Lessons learnt from quality improvement in Radiological service

Four key factors for success

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Abstract

Background
In this study, we describe a Quality Improvement (QI) intervention in three radiology departments within the Swedish health care system, with a special focus on access and methodology.

Aim
The goals for the QI-intervention were to implement best practice for patients with suspected colon cancer, and reduce the Turn Around Time (TAT). The aim of the study was to identify relevant factors for successful QI in order to further develop the organisation to create a system of continuous QI (CQI) for the radiological service.

Methods
Initially, a multiprofessional QI-team was formed. To identify waste and areas for improvement, process mapping and lead time analysis were conducted during a collaborative learning approach. A focus group interview was carried out with the participants in the QI-intervention and the local managers, and a qualitative content analysis of the focus group transcript was performed.

Results
Best practice was gradually introduced, and overall access was improved, but TAT was not changed. Four key factors for CQI were revealed; Communication, Engagement, Context, and Patient and Customer focus. Moreover, the impact of providing useful and reliable measurements to the frontline staff was found to be high.

Discussion
The lack of decreased TAT indicates that further redesign of the radiology process is needed. As the impact of measurements was considered high, an improved system for obtaining and providing useful information to all parts in the organization is essential. Moreover, the infrastructure for CQI needs to be developed further, e.g. by clarifying roles, educating in improvement knowledge, and developing multiprofessional meetings. Finally, motivating and engaging staff is crucial to improve healthcare. It is important with a deeper understanding what triggers this, patient centeredness could be one.

Keywords:
Quality improvement, Radiology, Access, virtual colonoscopy, colon cancer, multiprofessional
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Introduction

Background knowledge
Promoting and protecting health are essential factors for human welfare, social development and quality. National and international organizations point out that important goals for health care are that it should be safe, efficient, patient centered, fast, appropriate and fair (Institute of Medicine, 2011; Boyle, 2007; The Swedish Association of Local Authorities and Regions and the Swedish National Board of Health and Welfare, 2007-2011). Therefore, timely access to health care with high quality is in focus in most high-income countries.

Swedish healthcare is founded on all inhabitants’ right to equal access to health care service. The system is largely decentralized, taxpayer-funded, and performs well, with good medical results in international comparisons including countries with a similar level of development (Swedish Institute, 2009). However, one area where Swedish health care ranks relatively low is availability. Consequently, this is an important policy issue and often described as an area of improvement. Since 2005 there is a national healthcare guarantee in the country, which articulates a clear national policy with specific targets of the access for all scheduled care, and from 2010 the healthcare guarantee is part of the national health care law (SFS 1982:763).

An important contributor to understand the current state of the healthcare in each region and council, is the yearly report “Quality and Efficiency in Swedish Health Care – Regional Comparisons” (Swedish Association of Local Authorities and Regions & the Swedish National Board of Health and Welfare, 2006-2011). Results in the report from 2011, show that the cancer care in Sweden varies in medical results and availability to care, both within and between different counties, and although the Swedish cancer care in general is of good quality, there is a significant need for improvement (Swedish Association of Local Authorities and Regions, 2011; Swedish National Board of Health and Welfare, 2011a). In particular, important areas for Quality Improvement (QI) initiatives concern access to care, the use of best known methods for diagnostics and treatment (“best practice”) and coordination of the different levels of care (Swedish National Board of Health and Welfare, 2010).

To improve the cancer care, the Swedish government 2009 presented a national cancer strategy (SOU, 2009), which points out the necessity of better use of the resources, and multidisciplinary collaboration, both within hospitals, counties, and regions. The strategy led to formation of six regional cancer centres (RCC) in Sweden. In the beginning of 2011, the Cancer Centre in the Southeast Region stated a number of promises to the patients. Two of these promises are that; (1) the diagnostic service and treatment should be offered according to best practice, and (2) treatment should begin within 4 weeks. RCC initiated a regional project focusing on how to improve the health care for patients with suspected colon cancer. The present study is conducted in Jönköping County Council, based on a QI-intervention that is part of this regional project, and with a special focus on how to improve the radiology process for patients with suspected colon cancer.

Jönköping County has about 330 000 inhabitants, and there are three hospitals, situated in Jönköping (141 000 inhabitants), Eksjö (110 000 inhabitants), and Värnamo (86 000 inhabitants). Each hospital has a radiology department with 130, 80 and 60 employees respectively. In total there are 50 radiologists, 140 radiographers, 40 assistant nurses, and 35 medical secretaries in the county.
**Local problem**

In the beginning of 2010, all medical services within Jönköping County Council, were merged into one organization; The Division of Medical Diagnostics. Before this reorganization, the diagnostic service of medical radiology was managed within each of the three hospitals. In April 2012, the three radiology departments (dept A-C) were further merged into a county unit. The purpose for these reorganizations was to offer all inhabitants in the county an equal access to and equal quality of the radiology service, mainly by better coordination and use of the combined resources between the three radiology departments.

The local problem consisted of differences concerning methodology, and variation in access to radiological service in the county, but also shortcomings regarding cooperation between the departments. Data from the radiological information system (RIS) showed that less than one-third of all patients in the county with suspected colon cancer, were examined according to best practice, i.e. Computerized Tomographic Colonography (CTC), (Sosna et al, 2008). Also, there was variation between the three radiology departments concerning access to CT, and 10% of the patients had to wait 4 weeks or more for examination and diagnose, resulting in a delayed onset of treatment. This delay may influence the prognosis, and the waiting time also often affects the patients and their relatives in a negative way (Swedish National Board of Health and Welfare, 2010; 2011b).

