and increased their confidence in successive changes. Implementation of 5S and increased visualisation were the foundation for further improvements and implementation of less intuitive lean concepts. The 5S changes were an easy-to-grasp concept, and allowed staff to recognize their positive effects. The whiteboard for the rounds contributed to continuity, structure, and visibility of what had to be done, and made it easier for nurses and surgeons to appreciate changes such as separation of acute and non-acute patients.

5.2. Visible leadership, strong leaders and continuity

Management demonstrating support for change and its implementation is one of the keys to the success of the process (Kotter, 1996). Visible leadership demonstrates to staff that management cares about the change; this certainly applied during the implementation of change in this case. To promote confidence in the project, the department's management held informal meetings and interacted with staff in the break room to follow how the implementation was affecting them. There was a leadership change before implementation started, which opened the way to a new start and easier implementation of the new way of working. The new, stable department management provided continuity throughout the change process. A strong leadership that believed in the changes being implemented was crucial for the successful implementation of the process improvements.

5.3. Lack of knowledge of operations management and deficiencies in improvement work

The organisation had no tradition of operations improvement projects and the lack of knowledge in this area hindered implementation. Surgeons, nurses, managers, and department management generally are not knowledgeable about operations management aspects such as efficient design, planning, control, and management of patient flows. There is a general perception among these professions that reduced throughput time is not compatible with good quality care. According to the surgeons, the organisation of their work requires variability, which makes it difficult for department management to implement more efficient capacity planning. It has been argued that industry concepts cannot be applied to healthcare because of the complexity of the organisation of healthcare arising from its human products. The ward personnel were not aware of the potential for improvement and there were flow efficiency deficiencies in improvement work. Managers, nurses, and surgeons argued that the primary problem related to patient flow was lack of resources, not working routines. They experienced that they delivered good quality care, and the problem of long waiting times required more resources for its solution. It was difficult to persuade these professionals that existing resources would be sufficient if supported by lean principles. There were uncertainties also about what constitutes improvement, since there were no standard measures for throughput time and productivity. This led to lack of feedback to staff regarding patient flows, which reduced the motivation to improve. The lack of motivation hindered the nurses' and surgeons' willingness to take responsibility for the change when an initial implementation effort related to a new process flow solution was not immediately adapted. Staff perceived that former work routines were "good enough", and there was no strong culture of trying to find a solution to poor patient flow. Furthermore, non-permanently employed surgeons did not feel the need or responsibility for improvements.

5.4. Budget regulations

A number of external implementation barriers were identified. Improved productivity with an increased number of patient operations would lead to higher total surgery costs which would go over budget. A static budget does not consider actual numbers of treated patients and departments are therefore not encouraged to improve their productivity. The barriers related to financial aspects had to be addressed at a higher level in the hierarchy. In addition, if there are beds available in the department, management regulations force the department to offer these beds to patients from other departments. This inhibits the overcapacity required to handle variations in demand.

6. DISCUSSION

The main problem in the surgery ward was the low level of access for patients, which derived from excess non-value adding time in the care process, and high variations in patients' care time and medical conditions. Processes with high capacity utilisation rates and high variations result in long throughput times (Hopp and Spearman, 2000), a correlation that applies to healthcare since there are large variations among patients due to different symptoms and different care needs (Rognes and Åhlström, 2008). The surgeon's round and the discharge process were identified as the main non-value adding and time consuming activities, due to lack of prioritisation of the work and lack of forward planning and oversight. This caused patients to remain on the ward longer than necessary from a medical perspective. Moreover, the lack of routines and standardised work procedures caused undesired variations. Due to overcrowding in the middle of the day, the nurses experienced a stressful working environment and an irregular workload. Materials disorder caused non-value adding time to locate equipment. Accessibility to the ward is constrained by the number of care beds, and also by the number of surgical procedures, which cannot be increased due to budget restrictions. Therefore, the improvement proposals only concern accessibility to the care beds on the ward. The most relevant proposal to increase patient accessibility was separating patient flows into acute and non-acute patients, to reduce variations. Separation of patient flows in order to reduce variation have resulted in increased patient service (Hyer, *et al.*, 2009) and decreased throughput time for patients (King, *et al.*, 2006). Earlier timing of discharges during the day was enabled by new rounds routines focused on prioritisation, and a standardised discharge process. Standardised processes are a fundamental principle of Lean (see e.g. Liker, 2004), and a standardised procedure for the discharge process enables elimination of various forms of waste. In healthcare, waste can be defined as everything that does not add value for the patient; elimination of waste results in cost reductions as well as shorter waiting times between processes (Hadfield *et al.*, 2006). An oversight of the patient flow allowed activities to be performed earlier resulting in discharge at the time that the patient was medically fully treated. In order to reduce disturbances caused by disorganised materials, the 5S method was proposed and implemented. 5S creates order through the introduction of standardized working routines (Esain *et al.*, 2008), aimed at establishing and maintaining a work environment that allows personnel to offer high quality care in the most

