

Process management in healthcare

(an improvement journey with Lean Six Sigma)

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Introduction

Healthcare costs in the Netherlands have risen from 7% of the GDP in 2000 to more than 11% in 2010. For many years consecutive Dutch governments have been trying to stop the increase, but in vain. The expectation is that demographic developments – an ageing population in combination with decreasing birth rates – will be responsible for an even higher share of healthcare costs in the future.

The current system provides free access to several forms of healthcare for everyone, with only small private costs. Healthcare is mainly paid publicly, i.e. from tax and obligatory insurances. Individual users of healthcare facilities are therefore not really stimulated to be cost effective. The government itself is thus mostly affected by the financial consequences. Thanks to the recent financial crisis the Dutch government is anyhow forced to cut costs drastically, resulting in rather dramatic budget cuts for all healthcare providers, including hospitals. The urge to be cost effective and efficient has never before been so strong. As a result most healthcare providers are now practicing tried and tested methods for process management from industry, such as Six Sigma, Lean Manufacturing and Theory of Constraints.

A decade ago the Red Cross Hospital in Beverwijk was the first Dutch hospital to use the Six Sigma methodology (Van den Heuvel et al., 2005). The achieved results were enthusiastically published and promoted. Other hospitals were attracted, including the University Medical Centre Groningen (UMCG). In 2007 the UMCG introduced the Lean Six Sigma methodology, aiming at cost reduction and quality improvement, and creating the financial possibility to develop innovations.

The UMCG is the second largest hospital in the Netherlands, one of eight hospitals with a university medical department for education and research. It has more than 10,000 employees, and a budget of nearly €900 million (in 2009). The hospital has 1,339 beds with 35,412 clinical patients in 2009 and 138,171 outpatient first clinic visits. The hospital is top referral for the low populated northern part of the Netherlands, consisting of some 10,000 km² and 2 million residents.

Lean Six Sigma

Lean Six Sigma is a synthesis of Lean and Six Sigma. The Lean elements are taken from Lean Manufacturing or the Toyota Production System (Ohno, 1988). The essence of Lean is that everyone in an organisation is committed to serving customers, which is reflected in allergic reactions on *waste*. Every activity without value for the customer is considered as waste, and in a “lean organisation” it is everybody’s duty to continuously discover and eliminate wasteful activities. Employees are trained to recognise waste, to organise a workplace, to describe processes, and to create and improve standards. Special tools were developed to support these tasks, e.g. “5S” can be used for organising workplaces and a “Value Stream Map” for process description. Smooth logistical processes are key to avoiding waste, so much emphasis is given to just-in-time delivery, single piece flow production, pull production, and line balancing. The final tool for fighting waste is “visual management”. In a “lean organisation” an employee knows his performance, the areas where materials are stored are designated, the status of an improvement project is indicated, and so on. It is an important issue to make things *visible*. We may conclude that Lean is very much a company culture –

or a belief – reflected in every employee’s mentality. An example of Lean in healthcare can be found in Savary & Crawford-Mason (2006). In the Netherlands several hospitals and other organisations for (health) care embraced Lean wholeheartedly.

Six Sigma was developed by Motorola and popularised by General Electric (Harry, 1997). The essence of Six Sigma is a very structured and comprehensive programme for process improvement. The programme is carried out by a separate project organisation, with the programme manager – directly reporting to a senior business manager – in the lead. In a “six sigma organisation” senior management decides the themes for improvement, and defines projects to give it substance. A project is owned by its most involved line manager, who is called the “champion”, and done by a project leader, a so-called “black belt” or “green belt”. The belt uses the DMAIC roadmap, an acronym for the five phases Define, Measure, Analyse, Improve and Control. A six sigma project begins with properly defining the problem: context, process, stakeholders, Then a valid, precise and accurate measurement is developed, and after data collection the problem is quantified. The analysis may confirm that there is a serious problem, as well as indicating the nature of the problem: variation, off-target, out-of-control, Possible influence factors are listed, and the most important ones are selected, preferably with statistical tests. Improvement actions are designed for the vital few influence factors. In about five months the end of the project is achieved, after the new process is documented in protocols, and a dashboard is designed for the key performance indicators. With Six Sigma an organisation makes problems and processes *measurable*. A Six Sigma programme is financially driven: projects are only selected if expected financial results are substantial. The “every little bit helps” philosophy does not apply in the Six Sigma methodology, because scarce resources should be used efficiently.

The Lean Six Sigma methodology is built upon the Six Sigma framework, with a strong emphasis on measurements: facts instead of feelings and opinions. In healthcare organisations the Six Sigma methodology is essentially applied to management processes, and only indirectly to the processes of the medical professionals. The management processes are usually logistical, dealing with access and waiting times, with inventory and waiting rooms, with a chain of activities. Elements of the Lean toolkit are therefore more appropriate than some standard Six Sigma tools like Capability Analysis or Design of Experiments. A synthesis of Lean and Six Sigma has been the result, although the all-inclusive Lean philosophy is of minor importance in the original Lean Six Sigma methodology.