The risk when improving the access for one group of patients, i.e. patients with suspected colon cancer, is that it could impair for other patients as resources may be shifted internally. The usual way to cope with demand for higher access for certain patient groups in the radiology departments in the county, is to slot times for these patients, consequently further delaying the access for other, less prioritized patient groups (unpublished data). There are no shortcomings in CT-equipment in the county; each department has at least two CTs. However, there is a lack of permanent radiologists in all departments, covered by temporary contracted physicians.

**Intended improvement**

To change the current situation, with differences in methodology and different access to the radiological service in the county, the management group in Radiology found it crucial to increase the collaboration between the three departments, and that a multiprofessional approach was the best way to achieve this. Moreover, to prevent sub-optimization, and to get sustainable results, it was considered important to build knowledge from the work with one patient group, i.e. suspected colon cancer, and make improvements in the entire CT-process. The specific goals for the QI-intervention were therefore set to;

By January 1, 2012:
- at least 90% of patients with suspected colon cancer should be offered CTC
- the turnaround time (TAT), i.e. the time from request to report, for CT should be no more than 14 days

**Study questions**

In this study, we describe a QI-intervention to implement CTC and to decrease the TAT for CT. Since there are other, similar areas within the radiological service in the county that need improvement regarding access, methodology and better cooperation, lessons learnt from the intervention are considered as important contributors to further develop the radiological service by fostering a culture of continuous QI (CQI).

The guiding main questions in our study were:
- Which activities in the QI-intervention were successful and why?
- Which factors contribute to CQI?
- How can the organization for CQI be developed further?

Methods

Setting
When planning the intervention in the spring 2011, the local managers of the three radiology departments were invited to a group discussion to set targets of the QI-intervention. Collaboration and interprofessional learning were considered to be important approaches, partly by benchmarking the three departments to visualize any improvement gap, but also by stimulating learning from different approaches to similar “problems”. Consequently, a multiprofessional QI-team was formed, with members from each of the three radiology departments. The management group contributed with knowledge about each local context in the departments, and by choosing members for the team. There were some earlier experience working with multiprofessional teams in the radiology departments, but the county wide approach had never been tried before.

Planning the intervention
While planning the intervention, “the eight domains of knowledge” (Batalden & Stoltz, 1993; Ogrinc et al., 2003) were used as a framework for highlighting important factors for successful continual improvements (table 1). Also, Kotter’s three-step model for “leading change” (1996); (1) set direction, (2) align people, and (3) motivate and inspire people, was used as a guide.

Table 1 The 8 domains of knowledge (Batalden & Stoltz, 1993; Ogrinc et al., 2003)

<table>
<thead>
<tr>
<th>The 8 domains of Improvement Knowledge</th>
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<tbody>
<tr>
<td>1 Customer/beneficiary knowledge</td>
</tr>
<tr>
<td>2 Health and social care as process/system</td>
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<tr>
<td>3 Variation and measurement</td>
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<tr>
<td>4 Leading, following and making changes in health or social care</td>
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<td>5 Collaboration</td>
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<td>6 Developing new, locally useful knowledge</td>
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<td>7 Social context and accountability</td>
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<td>8 Professional subject matter</td>
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All activities in the QI-intervention were led and coached by the authors, i.e. the Director of Radiology in the county, and the Development Manager in the Division of Medical Diagnostics. Feedback and information on progress, critical measurements etc. were continuously displayed on the intranet, discussed at local meetings in the three departments, and in the management group in radiology. A schematic picture describing the different activities in the intervention is shown in figure 1.
The collaborative and multiprofessional approach

Within the radiology departments, there was a need of increasing the multidisciplinary teamwork, especially since the new digital imaging technology had separated most of the work processes for e.g. radiographers and radiologists, which also has been described by Weinreb (2004). The need of an increased multidisciplinary interaction was also emphasized by the management group. The positive impact of working in multiprofessional teams has been described in many reports, e.g. by Harolds (2005), who describes experiences from a radiological setting. Moreover, Nelson, Batalden and Godfrey (2007) have shown that working together in multidisciplinary teams is crucial to reach “a performance excellence” with exceptional outcomes. Other studies have shown the importance of applying multiprofessional learning to reach an increased awareness and acceptance for using the combined resources in an organization more efficiently (Mackay, Soothill & Webb, 1995). Otherwise, there is risk for conflicts that can sub-optimize the use of all competences. An important issue in the present QI-intervention was to improve the use of the combined resources, such as technical equipment and personnel competences, both within and between the three radiology departments.

To promote the QI-intervention, and “create a sense of urgency” described by Kotter (1996), all employees in the radiology departments were during the spring 2011 informed about the QI-initiative, the relation to the National Cancer Strategy and the promises given by the RCC in the Southeast Region. The QI-team was formed in June 2011. Seven members, two or three persons from each department, attended the group; one radiologist, four radiographers, one assistant nurse and one medical secretary. The researchers met up with the team once a month for a three hours meeting, and also had weekly telephone meetings (10 to 25 minutes) from September 2011 to April 2012. Memos from the meetings and collected data were continuously published on the intranet, for access for all employees within The Division of Medical Diagnostics.
SWOT

To identify important context factors, three SWOT-analyses (Armstrong & Scott, 1982) were performed, one at each department. Special focus was set at analyzing strengths, weaknesses, opportunities and threats connected to the change, i.e. implementing CTC and reducing the TAT. Besides the researchers and the QI-team members in each department, the groups also consisted of one local manager, the radiologist and nurse in charge of each CT-section, and some other persons affected by the change.

