Learning and understanding for quality improvement under different conditions
- An analysis of quality registry-based collaboratives in acute and chronic care

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DISSERTATION SERIES NO.65, 2015

JÖNKÖPING 2015
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Publisher: School of Health and Welfare
Print: Ineko AB, Göteborg

ISSN 1654-3602
Abstract

The demands that are placed on healthcare systems continue to increase, but several studies show that patient care and healthcare system outcomes are not as good as they could be. To come to terms with these problems, many stakeholders turn to systematic quality improvement methods. However, research and practice also shows that change in organisations is difficult. Consequently many quality improvement projects fail. Quality Improvement Collaboratives (QICs), introduced through the use of the Breakthrough series model, represent a commonly used approach. Despite their widespread application, uncertainty remains regarding the effectiveness of QICs. In Sweden, a number of national quality registries document healthcare actions and outcomes for different patient-groups and problem-areas. While these registries have long been used for follow-up purposes and for clinical research, they have not been used extensively for systematic clinical improvement purposes. The overall aim of this thesis was to examine if, and how, QICs which are supported by national quality registries can contribute to quality improvement in the provision of healthcare. The aim was also to examine what learning and new understanding occurred in the application of QICs in different settings.

The empirical material in this thesis comes from three QICs which included participating teams from different hospitals and health centres in Sweden. Each QIC included a national quality registry: the National Quality Registry for Acute Myocardial Infarction Care (RIKS-HIA); the National Diabetes Registry (NDR); and the Swedish Paediatric Diabetes Quality Registry (SWEDIABKIDS).

The thesis draws on an interactive research approach. The data collection and analysis employed both qualitative and quantitative methods. Data from the National Quality Registries, final team reports, focus-group interviews, and team members’ experiences were analysed and triangulated.

The studies show that QICs which are supported by national quality registries helped teams to close a number of gaps between ordinary clinical
practice and evidence-based guidelines, thereby contributing to the provision of better care and better clinical outcomes (Study I, Study II, and Study III). Important factors for success included stakeholders’ learning and understanding of the organisational context; structures that supported improvement efforts; and team members’ and managers’ commitment to improvement (Study IV). Furthermore, support by an internal team coach also promoted success (Study IV).

This thesis shows how national quality registries can be used in combination with systematic improvement efforts to produce better clinical results. It concludes that different areas of QIC application pose different challenges; for example, addressing care for acute disease versus chronic disease and evaluating professionally influenced process measures versus patient-dependent outcome measures. While different organizational contexts and care characteristics can pose challenges to QIC efforts, the formation of “Communities of Practice” during QICs enhanced the learning for improvement with and from others.
Original papers

The thesis is based on the following papers, which are referred to by Roman numerals in the text:

Paper I

Paper II

Paper III

Paper IV

The articles have been reprinted with the kind permission of the respective journals.
The voyage of discovery is not in seeking new landscapes but in having new eyes.

- Marcel Proust
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Acknowledgements

This thesis was written at the School of Health and Welfare at Jönköping University and The Jönköping Academy for Improvement of Health and Welfare. My studies and research were supported and financed through Futurum – the academy for Health and Care in Region Jönköping County, Sweden, and the Swedish Association of Local Authorities and Regions (Study III and Study IV). The research was also part of the Bridging the Gaps research program financed by Vinnvård. I am most grateful to these institutions, which supported me in this research project.

There are many people who supported and encouraged me during the years of research for this thesis, and to whom I would like to express my sincere gratitude.

First of all, I would like to thank my four supervisors who, in different ways, encouraged, supported, and pushed me forward in this work. Special thanks to my main supervisor, Professor Boel Andersson Gäre, for your endless positive energy and wisdom, for bringing up new perspectives, and for always finding time for me and my many questions. I must also thank my co-supervisors: Johan Thor, for sharing your knowledge of Improvement Science and for providing me with constructive criticism, (and improved my English), Berith Hedberg, for your valuable input and supervision, especially with respect to qualitative research. Finally, but not least, Soffia Gudbjörnsdottir, thank you for the great opportunity of working together with you and your colleges at NDR in several QICs.

I would like to express a very special thanks to my chief and colleague for many years, Mats Bojestig. Your support and encouragement gave me the energy and the belief that this research was important and possible. You have always given me insightful feedback and contributed with valuable discussions about Quality Improvement.

I would also express my sincere thanks to all my co-workers and co-authors from the different national quality registries that is such an important part of this research. Thanks to:
• Bertil Lindahl, Richard Carlhed, Christina Bellman, and Gunilla Lindström in the work with RIKS-HIA.
• Soffia Gudhjörnsdottir, Ulla-Britt Löfgren, and Linus Schiöler in the work with NDR
• Ulf Samuelsson, Lena Hanberger, and Karin Åkesson in the work with SWEDIABKIDS
• A special thanks to all the participating teams in the different QICs.