Phase 1: Introduction of Lean Six Sigma

A major intervention in an organisation, such as introducing Lean Six Sigma (LSS), requires top management commitment. LSS was new to the UMCG when in 2007 an external consultant was hired for training sessions to management and employees, and an external master black belt for support of the projects. Management – including the board – got a half-day training about basic knowledge of LSS and the specific role of managers/champions in the programme. Selected high potential employees were trained to become an LSS project leader: a fourteen days training for black belts (fulltime project leaders) and an eight days training for green belts (part timers). The training explains the DMAIC roadmap, with the corresponding tools, and the students are required to practice the new knowledge in a project. Belts and projects were selected from all over the organisation, projects ranging from length of stay and nursing efficiency, to energy saving, computer maintenance, and registration. Many projects aimed at solving really hard problems, such as improving efficiency of the operation theatre, or collective purchasing of implants.

The first experiences with the programme were promising. The belts started enthusiastically describing processes and determining relevant measurements: “Critical to Quality” parameters, or CTQ’s. Both elements were relative new to the organisation. There were process descriptions of patient treatments, of course, but most management processes just existed. And although many data were registered, they seldom met standards. As a consequence there used to be much confusion regarding measurement. Many key players were allowed to have their own data and their own version of reality, which of course is a major drawback for change. The value of an LSS project is that the context of a problem is clearly delineated and that valid,

accurate and precise measurements are collected to quantify the problem. The medical doctors in the UMCG appreciated that this kind of diagnosis could also be applied to managerial problems, not just to patients.

Most of the projects proceeded according to plan in the analysis and improvement phases. Actions to improve the processes were designed and the corresponding results were calculated. But the progress of several projects ended when the actual interventions were to be done. Later on we identified a few reasons:

- Interventions were beyond the scope of the champion.
- Internal budgets made interventions financially unattractive.
- Implementation depended heavily on external capacity.

These reasons can be related to the specific organisation of the UMCG: decentralised, divided into ten sectors, managed by sector directors. Medical departments are part of a sector, but with their own budgets and direct relations to the management board. The financial system is very complicated, with more than 1,000 sources of income (the ministries of health and education, the European Union, and insurance companies being the most important ones). Internal finance is likewise complicated and not transparent. It is difficult to calculate cost prices of activities. When the LSS programme started we thought that the champion of a project was authorised to intervene in the whole organisation. After all, the improvement actions were well substantiated, based on scientific methods. But it turned out that this was a step too far: managers did not allow interference at their departments from plans designed by others. From this we learned that for successful projects the scope should be limited to the organisational scope of the champion. And we learned that large problems, with more than one manager (or decision maker) involved, had to be organised in a concerted effort.

Notwithstanding negative experiences with implementing improvements, the UMCG management decided to continue using LSS as a method for efficiency and quality improvement. Many projects were successful in demonstrating that processes comprised wasteful activities. It became clear to management that these activities could be skipped without compromising quality of care, and at the same time saving money for the organisation. LSS could indeed be used as a vehicle for judicious cost saving: see Wijma et al. (2009) and Niemeijer et al. (2010) for examples from the UMCG about nursing efficiency and length of stay respectively.

Phase 2: Growth

During the first two years the in house LSS trainings were given twice a year by the external consultant. He trained 82 employees, 19 black belts and 63 green belts. Black belts are fulltime LSS project leaders, usually staff members. Green belts are temporarily assigned to LSS projects, usually two days per week, next to their normal work as a manager, nurse or medical doctor. There were more than 100 official projects, in nearly all parts of the UMCG organisation, but with an emphasis on the primary process of patient treatment and care. In nearly every nursing department the nursing efficiency and the length of stay were subjected to LSS projects. The financial benefit of all projects was calculated at some €10-15 million.

Two years after the introduction of LSS the UMCG management decided to go along without external help. The master black belt was recruited and assigned the task of facilitating the LSS activities, including the training of new green belts. In the meantime a group of coordinating black belts has been arisen, not in a centrally organised group, but operating in their own sectors and departments. There have been stiff conversations about the organisational form for LSS, and the outcome was that a non-central organisation felt most comfortable. The sector directors took upon them to solve all kind of tuning problems.

The experience with the LSS projects was that related problems in different sectors or departments were often very similar, with often similar solutions as well. If you look at it with a process view in mind, and taking some distance (the helicopter view), then you will not be surprised. However, for improvements to be implemented in the UMCG, it is absolutely necessary for the employees involved to experience the problems themselves and to design their own solutions. That is why we chose to “repeat” projects at different departments, wards or clinics. In a sense this is also a kind of waste – doing projects “double” – but it is the

price to be paid for higher chances of implementing solutions. In this regard healthcare is really different from industry, where improved processes may be obtained by new settings of a machine or other technical measures. Most improvements in healthcare require another way of working, new standards or protocols, and eventually new habits: a “culture change”. This is not something that can simply be arranged. In the UMCG it certainly cannot be imported from other projects, and probably not even arranged between the champion and the belt, without commitment of the whole team of people involved.