Capacity and access

Differences regarding availability in the three departments were relatively well known. Earlier QI-initiatives had focused on better planning of capacity to improve access, with some good results, but without lasting and systemic improvements, and without any collaboration between the three radiological departments. One of the lessons learnt, was the importance of making improvements in the processes, and not only “working off the queue”. To achieve this, a deeper knowledge concerning demand and capacity, and their relation to scheduling, booking and production were identified as a crucial part in the QI-intervention. In addition, establishing a rich information environment for the frontline staff as described by Nelson et al. (2007) was considered important.

Consequently, three teams, one from each department, attended in a learning program on capacity and access. Each of these teams included at least one member from the QI-team. Besides increasing the knowledge, the purpose was to enable a faster reaction in the system to changes in the demand or capacity, and to stimulate cooperation between the departments to improve the use of the combined resources. The teams obtained weekly data, concerning number of requests, bookings, and performed examinations, mainly from the RIS. Subsequently, the data were gathered and analyzed in an Excel-file, developed for this purpose, one for each CT-section in the county.

Process mapping, lead time analysis and empiric testing

Using CTC as a prototype, the QI-team identified improvement areas in the CT-process, initially by mapping the activities in the process, followed by a lead time analysis (LTA). The next step was to eliminate waste in the process, and analyse root causes in the bottle necks. Subsequently, ideas for improvement were tested in small scale using the PDSA-cycle, according to the model for improvement (Langley et al., 1996). Some basic education in improvement knowledge was given at the meetings, e.g. the principles behind the PDSA-cycle, root-cause analysis, and how to use the PDSA-cycle etc.

Workshops

In October and November 2011, all employees in the three radiological departments attended workshops focusing on colon cancer, and specifically the needs and wishes of the customers, both referring physicians and patients. Represents from the Department of Surgery and the Department of Pathology were invited to hold short educational sessions on their parts in the care process during the workshops. Also, two patients and their relatives were invited to an open discussion and reflection upon the experiences from their care and treatment from colon cancer. Sessions on CTC and its advantages over the old method, double contrast barium enema (DCBE), were held by professionals from the radiology departments, to reflect different perspectives from two important the steps in the radiology process; the examination and the reading. An additional purpose with the workshops was anchoring CTC, especially among the radiologists, as the method of choice in all departments.
Moreover, the workshops served to give information about the QI-intervention and anchoring some of the improvement initiatives, but also to involve the employees in a “brain storming activity” to come up with ideas about improvements to test. The workshops also intended to stimulate collaboration both between different professions and the different radiology departments.

The workshops were held three times to cover all employees, with a mix between the professions and departments.

**Methodology**

In one of the departments, dept C, CTC has been used for the majority of patients for several years. In the two other departments the method is implemented since a couple of years but only used for a small number of patients, mainly those who have had a failed colonoscopy. The reasons for this are both access problems on CT, and resistance from radiologists. There is an on-going debate in the country whether CTC should replace DCBE as the method of choice, and so far no consensus has been reached (Swedish Council on Health Technology Assessment, 2004). However, there are indicators that this soon will happen, and in the regional project on colon cancer, CTC is defined as “best practise”. There are also some issues in the county regarding certain technical diagnostic support, e.g. “virtual colonoscopy”, and due to low number of examinations, lack of experience among the radiologists is a problem in two of the departments.

**Planning the study of the intervention, methods of evaluation and analysis**

To evaluate the effect of the QI-intervention, and also examine whether sub optimization for other patients was avoided as planned, quantitative measurements were manually collected from the RIS. The data were displayed weekly in different types of charts, and published on the intranet. Initially, visual analyses of outliers, trends or shifts in the charts were done in the charts.

**Quantitative assessments**

**Implementing CTC**

The proportion of CTC was measured weekly by dividing the number of CTC examinations by the total number of colon examinations.

**Access, TAT and LTA measurements**

The access to radiology in the county has since several years been assessed by measuring the waiting time from request to examination in different ways, e.g. number and proportion of patients waiting more than 4 weeks for examination. Besides this measurement, two new measures were developed; TAT and LTA, to assess the efficiency in the whole radiology process.

Weekly, 30 randomly selected outpatients, 10 per department, scheduled for CT-examination were measured. A mix was made from different types of examinations, i.e. CT head, thorax and abdomen. 30 patients represents around 10% of the total number of outpatients per week, and the three groups (head, thorax and abdomen) are by far the three most usual types of CT-examinations. Also, data on all CTC-examinations at each department were collected. To improve the internal validity, all measurements were obtained the same way every week in all departments, and by one person, a medical secretary in the QI-team. From these samples, the TAT and lead times for CTC and CT (other than CTC) were collected. The TATs were displayed graphically in Statistical Process Control (SPC) Charts or in Run Charts, and the lead times were presented as mean values in bar charts.
Qualitative assessments
The impact of the different activities were analysed continuously by the authors. This was made partly by regular reflective dialogues, at least once a week, and by sharing a logbook on all events. Memos from all meetings were made continuously by the authors, and published on the intranet. Some of the activities, i.e. the workshops, were also evaluated by the participants in a survey, and others assessed by reflections with members in the QI-team and local managers respectively.