Without you this research would not have been possible.

I must also thank Göran Henriks and all the staff at Qulturum for their generous support during all of the QICs, especially during the learning sessions. It’s a great environment to be in and you all are doing a fantastic job in getting everyone to feel welcome. Thanks also to Anette Nilsson for valuable contribution on coaching in the third QIC.

I thank Staffan Lindblad, Christina Keller, and Truls Neubeck for your critical scrutiny of my “kappa” and for your positive feedback during my final seminar. I am also grateful to Bo Bergman, Beatrix Algurén, and Pär Höglund for your insightful reflections and advice at my halfway seminar in 2012.

I thank all my fellow PhD students at the Research School of Health and Welfare at Jönköping University, at Jönköping Academy for Improvement of Health and Welfare, and in the Bridging the Gaps research program. I appreciate your support and interesting discussions.

I am also grateful for the support and encouragement from all my fantastic colleagues at “Folkhälsa och sjukvård”.

Finally, I would like to thank my dear family, especially my two sons Andreas and Daniel, and my beloved husband, Mats, for putting up with me when I’m always being busy.

Jönköping, November 2015

Anette Peterson
Abbreviation

ACE – Angiotensin Converting Enzyme
AMI – Acute Myocardial Infarction
BP – Blood Pressure
BtG – Bridging the Gaps
BTM – Breakthrough series Model
DM – Diabetes Mellitus
EBM – Evidence-Based Medicine
FM – Follow up Meeting
HbA1c – Glycosulated Hemoglobin A1c
IHI – Institute of Healthcare Improvement
IMD – Internal Medicine Department
IoM – Institute of Medicine
JCC – Jönköping County Council
LDL – Cholesterol bound to Low Density Lipoproteins
LMWH – Low Molecular Weight Heparin
LS – Learning Session
NDR – the National Diabetes Registry
NQR – National Quality Registry
PCU – Primary Care Unit
PDSA – Plan-Do-Study-Act
RCT – Randomized Controlled Trials
RIKS-HIA – the National Quality Registry for Acute Myocardial Infarction
SKL – Swedish Municipalities and County Councils
SPC – Statistical Process Control
SWEDHEART – Swedish Web-system for Enhancement and Development of Evidence-based care in Heart disease Evaluated According to Recommended Therapies
SWEDIABKIDS – The Swedish Paediatric Diabetes Quality Registry
TCM – Team Coaching Model
QI – Quality Improvement
QIC – Quality Improvement Collaborative
QR – Quality registry
Prologue

In the modern healthcare sector, constant development in new technologies takes place and new knowledge through research is revealed. The healthcare sector is also exposed to pressures related to changes in both society and to people's values and needs. Meanwhile, several studies show that it is challenging for healthcare professionals to keep abreast with new developments, while simultaneously ensuring that new knowledge is incorporated into their practices. Despite the extensive development work that takes place in many areas of the healthcare sector, we read daily in the newspapers about shortcomings in the quality of care, patient safety, and patient access to care. This situation piqued my curiosity and my desire to contribute to an understanding of how one might bridge the gaps between knowledge and practice in the provision of healthcare.

I have worked many years in healthcare, first as a registered nurse and then as a healthcare developer and leader. I have long marvelled at the depth of commitment and the high level of knowledge among the clinical staff. At the same time, I note that there is a growing understanding that healthcare needs to constantly develop and improve. Jönköping County Council (JCC), where I work (with approximately 10 000 employees), exists in a county in the south of Sweden with about 330 000 inhabitants. Several years ago, the management at JCC realized the importance of quality improvement and embraced Edwards Deming’s model of Profound Knowledge (Deming 1994) as a strategy for improving quality within healthcare.

In the middle of the 1990s, I was given the opportunity to be part of the nationally renowned (and, later, internationally renowned) *Esther Project* (Wackerberg 2013) My participation in this project provided me with my first experience of how one might work with quality processes that are developed from the patient’s point of view. Through this work, I had the opportunity to be part of improvement efforts in an inpatient unit, in a department, in collaboration with others, and I have been part of a team that received the Swedish National Award for Quality 2002. For the last fifteen
years, I have also taught and lead a number of local and national Quality Improvement Collaboratives (QIC).