The Control Phase of the DMAIC roadmap is concerned with preventing problems to recur. For the UMCG this often entails achieving a minor or major culture change. Within the LSS framework (with belt and champion in the driving seats) and its project based approach (projects lasting five months at most) a culture change is hardly feasible. And thus for really lasting results the UMCG took resource again to Lean, in particular to the elements of visual management, working as a team, and continuous improvement (kaizen). The end of an LSS project is ideally the beginning of a never ending continuous improvement journey for the whole team.

Since several projects dealt with related problems, be it in different departments, the need for overall solutions and measures became clear. Two examples serve to illustrate the point. The projects on nursing efficiency demonstrated a need for clearly defined functions, and general rules about staffing in relation to the number of patients and their needs. These matters can only be solved adequately in the form of guidelines and rules for the whole organisation. Owing to the financial structure of the UMCG the projects on length of stay required central direction. The result of most projects was that a number of beds could be closed, but that financial benefits were only small because staffing could not be reduced. A combination of results – combining the reduced beds of several departments – was needed for financial result. This is clearly beyond the scope of department managers, so eventually senior management had to interfere to force the cooperation.

Phase 3: Consolidation

When LSS was introduced in the UMCG, it was new and exotic, with the potential of being a hype. Four years later LSS appears to be anything but a hype. The method is heard of in most parts of the organisation, although for many employees LSS is still rather exotic. For management LSS represents an obvious method to use for efficiency improvement. Indeed, within a current cost cutting programme LSS is explicitly used to analyse processes and to eliminate waste. More than 100 people were trained as black belts or green belts, constituting a pool of employees to be employed for projects and process analyses, although no more than 10-20 of them are at any given time doing LSS projects or related work. Several managers within this group play a special role in “spreading the word” and “walking the talk”.

LSS projects are less scattered now than when we started. Initially there were projects all over the organisation and then we struggled to raise the results to a higher, organisation-wide level. Now top management selects themes for improvement, and within a theme one or more LSS projects may be done. We learned that LSS is not always the most suitable method, so alternatives are allowed – use of LSS is less dogmatic than it was in the beginning. Scattered LSS projects still happen, however, allowing us to discover potentially new UMCG themes.

Each half year there is an in-house training for new green belts, but the number of students is significantly smaller than in the beginning. To maintain the pool of belts, however, new employees must be trained to replace the drop outs. With a few guests from other hospitals in the neighbourhood there are some six to eight students per training. The outline of the training is equal to the green belt training of the external teacher, but we tailored it to the UMCG needs (less statistical analysis, more “Lean thinking”) and use UMCG cases only. With a new and separate workshop “Lean Thinking and Doing” all employees are targeted. After all co-workers of the Logistics department did the workshop, “improvement boards” were installed in every team, to start continuous process improvement. Nursing departments and laboratory teams are also specifically targeted for the workshop.

Conclusion

Lean Six Sigma was introduced mainly because of a major cost reduction programme in the UMCG. The notion was that LSS would be useful to bring this unique programme to a successful end, and at the same time lay the foundation for future improvements in a financially healthy organisation. Our claim is that these results were achieved, except for the “financially healthy” part. Much more severe cost reduction is needed now and in the near future, owing to the bad financial state of the Dutch government. The introduction of LSS, however, aided the transition of the organisation from purely problem oriented to more process oriented, which in turn is helpful in eliminating waste and finding solutions for difficult problems. The organisation is therefore well prepared to face the challenges of the near future.

Lean Six Sigma as now practiced in the UMCG is different from the original version of 2007. It is only natural that an evolution takes place, because every organisation is unique. Strong elements are fully maintained: measurements and data, the DMAIC roadmap, project management. But the emphasis on statistical methods is a little weakened, in favour of more attention to Lean Thinking and Doing. The organisation of LSS is neither copied. The function of a black belt (an employee with a fulltime task of increasing efficiency) could not be made official, let alone that a group of dedicated black belts could be formed. The modification, a pool of employees trained as black belt or green belt, working in their own departments, appears to be a good alternative. There is not much central direction to the LSS programme, with obvious disadvantages, as we described. In the end, however, it does not mean that LSS is not successful, it merely means that everything takes more time. That may be the price to pay in a university hospital, a “political” organisation par excellence.

The world of healthcare is obviously different from industry. The UMCG discovered that the Lean philosophy was more important than originally envisaged in the LSS programme. Commitment of the whole team is a requirement for continuous and lasting improvement. One of the challenges of the coming years is to get this commitment, a challenge not only for the UMCG, but for all healthcare providers. And to complicate matters, most organisations will also face compulsory redundancies, because the budget limitations are more severe than ever before. Time will tell whether it is advantageous to have an organisation trained with Six Sigma skills for structured process analysis and improvement, additional to knowledge of the Lean philosophy and toolkit.

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ABSTRACT

Lean Six Sigma (LSS) is a methodology for cost reduction and quality improvement developed in industry. In recent years it was also applied in healthcare, and this paper describes the experience with LSS in a large university medical centre in the Netherlands. Strong elements are the emphasis on measurements and data, and the structured way of working in a well defined project organisation. These elements are as useful in healthcare as they are in industry. In addition to the original Six Sigma programme several elements of Lean Manufacturing, including the focus on continuous improvement, make the programme even more suitable to a healthcare organisation.