To further analyze the effect of the activities in the intervention, and to find out how the radiology process could be improved further, a semi structured focus group interview was performed. Focus groups are especially appropriate for studying people’s experiences, and to provide information on attitudes and opinions between participants, in this case the experiences from the current QI-initiative (Granskär & Högland-Nielsen, 2008; Morgan, 1988). A focus group can also help people to explore and clarify their views (Kitzinger, 1995). In order to find different aspects on the experiences of the activities in the QI, it is important to choose participants with different professions and various prerequisites (Patton, 1987). A suitable size of a focus group is eight to twelve persons (Krueger & Casey, 2009; Stewart, Shamdanasi & Rook, 2007). With this in mind, we performed the interview with eight participants from the multiprofessional QI-team and some of the involved managers.

The focus group interview was coordinated by the authors and a semi structured interview guide, designed together with the supervisor for the study was used. In particular, the responders were asked to describe contributors and barriers connected to the outcome of the intervention, and to their own commitment. Moreover, questions were asked regarding their experiences on new knowledge or any other values for them, for customers, or for colleagues connected to the intervention. Finally, they were asked to estimate their time invested in the QI-initiative and if the results were worth the effort made.

The interview was recorded, and a medical secretary prepared a transcription in which the responders were coded, to minimize risk for identification by external readers (Stewart, Shamdanasi & Rook, 2007). The medical secretary was also attending the interview as an observer, to further increase the validity. The text was analysed by the authors via a qualitative, latent content analysis which is a systematic and strict method to analyse a text that involves interpretation of the underlying meaning (Graneheim & Lundman, 2004). Subsequently, condensation of the text was made, followed by coding and defining sub-categories in order to identify key factors connected to progress or outcome in the QI-intervention.

Ethical issues
The study of the QI-intervention was formally approved by the Ethical Committee at the School of Health Sciences in Jönköping, reference number 561/2012(279). Participation in both QI-intervention and focus group was voluntary. The participants in the focus group were informed both verbally and in text about the aim of the study and the use of the information (appendix), and a written consent was obtained from the participants. All information from the interview was decoded, i.e. person, profession and department, handled confidentially, and will be stored 10 years according to Swedish legislations (SFS 1990:782).
Results
The QI-intervention started in June 2011, and included several activities. Each activity was evaluated and planning and re-planning of coming steps was made when necessary. A time line is seen in figure 2.

Figure 2. A time line illustrating some of the activities in the quality improvement (QI) intervention.

SWOT
The local SWOT-analyses revealed local differences regarding “readiness to change”, but also contributed in identifying some of the local “improvement-champions”. In addition, the need of more radiologists with competence in reading CTC was highlighted, and consequently a common guide for reading CTC in the county was developed. Furthermore, it clarified that substitution of two of three CT-equipments in department B was planned for Nov 2011 to March 2012. This was a problem, both concerning access to examination, and focus among the involved personnel in the department, especially staff at the CT section.

Capacity and access to CT
One important first step to increase the access was to reduce the queue. This was done in all departments during the summer and fall 2011 (figure 3), and mainly without extra costs or resources, for example by extended working hours some evenings. Due to differences between the departments in access and capacity, the queue shortening made cooperation necessary. Some patients agreed to have the examination at another department in the county, and in some cases teleradiology were used for sending images within the county for reading.
The three teams in the learning program on capacity and access, agreed to focus on matching the capacity of examinations, defined as the machine-, and radiographer-time, with the demand, i.e. the number of requests. The next step intends to match the radiologist-, and medical secretary-time with the production (not in the scope of this QI-initiative).

An Excel-tool was developed to gather and visualize data on the demand and capacity concerning CT in each department (figure 4), since earlier experiences in capacity planning stated the need for such a tool. Also, to be of value for the frontline staff working with scheduling personnel and booking patients, the tool had to be easy to handle. There were difficulties in obtaining valid data, and subsequently in spreading the tool to the front line staff. After several adjustments, tested in PDSA-cycles, a version of the tool is since January 2012 in use in some sections.

**Figure 3.** Proportion of patients examined with CT within four weeks from request.

**Figure 4.** Example on a graph from the Excel-tool, showing the balance each week between demand and capacity, in terms of examination time.
The learning program led to increased awareness on the relation between capacity and access; in particular it enabled faster reactions on variations in either demand or capacity. Moreover, it led to a principal change in the planning process, by basing the booking and scheduling on the actual demand, and not the capacity of e.g. radiographer-, or radiologist-resource.

**Process mapping, TAT, and lead time-analysis**

The process mapping made by the QI-team, revealed that the CT-process in each department was similar, but still with some local differences. Besides triggering improvements, this benchmarking led to agreement of a common mainstay for all three departments (figure 5).