In the beginning of 2000s, JCC was invited to participate in *Pursuing Perfection*, a project financed by the Robert Wood Johnson Foundation and led by the Institute for Healthcare Improvement (IHI) in Boston, USA (Kabcenell et al. 2010). In this project, we had the opportunity to meet and learn from teachers who were some of the founders of Quality Improvement in Healthcare (Batalden & Stoltz 1993, Berwick 1996, James 2003, Batalden & Davidoff 2007). In the *Pursuing Perfection* project, measurement for improvement came to be an important issue and the use of national quality registries was identified as an excellent way to follow patient groups and compare clinical results with other county councils and hospitals in Sweden.

As I worked with different teams in different QICs, I became fascinated by how different teams could improve their clinical results. This is where my interest in research started, and my desire to understand what key factors lead to success in a QIC.

The research that is included in this thesis is part of an interdisciplinary research project called *Bridging the Gaps* (BtG). This project was funded by the Vinnvård program and is led by Professor Boel Andersson Gäre at Futurum and at the Jönköping Academy for Improvement of Health and Welfare. The aim of BtG is to contribute to our understanding of improvement in health care in order to reduce the gap between the knowledge that is made available to us via research on how to treat patients, and what actually happens in practice. So far, different knowledge has been developed in the BtG project via the research that has been reported on in several doctoral thesis; for example, on team-development (Kvarnström 2011), on the development of collaborative learning (Godfrey 2013), on learning in the microsystem (Norman 2015), on patient empowerment (Nygardh 2013) and on the use of external team coaching (Godfrey 2013, Norman 2015). With the present thesis, I contribute to and complement earlier research, and I highlight a number of areas that have not been reported on, for example, with respect to understanding how systematic quality improvement in conjunction with Quality Registries can support better quality of care for patients. Further to this, I investigate the particular
improvements that teams have identified as being important to success, and how the addition of internal team coaches works in practice.
Introduction

In 2000 and 2001, the Institute of Medicine (IoM) published two reports on the evidence of quality failures in healthcare and urgently called for the redesign of care systems so as to achieve improvements (Kohn et al. 2000, IoM 2001). These reports were eye-openers for many professionals working in healthcare, and prompted more systematic quality improvement and safety efforts in the organisation and provision of healthcare (Berwick 2008). These reports also emphasized the insight that “every system is perfectly designed to achieve the results it gets” (Berwick 1996: 312, Batalden & Splaine 2002: 53, Carr 2008: 4). This implies that, to achieve new and better results, changes in the system are required. Meanwhile, Berwick also notes that not all changes are improvements, but that all improvement requires change (Berwick 1996). Such is the challenge faced by improvement efforts in healthcare.

The demand on healthcare continues to increase and there is a lot of research in the medical field, as well as in other caring sciences, which could potentially improve the quality of care. The IoM (2001) defines quality in health care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (p 232). According to this, good quality care provides patients with appropriate services in a professional manner, with good communication, involvement of patients and sensitivity to cultural differences. The report also describes that quality can be evaluated in different ways and refers to Donabedian’s (1988) distinction of structural quality which concerns healthcare capacities, process quality which concerns actions and interactions between medical staff and patients, and outcomes which concern evidence about changes in patient health status attributed to health care.

The IoM report “Crossing the Quality Chasm” inspired the Board of Health and Welfare in Sweden to use it as guidance for a new healthcare regulation, namely, God Vård (Good Care) – quality management system and patient safety in health care (Socialstyrelsen 2006). The God Vård (GV) policy
document focused on the same areas of quality as outlined in the IoM report; safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity. These areas were highlighted as being important to the provision of good and safe care. GV described the problem in the following way:

“The professional knowledge that leads to improvement in diagnosis, treatment and care within the health services is growing rapidly. The knowledge is implemented, however, to different degrees and at different speeds, leading to wide variations in practice.’(Socialstyrelsen 2006: 7, translated from Swedish).

Another way to meet increased demands on the transparency of healthcare outcomes is reflected in the Open Comparisons of healthcare outcomes published by the Swedish Association of Local Authorities and Regions Municipalities (SKL) and the National Board of Health and Welfare published annually since 2006 (Quality and Efficiency in Swedish Health Care - Regional Comparisons 2012, 2013).