efficient way (Graban, 2009). The 5S method was expected to further support the other improvement proposals by creating positive synergies.

Improvements were immediately evident thanks to the implementation of 5S and increased visualisation. 5S is designed to improve efficiency through standardisation and enable continuous improvements (Hiroyuki, 1995). The implementation of 5S standardised routines allowed for improved processes. The divide between professions is a problem in healthcare generally (Glouberman and Mintzberg, 2001), and there is a lack of overview of the care process (Fillingham, 2007). The increased visualisation helped to alleviate these problems and enable a more transparent workflow. Visible leadership is an important part of change management (Kotter, 2006). The change project had strong support from the head nurse and the chief of surgery which allowed everyone else on the ward staff to see that their superiors supported the change. This was advantageous for its implementation because visible leadership is necessary for the implementation of process flow solutions in the public sector (Radnor, *et al.*, 2006). Since in the medical environment the power of the physicians often exceeds that of the formal management (Glouberman and Mintzberg, 2001), it was advantageous that the initiative for change came from the chief of surgery who was a surgeon as well as the department manager. Solid support is particularly important in fragmented organisations such as healthcare (Glouberman and Mintzberg, 2001). Had the initiative been supported only by one group, it would have been significantly more difficult to implement. The leadership change took place before implementation, which allowed for continuity through the change process. Well-respected leaders motivating their social group are an important factor for successful implementation of lean in healthcare (Holden, 2010).

The implementation of process flow solutions faced a number of challenges. Highlighting and raising consciousness regarding these barriers could aid future implementations of process flow solutions. Healthcare workers are reluctant to apply management knowledge from other industries because they are dealing with people and not products (Papadopoulos, 2008). However, understanding that decreased throughput time is compatible with maintaining quality of care could contribute to a smoother and faster implementation process. There is a need for increased knowledge of operations management in healthcare organisations (Walley and Davies, 2002). A deeper understanding of operations management would increase the willingness to change and the rate of successful change projects. Lack of knowledge in operations improvement projects could be the reason why managers, nurses, and surgeons often argue that the primary problem related to patient flows is lack of resources. With physicians often having more power in healthcare organisations than their formal management (Glouberman and Mintzberg, 2001), it might be useful to focus educational efforts related to operations management on this group. Increasing their understanding could be the key to increasing the willingness to change in the whole organisation. Furthermore, the existing budget system and regulations regarding resource utilisation need to be revised and developed in order to encourage improvement work; both of these aspects can be barriers to process improvements in health care (Hellström *et al.*, 2010). By including parameters such as number of treated patients and costs of external care, budget system might be adjusted to reward successful improvement work.

7. CONCLUSION

This paper provides a qualitative method and quantitative calculations related to how accessibility to a surgery department could be increased and what facilitates and hinder the implementation of process flow solutions in healthcare. The study shows that accessibility can be increased by using operations principles such as separated flows of acute and non-acute patients to different wards. This was further enabled by the principle of visualisation, via a whiteboard that provided a continuously updated overview of the ward situation and patient flow in the department as well as by the implementation of 5S to decrease material disorder. The implementation was facilitated by short term gains, management support, and visible leadership. The barriers were identified as lack of knowledge of operations management, deficiencies in improvement work, and hospital regulations.

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