![Process Mapping Diagram](image)

**Figure 5.** A general mainstay in the radiological process; from request to report.

The TAT’s were initially illustrated in SPC-charts for each department. The result revealed an unstable process, with outliers almost every week (non-published data). Analysis of the outliers showed that the sample included cases not matching the inclusion criteria, e.g. follow-up examinations. These observations led to an improvement initiative to increase the data reliability. Since the QI-team found the SPC-charts hard to understand and communicate, the TAT’s were also illustrated as mean values in run charts. The data showed that the TAT for CT was not affected during the intervention, indicating that the implemented improvements and reduction of the queue were insufficient, and that further redesign of the process were needed to reach the goal; TAT 14 days (figure 6-8). There might be a trend with decreasing TAT for CTC in dept A and dept C, and increasing in dept B, but an extended observation time is needed to clarify this. Furthermore, there were no findings indicating that introducing CTC led to sub-optimization for other CT-examinations. The time invested in manually extracting data from RIS and displaying it in charts, was three to four hours per week. This indicates that a more efficient procedure to obtain data would be of value.
Figure 6. Turn around Time (TAT) for computerized tomographic colonographies (CTC) and CT-examinations in department A (dept A) (n=10 in each subgroup).

Figure 7. Turn around Time (TAT) for computerized tomographic colonographies (CTC) and CT-examinations in department B (dept B) (n=10 in each subgroup). No CTC-examinations were performed during week 3.

Figure 8. Turn around Time (TAT) for computerized tomographic colonographies (CTC) and CT-examinations in department C (dept C) (n=10 in each subgroup). No CTC-examinations were performed during week 12.
The results from the LTA showed, not surprisingly, that the longest lead times in all departments were identified between booking and examination. An unexpected finding was that the lead time between first and second reading usually was shorter than expected. Also, the variation over time, both between departments and within the same department was considerable. The QI-team and the local managers considered the impact of visualising the lead times as very high, consequently the lead times for CT and CTC were illustrated weekly in charts for each department (figure 9).

![Figure 9. Example on Lead Time Analysis (LTA). The bar-graphs correspond to the mean lead times for computerized tomographic colonographies (CTC), and the mean lead times in the CT sub-group.](image)

Altogether, the LTA and process mapping resulted in some general areas for improvement, such as decreasing the time from request to booking, in particular from referral to choice of protocol. Also, it generated several local and county wide improvement ideas, e.g. developing a smoother workflow by adjusting the scheduling and booking procedures. Another improvement initiative was started to facilitate for the patients in getting their laxative prescription for the CTC directly from the referring physician.

**Workshops**

The workshops were the very first occasions were all employees from all professions in the three radiology departments in the county met. Besides reaching consensus on that CTC was best practise, and producing a long list of improvement ideas (99 in total), the workshops also clarified that there were several differences in the care process in the county. The fact that both referring physicians and patients and relatives were present, led to a focus on the customers’ needs and wishes, not only improvements of the internal radiology process. Evaluation of the workshops were very positive (non-published data), especially the participation from clinicians and patients, and the multiprofessional and interdepartmental approach were highlighted as positive.

**Methodology**

After consensus on using CTC, further benchmarking by the QI-team revealed local differences in CTC-methodology, e.g. regarding patient preparations (type of and duration of laxation), and the use of double reading and virtual colonoscopy. In department B, both virtual colonoscopy and double reading were mandatory, which made it harder to implement CTC and spread the competence to all radiologists. The need to educate radiologists and to some extent radiographers was clarified, and
there was a discussion concerning generalists-specialists. It was agreed that all radiographers and radiologists who worked with general CT also should be able to carry out CTC. Subsequently, this lead to education activities in all departments.

The initial goal was that all patients should be offered CTC. This turned out to be unrealistic, and subsequently first reduced to 90 %, and then to 80 % from April, and 90 % from June 2012 respectively. The proportion of CTC is shown in figure 10.

![Proportion of CTC](image)

**Figure 10.** Proportion of computerized tomographic colonographies (CTC) of all colon examinations, 2011 and 2012 (Jan – April).

**Results from the focus group interview**

The focus group interview, concentrating on contributors and barriers in the QI-intervention was carried out during a 2.5 hour session. When analysing the material, a pattern of four main key factors important for successful improvement were revealed; (1) Communication; (2) Engagement; (3) Context, and (4) Patient- and Customer focus. In addition, all identified condensed meaning units could be categorized according to the eight domains of knowledge.

**Communication**

The importance of continuous communication and information, both locally, in county wide sessions, and electronically on the intranet, were frequently mentioned in the focus group as being important contributors to maintain focus.

"...It's all things, all the meetings and information. You can't get away from it."

The visualization and communication around data contributed to interdepartmental learning by comparing ways to handle for example the scheduling and workflow in the different departments.

"...it is enriching and you discover wow, we really do things differently..."

Also, the impact of visualizing data; the lead times, the TAT, and the excel-tool developed to illustrate the balance between demand and capacity, was considered as a major positive contributor in the QI-initiative, e.g. by enabling faster reactions to variations.

"...we have become much quicker to react as soon as it starts to become bumps (queues)"
Furthermore, the specific goals contributed to anchor the QI-initiative among staff. Setting goals also facilitated in creating “a sense of urgency”, by challenging the local current state in relation to the new goals.

**Engagement**
Several comments from the participants involved the importance of having engaged people with a willingness to attend in a QI-work to succeed with improvements. The comments reflected that it was more important to have an interest and knowledge in the improvement area in focus, than to have all professionals represented in the different teams.

”It takes the right person in the right group so to say, You have to have an interest for the thing you are joining…”

Also, it was considered more important to have members with different perspectives and opinions, than fully agreed.

”…It’s a difference between negative and constructive, it is two different things”

**Context**
The local culture differed between the three departments, and was influenced by e.g. the local traditions, and leadership. Not least there were differences regarding the “willingness to change” among staff.