The continuous development in healthcare includes new technologies and new knowledge. They make the need for dissemination of new knowledge to steadily increase, along with the need to translate this new knowledge into everyday work (Brown 2009). For example, in many cases, an increased rate of delivery of established therapies would save more lives than the next innovation in therapy (Woolf & Johnson 2005) which indicates that this, i.e., that patients receive the treatment they will most likely benefit from according to evidence-based guidelines, is an important challenge. It is estimated that one third of the leading causes of death can be prevented, and that one third of healthcare spending can be saved if we adhered to evidence-based guidelines (Pronovost 2013). Evidenced-based care and guidelines to support the provision of the right treatment and care are therefore essential. Consequently, there has been an increased interest in “evidence-based medicine” (EBM) to influence clinical practices (Walshe & Rundall 2001). The definition of EBM is: “integrating the best research evidence with clinical expertise and patient values to achieve the best possible patient management” (Glasziou et al. 2003: 3). However, there are studies that show that best-practice care, or evidence-based care, is not applied fully in healthcare (Grol & Grimshaw 2003). Notably, only about half of adult
patients in the USA received care which was in line with well-established evidence or recommended care (McGlynn et al. 2003). While EBM and quality improvement have similar goals, they differ in focus. However, if EBM and quality improvement are combined, they would provide us with direction on how to ‘do the right things right’ (Glasziou et al. 2011: 16).

Eliasson and Targama (2005) argue that the mere existence of knowledge is not enough – knowledge must also be translated into practical, everyday work. Several studies show the difficulty of implementing new research and new guidelines, and of translating them into clinical practice (Willman & Stoltz 2002, Grol & Grimshaw 2003, Nilsson Kajermo 2004). One way to improve quality in healthcare is through the use of different quality improvement (QI) initiatives. Unfortunately, however, the effectiveness of QI interventions and methods remains uncertain and varied (Walshe & Freeman 2002, Mittman 2004, Shoania & Grimshaw 2005, Schouten et al. 2008). Organizations perceive an undesirable complexity with respect to improvement efforts and how they should proceed, including what methods should be used and how they should be used (Book et al. 2003). Alemi et al. (2001) found that only about 20-40% of the 92 healthcare QI projects from 32 organizations that they surveyed in five different areas were measurably successful. A Swedish study showed slightly different results, where 58% of the QI projects surveyed demonstrated success (Thor et al. 2010).

According to experience-based learning theory, theoretical knowledge needs to be interpreted by the learner and conclusions need to be drawn from the learner’s practical experience, together with practical action, before this knowledge is consolidated and becomes part of the learner’s professional competence (Ellström et al. 2003). Grol et al. (2007) advocate for more systematic use of different theories in planning and evaluating QI interventions in clinical practice. Different approaches and different theoretical perspectives can contribute to improving the organization and provision of healthcare and thus need to be considered simultaneously (Grol & Grimshaw 2003).

QI initiatives are, despite the remaining uncertainty about their effectiveness, frequently used to improve the quality of healthcare. Given this, we now question if these initiative can improve quality in both acute and chronic
settings, and how they can strengthen learning and improved understanding on individual, team, and organisational levels.
Background

QI methods and the continuous evolution of such methods, informed by “improvement science” research, have been used to shape strategies to deal with a number of current problems in the organisation and provision of healthcare (Berwick 2008, The Health Foundation 2011). Research on the learning processes that take place in QI is needed, to find out how QICs can foster learning in teams and on organizational level (Weggelaar-Jansen et al. 2015). The following sections provide the reader with background to the present thesis, and will highlight the knowledge and the knowledge gaps that underpin the research questions it addresses.

What is Quality Improvement?

Batalden and Stoltz (1993) describe two types of knowledge that are needed to transform the healthcare sector (Figure 1).

Figure 1: ‘Professional knowledge’ and ‘improvement knowledge’ together make continual improvement in healthcare possible. (developed from Deming, 1994 and Batalden & Stoltz, 1993).
These knowledge areas are; ‘professional knowledge’, which consists of subject knowledge, personal experiences, values and ethics, and ‘improvement knowledge’, which concerns understanding systems, variation, change psychology, and learning-driven improvement efforts (Figure 1).

Improvement knowledge has developed from what Deming (1986, 1994) called “Profound Knowledge”. Edwards W. Deming [1900-1993], a physicist and statistician, claimed that a more profound and insightful knowledge was needed to create a basis for lifelong learning, at school, at work, and in society at large (Axelsson & Bergman 2005). Deming (1994) described four different knowledge domains as necessary and sufficient to forming the basis of continuous improvement which would lead to increased value for customers. These four knowledge domains, and questions that are related to them, are: 1) Understanding of the system – What does our system look like? Who are our customers? 2) Understanding the knowledge of variation – What kind of variation do we have in our results? 3) A theory of knowledge – How can we understand if a change is an improvement? How do we learn, and create theories which are related to and used in reality? 4) Psychology – How will we understand what happens within the system when changes are made? Deming also placed emphasis on an individual’s motivation, participation and engagement, and the importance of cooperation and communication. He therefore believed that knowledge of human psychology is essential to the modern quality philosophy (Deming 1994).