”…the thing I find most fascinating, is that it takes much more energy to work against something than to do it…”

There were also differences in the local structures and responsibilities in how to organize for QI, the roles of the managers and staff. Especially, the need to develop an infrastructure for CQI and a broader distribution among the staff, were emphasized among several of the responders.

”It (QI) should be spread a little more… set free, since there are many who are as good everybody else… Consider the numbers of improvement ideas that came in (at the workshops)”

Moreover, differences regarding local traditions were revealed by the process-mapping and the LTA, e.g. differences in the local operational procedures, booking, planning and distribution of work, but also the degree of multidisciplinary interactions.

**Customer and patient focus**
The influence of focusing on one specific group of patients in the QI-initiative was mentioned as a positive contributor, and a similar approach was suggested to be used in other QI-settings.

Involving patients and customers at the workshops were also considered as a success factor, which may enhance the reason to change. In fact, a lot of the improvement ideas raised at the workshops, concerned how to improve the service, and patient and customer relations.

”I think it was the most important that day (workshop)… to have the patient, to hear the whole trip and to get a face behind the request”
Several responders in the focus group also emphasized the impact in involving patients earlier in booking process, to personalize the time for the examination, and to reduce re-bookings.

"...when the waiting time is so short, and to go below this we have to look into completely new ways to schedule or something, since we will have a lot of cancellations when we go under 2 weeks... I can’t take time off from work, and stuff like that”

"It’s the optimal way, to be able to choose the time for examination”

Finally, concerning the time invested in the QI-initiative, all participants agreed upon that it was worth it, particularly considering the achieved learning and possible effects on other patient groups.
Discussion

Summary
The QI-intervention resulted in a gradual implementation of CTC, which in April 2012 was offered to 70% of the patients compared to 30% in August 2011. Access to CT measured as proportion waiting less than 4 weeks was improved, but the TAT was not affected significantly during the intervention indicating that further redesign of the process is needed. Although the goals in our intervention were not completely fulfilled, we find the eight domains of knowledge for QI useful when planning an improvement. We take the fact that the results from the focus group interview align to the knowledge domains, as an implication to this. Our results show that the multiprofessional and inter-departmental approach contributed to a common learning by shared experiences between the different departments. Also, the impact of providing and visualizing useful and reliable measurements in the organisation was high, and the focus and involvement of patients and customers in the QI-initiative important.

Interpretation and relation to other evidence
We had expected a decrease in TAT, particularly after working off the queue. Possible reasons that this was not found in the study are; (1) that the waiting time already was considered as good enough among staff; hence “the sense of urgency” was low, and improvements not fully implemented, (2) sampling and measurement errors, e.g. that all control-cases were not excluded, and (3) the use of old prioritization and booking routines, e.g. patients are not always scheduled in the first possible appointment, to save time-slots for later, more prioritized patients. The last of these reasons indicates the need of further improvements in the process, e.g. concerning prioritizing and booking. One improvement suggested by the QI-team, was to eliminate the four different priority grades in use for outpatients, since short TAT, at least less than 14 days, obviates the need for them. This suggestion has not been accepted by the staff. Another change in the process is to redesign the booking routine by introducing telephone-, web-booking or other solutions that increase the patient- and customer service. Drop-in is another option already in use in all departments, but only for a few patient groups, and not for CT. Except for decreasing the TAT, these improvements could diminish re-bookings by offering a “just-in-time-examination”. These are examples of increased patient centeredness, which is an important goal in most international healthcare organizations, and well described by Bate (2006) and Nelson et al. (2007).

Another identified process-improvement with possible high potential to decrease the TAT is voice recognition, which would eliminate the need of transcription. Also, to release time from the radiologists for better use of their competences, changes in work-distribution between the professions are needed. For example, a broader competence among radiographers or assistant nurses in certain areas has in many other settings been very positive. However, such changes can also meet resistance (Chapman, 1997).

When planning the intervention the risk for sub-optimisation was considered. Our results indicate that this did not occur, in fact the CTC process seems slower than other CT-examinations. The reason for this may be that CTC is still not fully incorporated in the routine work, e.g. there are still a limited number of available time slots for CTC every week, that do not match the demand completely. Another reason is that the education of radiologists in reading CTC is not yet completed. The delays in implementing CTC were mainly due to the exchange of the CT-equipments in department
B, but also, to some degree, reluctance among radiologists to embrace and learn the new methodology.

Our results confirm the importance of multidisciplinary and interdepartmental collaboration. These findings align with other studies describing the positive impact of collaborative and multiprofessional learning. Wenger (1998), and later research from Bartunek (2011), states that learning is a social phenomenon occurring through participation in different “communities of practice”, thus enabling informal learning in reality based situations. Also, the research from Yang and Yu (2006) shows that a multiprofessional QI-approach can increase the quality of the outcomes by making the problem solving more efficient. Moreover, a collaborative learning can illuminate the context and contribute to a deeper understanding of the current knowledge within an organization (Pan & Scarbrough, 1998). This was also evident in our study.

Interestingly, when testing ideas for improvement in an early stage of the QI-intervention, a “fast track” for the patients with suspected colon cancer was suggested and discussed with a group of referring physicians. In this solution the CTC was read while the patients were still at the department of radiology, and patients with positive findings were directly referred to the department of surgery for colonoscopy or surgery. However, this idea was rejected by the majority of the referring physicians, mainly since the patients were not considered ready for such a fast process. Still, one can wonder about the readiness to such radical changes, is it the patient or the health care itself that is not ready?

The four identified main areas for successful implementation of improvements; (1) Communication, (2) Engagement, (3) Context and (4) Patient- and Customer focus, go hand in hand with previous research, for example by Brandrud et al. (2011).

One aspect of communication is providing timely and useful measurements and data to different parts of the organization, which was highlighted in our study. The importance of a rich information environment has also been described by Nelson et al. (2007), and Provost (2011), who also emphasizes the choice of a suitable graphical design of the measurements. We obtained and displayed several useful measurements during the QI-intervention. However, these data have not yet been fully implemented in the daily routines. An appropriate next step would be to introduce and organize recurring and predictable multiprofessional meetings, i.e. huddles, were these data are an essential part, e.g. for planning the production the coming week. The use of huddles can also increase the collaboration among professionals (Nelson et al., 2007), which also was recognized in our study as important to improve further. The purpose of these short meetings is to introduce new habits into daily work by enabling reviewing and reflecting.

Engagement was identified as one of the key factors, and an interest in the specific topic was considered more important than professional knowledge, e.g. when selecting members for a QI-team. However, it is sometimes essential to involve all professions in a QI-project, and recruiting members with an interest may be a difficult challenge. In our study, a broader engagement in the organization could probably have led to a greater degree of improvement. One difficulty for the QI-team was spreading information and anchoring ideas among radiologists in each department. With a highly motivated radiologist from each department in the QI-team, this task would probably have been easier. Motivating staff, not least physicians, into QI is crucial and one of the most important commissions for leaders in today’s healthcare (Godfrey, Nelson, Wasson, Mohr & Batalden, 2003). These lessons learnt are valuable when currently organizing for implementing best practice in other areas of
radiology in the county. Also, inspired by the work by Gary Kaplan at Virginia Mason Medical Center (2012), a plan to develop “compacts” defining the organizations’ and the employee’s responsibilities, has been initiated.

The intervention took place in three different contexts, and three cultures with different capacities in QI emerged. The importance of the local context was evident, which is also shown by e.g. Yang & Yu (2006) making it necessary to lead the improvement in different ways in each department. Another important finding in this area was the need of an improved infrastructure, regarding roles, responsibilities and also a wider distribution of QI. Furthermore, deeper improvement knowledge among the frontline staff and the managers are needed. This aligns with the research by Walsh and Freeman (2002), who emphasize the need of a better understanding of the cultural traits of the organization for a successful QI. Thus, clarifying the roles, increasing the improvement knowledge, and adapting the support even more to the context will be in focus in future QI-initiatives.

Our results show the importance of patient and customer focus. By visualizing the whole care process, and involving patients and customers in a QI-initiative, a stronger patient focus can be developed among the professionals. Interestingly, the awareness of the importance of patient involvement increased among the members in the QI-team during the intervention. For example, the need to redesign the booking routine, as previously described, was proposed by managers at an earlier stage, with low response, but during the intervention the interest increased. The impact of focusing on the patients and customers’ needs and wishes has been described by several researchers, i.e. Nelson et al (2007) and Bate (2006).

An organizational change during the intervention could have influenced all staff, not least the involved managers. This could be either positive, in “creating a sense of urgency”, or negative, in stealing attention, and we found examples on both during the intervention.

The total cost for the QI-intervention is hard to calculate, partly by the fact that it is impossible to define what is part of the intervention, and what is not. The time invested by the participants in the QI-team in the various activities, and meetings from the start in June 2011 to April 2012 is estimated to about 230 hours. Calculating on a mean salary of 260 SEK per hour, this corresponds to a total cost of about 60 000 SEK. Time invested by the authors has not been included.

This intervention was initiated partly as a consequence to the promises given by RCC, to improve the cancer care, i.e. implementing “best practice” and improving access. Also, our objectives were to offer equal access and quality in the whole county, and to increase collaboration and organizational learning. This could possibly have been done in other ways, some probably easier and cheaper, and some more expensive, but without the organizational learning we wanted to achieve. For example, one alternative could be improving only the CTC process, and buying the reading from an external provider, via teleradiology. An estimation of the cost for CTC reading via teleradiology, is about 1 M SEK (80% of 1750 colon-examinations á 675 SEK per CTC-reading) in the County 2011

**Limitations**

Our study has several limitations worth mentioning. Firstly, the authors both have leading roles in the organization. This is mostly positive when planning and conducting a QI-intervention, and doing research on the outcomes, but can also be negative if actions are based on inaccurate assumptions, or if the results are glorified. Regular reflections between the authors, within the QI-team, with managers, and other personnel served to minimize this risk.
Secondly, the focus group was composed of only members in the QI-team, including some local managers, and no representatives from the rest of the staff. There is a risk that the participants overstate the positive results, and vice versa. A survey could have been an alternative, but was rejected because we wanted to have a deeper understanding of experiences of the involved members. Potential bias also existed by having the authors lead the focus group interview, and also that some local managers were present. This could again lead to an overestimation of positive results, but also in influencing the degree of honesty and openness among the participants. To avoid this, the authors strived to create an open dialogue, and make it clear that their truthfulness was important, and that there would be no retaliation for criticism.