According to Batalden and Davidoff (2007a), quality improvement is all the activities that healthcare professionals, patients, families, researchers and others undertake that lead to better patient and population outcomes (health), better system performance (care), and better professional development (learning). They argue that QI entails the combination of, and involvement in, five different “knowledge systems”. These include: 1) Generalizable scientific evidence, 2) Particular context awareness, 3) Performance measurement, 4) Planning for change, 5) Execution of planned changes. The connection between these knowledge systems in a “formula” combines the knowledge on current scientific evidence with the characteristics of a particular context, the knowledge on planning changes and the execution of these changes to yield measurable performance improvement. These
Improvements are demonstrated by using balanced measurements which are analysed over time (Figure 2).

![Diagram](image)

**Figure 2:** The “formula” describes a framework of how five different knowledge systems in combination are needed to improve quality of care (Batalden & Davidoff 2007a).

To improve an organization, or to alter established habits and routines, requires *continuous* improvement efforts. A vast body of literature describes the need for tools and systematic approaches (Langley et al. 2009, Bergman & Klefsjö 2001, Batalden & Davidoff 2007a). Others have highlighted the need to combine the technical side of improvement (for example, by using different improvement tools, such as PDSA) with knowledge from social science (Bate et al. 2008). There are also a variety of frameworks, models, and tools which can support the conduct of an improvement project. For example, Kotter (1996) divided the improvement process into three distinct phases: *preparation, execution, and completion*. In the preparation phase, the need for improvement is identified and a vision is created. The team, which must have the right competence, a high level of legitimacy and trustworthiness, is also formed at this phase. In the execution phase, communication is important, so as to involve relevant stakeholders in the proposed vision and to change (preconceived) ideas. It is also important to achieve some quick positive results to strengthen the motivation in the improvement team. In the third phase, the completion phase, the changes should be consolidated into the practice, and the team members who work and achieve the desired results (according to the new way of working) should be rewarded. Lately, Kotter (2012) has expanded his strategy for change and updated with a second system with an agile, ‘networklike’ structure. Kotter (2012) suggests that organizations need to react with greater speed and creativity than described in his earlier model. Furthermore, instead of sequential steps in the improvement work, the steps should be concurrent,
and instead of a small group which is engaged in improvement work, there should be as many as possible. Finally, the steps that are taken should be deployed, not just in a traditional hierarchy, but in the flexible and agile context of a network (Kotter, 2012).

The knowledge and skills that are needed for improvement

The healthcare sector is a knowledge-intensive sector that is dependent on staffs who possess extensive knowledge and skills in their professional fields. Rapid changes in healthcare require that the professional knowledge that is possessed by the staff members also evolves. A significant problem, however, is that it is difficult to get new knowledge into practice (see Willman & Stoltz 2002, Nilsson Kajermo 2004). An interaction between "theoretical knowledge" and "practical work" is thus needed. As mentioned earlier, experiential learning requires theoretical knowledge to be interpreted by the learner and for the learner to be able to draw conclusions from lessons learned. At the same time, theoretical knowledge requires opportunities for action in practice so as to enable consolidation of such knowledge and thereby become part of the desired skill set (Ellström et al. 2003).

‘Professional skills’ are synonymous with how the practitioner understands his/her task and the context in which the work is performed (Sandberg & Targama 1998). A result of this state of affairs is that even if the healthcare sector employs highly trained staff, not every patient will receive the treatment or care that they need. This is because the staff do not have the knowledge and the practice required for this to be realised in truth. A mere increase in knowledge is no guarantee of better care for patients. Although physicians and nurses may have mastered the underlying theories well and have a wealth of knowledge, it is not obvious that these theories and knowledge are used properly, and neither is it guaranteed that they will be reflected on when a patient’s problem is to be solved (Eliasson & Targama 2005).

‘Knowledge’ and ‘skills’ are often described as essential to the development and success of individuals, groups, and organizations. Knowledge can be
described in terms of various forms. Aristotle was perhaps the first to discuss knowledge and contributed to our understanding of different forms of knowledge. The division that Aristotle made facilitates understanding, and how we can deal with knowledge and learning. He divided knowledge into *episteme*, *techne*, and *phronesis* (Aristoteles 1993). *Episteme* refers to theoretical, scientific knowledge that is based on facts. For a long time, this knowledge was perceived as the only form of knowledge of real importance, because scientific knowledge was produced through research (Gustavsson 2000). Theoretical knowledge is often associated with formal qualifications and is offered via traditional training in the form of shorter or longer courses. This is done through formal education (Ellström et al. 2003). *Techne* refers to practical, productive knowledge. This knowledge has been described as ‘tacit knowledge’ by for example Polanyi and, in recent decades, has been recognized more by organisations for people with practical professions (Gustavsson 2000). According to Aristotle, *techne* was linked to action and how it is implemented. Practical knowledge is described as useful, relevant, and connected to action; something that must be learned in practice (Mogensen 1996). Finally, *phronesis* refers to knowledge associated with morality, ethics, and emotions. *Phronesis* includes ‘practical wisdom’ and, like *techne*, is a practical form of knowledge that is based on human actions (Gustavsson 2000). The difference between these two forms is that *techne* is tied to manufacturing and production, while *phronesis* is tied to ethical and political dimensions. Embedded in *phronesis*, we find norms and values that affect different attitudes and behaviour patterns. This categorization corresponds well with what later researchers have expressed. For example Ellström (1992) points to a common division between *theoretical knowledge*, *practical knowledge*, and *experiential knowledge* (Ellström 1992). Practical knowledge and experience-based knowledge is sometimes referred to as *tacit knowledge*. Tacit knowledge is not only presented at the level of the individual, but can also be found at the organizational level. Polanyi [1886–1964] was early to recognise tacit knowledge (Rolf 1995). By using terms like *personal knowledge* and *tacit knowledge*, Polanyi was able to refer to ideas about how knowledge was constructed. With *personal knowledge*, Polanyi claimed that knowledge always requires commitment in some form and will, therefore, be personalized. On the other hand, *tacit knowledge* requires knowledge in all activities and actions. Tacit knowledge that exists within an organization is difficult to capture, reflect on, and work
with (Brown et al. 2005). Polanyi, (according to Rolf (1995) and other researchers, for example, Tsoukas (1996), believed that tacit and explicit knowledge cannot be separated from each other because explicit knowledge is always based on tacit knowledge. Nonaka and Takeuchi (1995) argue that tacit knowledge and explicit knowledge are complementary to each other, and see the creation of new knowledge as an interaction between these two forms of knowledge.

Knowledge is not only individual, as previously mentioned, but can also be found in organizations. For an organisation to develop, such knowledge must also be developed and the organisation should find the conditions that are required for the transfer of knowledge between individuals. Senge (1990) argues that, in order to develop an organization, conditions for learning must be created. However, learning at the individual level does not automatically mean that learning at the organizational level will take place. One practical challenge that researchers in this field face is how to translate newly developed knowledge into knowledge in practice that will contribute to improvement(s) in an organization (Van de Ven & Johnson 2006).

All the different types of knowledge mentioned above are needed in quality improvement efforts in healthcare. Professional practitioners need to keep up-to-date with research results and new methods, i.e., theoretical knowledge, or episteme; the area of professional knowledge (Batalden & Stoltz 1993). But to improve healthcare they also need practical knowledge, or techne, since in the area of quality improvement there exists a large number of different methods and tools that are available. This is an important part of what Batalden and Stoltz (1993) call improvement knowledge.

**Learning in relationship to change**

In the context of continuous quality improvement, knowledge and skills not only refer to individual skills and knowledge but also to the experiences, personal characteristics, values, and commitment to the development of organizational knowledge. Therefore, the definition of competence in the sense of ‘continuous improvement’ according to Ellström and Kock (2005:

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is: “the ability to successfully solve tasks/problems, including the ability to utilize and, if possible, extend the interpretation, action and measurement space that the work offers.” According to this definition, the process of continuous improvement requires some expertise, but also problem-solving and learning processes, which, in turn, lead to the creation of opportunities for learning and skill development, both at the individual level and at the organizational level.

Ellström and Kock (2005) further describe the skills required to work with continuous improvement and to increase an organization’s knowledge. They include the ability to identify and define tasks and problems, linguistic and communicative competence, and a comprehensive understanding of processes and systems. In addition, individuals need to take responsibility for the improvement process and work in teams. Thus we observe a necessary combination of individual knowledge in different forms of theory, practice, and experience, but also taking into account the organization’s collective knowledge.

Theories on adult learning claim that people are more motivated to learn and change when they understand the context in which they find themselves. For example, people will be motivated if their learning process starts with thoughtful consideration of the problems that they have been confronted with in practice, and if they can relate to coherent strategies that are related to clear objectives (Holm 1998, Illeris 2001, Grol et al. 2007). Sandberg and Targama (1998) claim that the results of a large number of interpretive research studies show that ‘understanding’ is the foundation for a variety of human behaviours. Senge (1990) has argued that, in order to develop an organization, one must actively create conditions for learning. Learning at the individual level does not automatically result in learning at the organizational level (Senge 1990). Notwithstanding this, learning still needs to be defined both from an individual perspective and from a group perspective (Ellström & Hultman 2004).