To increase the reliability of the results, an additional focus group interview could have been performed, preferably with employees not directly involved in the QI-intervention. This is a limitation in the study, but in order to increase the trustworthiness and generalizability in the analysis of the resulting data from the focus group, the authors first analysed the transcribed text separately, and then together. Subsequently, this was followed by a dialogue and agreement concerning labelling and sorting of data, at first between the authors, and then with the supervisor, who has a deep knowledge in qualitative content analysis. We found the inter-coder reliability high. Furthermore, to increase the validity of the qualitative content analysis, the participants in the focus group interview were asked to confirm the result from the analysis, which they did.

Regarding the reliability of data, this has been an important issue during the whole intervention. A lot of effort has been made to eliminate sources of errors, e.g. removing outliers when appropriate. However, the data is still not completely reliable, and there is an understandable lack of confidence regarding some measurements in the organization, in particular the TAT’s.

In spite of these limitations, we still find that we can draw conclusions from the results, in order to further improve the radiological service. Regarding generalizability, most findings, but not all, align with our prerequisites, and also with other research. However, concerning some of the quantitative measurements, we still find both the internal and extern validity inadequate.

**Conclusions**

The present QI-intervention has contributed to some improvements regarding access and methodology for patients with suspected colon cancer, which also can be used for other patient groups. The study has led to an increased knowledge of key factors for successful CQI, and important areas to develop further in our organization. Especially, motivating staff is crucial and deeper understanding of what triggers staff, and how to apply this knowledge in a certain context are important fields for future research.
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References


Appendix

Information to participants in the Focus Group Interview

Införande av bästa undersökningsmetod och ökad tillgänglighet inom medicinsk radiologi.

Bakgrund

Cancervården i Sverige håller generellt sett en god kvalitet. Det finns dock viktiga förbättringsbehov, inte minst vad gäller tillgängligheten till bästa kända metoder för diagnostik och vård, samt samordningen av olika led i vården. Bristfällig patientfokusering och fragmenterad vård leder ofta till onödigt långa och varierande väntetider vid utredning och behandling av cancer, vilket framgår i utredningar av bl a Socialstyrelsen som lyfter fram detta som viktiga förbättringsområden. Vidare har Regionsjukvårdsledningen uttalat löften till alla invånare om en god cancervård på lika villkor för hela befolkningen, vilket förutsätter förbättringar av just tillgänglighet och diagnostik, men också av andra delar i cancervården.

Genomgångar i landstinget i jönköpings län visar att mindre än en tredjedel av alla patienter idag genomgår radiologisk diagnostik vid misstänkt tjocktarmscancer med bästa kända metod, och att det stora flertalet får vänta 4 veckor eller mer på undersökning, vilket därmed fördöjer diagnostik och eventuell behandlingsstart. Målet är att alla skall inleda behandling för sin tjocktarmscancer inom 4 veckor, vilket överensstämmer med regionsjukvårdsledningens löfte till befolkningen.

Mål med förbättringen

Mot bakgrund av ovanstående behov av ökad tillgänglighet till och samt en effektivare radiologisk service, har en förbättringsansats genomförts med stöd av en länsövergripande tvärprofessionell förbättringsgrupp. Målsättningen har varit att:

- införa bästa undersökningsmetod vid utredning av misstänkt tjocktarmscancer,d v s dator-tomografisk tjocktarmsundersökning

- förkorta genomloppstiden från remiss till svar för alla datortomografiska undersökningar

Syftet med studien av förbättringen

Studien av förbättringsansatsen syftar till att erhålla en ökad förståelse för framgångsfaktorer och barriärer i ett tvärprofessionellt förbättringsinitiativ, för att dra lärdom av detta i kommande förbättringsprojekt. De variabler vi avser att studera är medarbetares och chefers uppfattningar och erfarenheter om projektets fortskridande, vad som varit bra resp mindre bra, samt om ett lärande och utveckling inom organisationen skett.
Resultatet av studien kan komma att presenteras i en vetenskaplig tidskrift och/eller vid en konferens, och den kommer även att finnas tillgänglig på webbplatsen för Högskolan i Jönköping. Inga personuppgifter hanteras och involverade medarbetare och berörda kliniker kommer ej att beskrivas med namn eller länsdels-tillhörighet. Om muntlig eller skriftlig kommunikation citeras, kommer det att ske endast efter vederbörandes godkännande.

**Har du frågor, är du alltid välkommen att ta kontakt med någon av oss.**

*Oskar Löfgren,*  
överläkare och länschef medicinsk radiologi  
Medicinsk diagnostik,  
Landstinget i Jönköpings län

*Anna Österström,*  
utvecklingsstrateg  
Medicinsk diagnostik,  
Landstinget i Jönköpings län
Informerat samtycke till att delta i studien:

"Införande av bästa undersökningsmetod och ökad tillgänglighet inom medicinsk radiologi."

Jag har informerats om studien och samtycker till att delta. Min återkoppling kommer att hanteras konfidentiellt och användas för att utvärdera designen av själva förbättringsansatsen och utfallet av densamma. Mitt deltagande är helt frivilligt och jag kan när som helst och utan närmare förklaring avbryta mitt deltagande.

Undertecknad har läst informationen om studien och ger sitt samtycke till att delta.

________________________________________________________________________

Ort och datum

________________________________________________________________________

Namnteckning

________________________________________________________________________

Namnförtydligande