There are several factors that affect learning, including tasks, design, complexity, autonomy, and competence requirements. Learning requires that the individual or group has the necessary conditions to exploit the inherent flexibility of humans to change habitual practices and procedures (Ellström & Hultman 2004). The individual’s knowledge and understanding of the
task, and its relationship to the organisation as a whole, are important. People develop the knowledge and skills that they use in performing work within the framework of their understanding. If we can change the framework of a person’s understanding, then we can change how people develop knowledge. This has immediate and direct consequences for how one should lead and organize learning. Skills develop within an organization, which, in turn, demonstrates the fact that the creation of conditions for learning must be a central element in a QI team leader’s daily work within an organization (Sandberg & Targama 1998).

Senge (1990) discusses five disciplines that are required of learning organizations: “A learning organisation is an organization where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to learn together” (Senge 1990:3). Senge (1990) also discuss personal mastery that refers to personal growth and learning. Mental models guide our way to interpret what we see and how we act. Learning in groups involves the ability to learn together and the capacity to engage in collective learning, in a group of individuals that shares a common vision to stimulate new ways of thinking and acting (this includes the management’s focus on the future.) The fifth discipline highlights system thinking. In a system, many different relationships and interactions exist. A decision or change in one part of the system may have consequences in some, or all, of the other parts of the system. The ability to engage in system thinking and to see one’s own part in the overall system is critical to the creation of an understanding of how to activate the forces that are needed to achieve success and achieve future visions. System thinking also helps one to understand how complex phenomena are interrelated and influence each other (Senge 1990).

In their discussion of development and learning within an organization, Argyris and Schön (1996) emphasize the difference between ‘single-loop learning’ and ‘double-loop learning’ (Figure 3).
According to these researchers, single-loop learning is comparable with the improvement of skills and practice development. For example, single-loop learning may refer to a situation where a person is learning to perform a given task better. It takes place under a prevailing (i.e. ‘old’ or ‘traditional’) system of working and thinking. When the learning goal is to correct errors, or to quickly and effectively meet a simple objective, a single-loop learning approach may well be sufficient. In such cases, rules and routines may be modified within the prevailing system, but the organization within which learning takes place is not placed in question or challenged. Double-loop learning, however, questions the principles and values that form the basis of the learner’s behaviour and action. Double-loop learning involves the learner reflecting over and questioning that which was previously taken for granted. Double-loop learning involves critical reflection over the learning process, its goals, the knowledge that is exchanged, and the individual’s and the organization’s role and structure. Previously established patterns of behaviour and taken-for-granted ‘truths’ have to be reconsidered. Double-loop learning is about radical change. Everyone must be aware that a current problem cannot be resolved within the existing approach; a new understanding must be added. According to Argyris and Schön (1996) double-loop learning can be used on the individual-, the group-, and the organizational levels to change norms and values.
An early model of the learning process is presented in the experiential learning theory formulated by Kolb (1984), which was originally inspired by Lewin, Dewey, and Piaget (Kolb 1984). Kolb’s model views learning as a process involving continuous ideas and habits as a result of experience. Lewin [1890-1947] also describes an early learning model for change. Dewey’s [1859-1952] contribution to Kolb’s formulation of experimental learning is expressed by the inclusion of notions of multiple iterative cycles of action, observation, the gaining of knowledge and judgement which carried over from one cycle to the next. Finally, Piaget’s [1896-1980] model of learning describes a cycle of interactions between the individual and the individual’s environment (Kolb 1984).

Kolb’s experiential learning cycle, which includes experiencing, observing, conceptualising, and retrying (Kolb 1984), has similarities with a model used in contemporary quality improvement efforts: the Model for Improvement known as PDSA (plan-do-study-act) cycle, or the Improvement Circle (Moen et al. 1999, Langley et al. 2009). The model was initially developed by Walter Shewhart (Bergman & Klefsjö 2001) and Edward W. Deming (Deming 1986), and is a flexible framework for developing and testing changes. The model is based on three questions about current knowledge and the plan-do-study-act cycle (Figure 4).

![Figure 4: The Model for Improvement starts with three fundamental questions and then the PDSA cycle is used to turn ideas into actions and connect actions to learning (Langley et al. 2009).](image)
The different steps in the PDSA cycle are: **Plan** for a small test of an improvement idea. Decide who is going to do what, where, and when. **Do** the test as planned, document, and measure what is happening. **Study** and reflect over the effects and results of the executed test and compare the changes with the expected effects. **Act** on the basis of the knowledge gained and plan for how one might continue. Do we have to perform new tests? Do we need to make changes to the improvement ideas? Can we spread the improvements that have been gained? Can we introduce the idea into daily practice? Small-scale, rapid PDSA-cycles are recommended as an effective trial and learning approach to making changes (Moen et al. 1999).

The PDSA quality improvement tool is defined when data is collected to demonstrate the change caused by intervention results in improvement. Speroff and O’Connor (2004) advocate for the use of quasi-experimental strategies to improve the scientific foundation of PDSA quality improvement in health care. Taylor et al (2014) argue that the understanding of the use of a variety of improvement methods, including PDSA, needs to be improved to better understand the effectiveness of these methods.

Running a quality improvement initiative can be both stimulating and challenging, since it demands changes in routines, habits, and the way one might currently work. In order to manage this, the four different knowledge domains (Batalden & Stoltz 1993, Deming 1994) described above are essential for adults in their efforts to learn and improve healthcare. Theories of knowledge and improvement psychology can be supported by different systematic quality improvement methods and tools which can help learning and the creation of a new understanding, including systematic approaches such as PDSA. The structure of this approach helps teams and individuals make small scale tests, evaluate these tests, and learn from them. The claim made by collaborative learning theory is that the application of these methods in such settings will further enhance learning.

**Quality Improvement Collaboratives in healthcare**

A quality improvement collaborative (QIC) is a common pedagogical model for working with improvement in healthcare. Collaboratives of this nature follow a structure where groups of healthcare professionals from different
healthcare organisations are brought together to work in the improvement of a specific area (for example, a particular clinical practice, a specific process, or specific disease) during a number of learning sessions (Schouten et al. 2008). Learning sessions include lectures on improvement techniques, teamwork, and reflective learning and sharing of experiences between the teams. The time between learning sessions are called ‘active periods’, during which the teams identify and inventory problems, prepare action plans, test, change and monitor results at their ‘home’ workplace. Most of the improvement work is done at the work place, as an integrated part of their day-to-day work. In QICs, teams can get support for experienced based learning (Ellstöm & Kock 2005) by the opportunities created for reflection and work in learning circles (Kolb 1984, Langley et al 2009). The QIC also supports system thinking and learning in groups and what Senge (1990) calls a ‘learning organisation’.

QICs are inspired by the ‘Breakthrough Series Model’ (BTM) (Kilo 1998, Wilson et al. 2003) developed by Paul Batalden and colleagues at the Institute of Healthcare Improvement to help organisations to improve the organisation and provision of healthcare. The original BTM includes a group of faculty members who are tasked to convey the key aspects of best practice, i.e., evidence-based guideline components of care for the specific patient group that is target for the collaborative (IHI 2003).

Even though the QIC model follows a very structured plan, it also allows for the support of “communities of practice”, since time is set aside for the team members to meet with each other, to interact with each other, and discuss common topics. According to Wenger et al (2002: 4) “communities of practice are groups of people who share a concern, a set of problems or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.” By sharing ideas, insight, and advice, the teams can help each other solve problems. Communities of practice also provide opportunity for team members to share tacit knowledge and informal learning through, for example, storytelling, conversations, and coaching (Wenger et al. 2002).

Most quality improvement efforts are performed within the working team and unit that is found nearest to the patient. For example, the Clinical
Microsystem model is one way of describing these “smallest functional groups” (Nelson et al. 2007). Note the following definition:

“A Clinical Microsystem is a small group of people who work together in a regular basis to provide care to discrete subpopulations of patients. It has clinical and business aims, linked processes, and a shared information environment, and it produces performance outcomes. Microsystems evolve over time and are often embedded in larger organizations. They are complex adaptive systems, and as such they do the primary work associated with core aims, meet the need of their members, and maintain themselves over time as clinical units.” (Nelson, Batalden & Godfrey 2007: 7).

According to this definition, the Clinical Microsystem is the foundation of a healthcare system. Despite the presence of the various meso-levels and macro-levels within the system, it is within the different microsystems that value is added, quality is achieved, and patient safety is ensured. Consequently, the results that obtain on the macro-level can never be better than the performance of the microsystems that it subsumes (Barach & Johnson 2006).

The ‘5P Framework’ is a tool that can be used to increase one’s understanding and deepen one’s description and analysis of a Clinical Microsystem (Nelson et al. 2007). Using this framework, a microsystem can be identified in terms of its core purpose and give a good picture of the patients in the clinical microsystems. The professionals, who possess different skills and roles as they work with the patients, are engaged in different processes to meet the patients’ needs. The results of the work that is performed with patients and processes can be analysed and shown patterns of care. These work results can be presented, for example, by using the “Clinical Value Compass”, which balances measures from four different perspectives: clinical results, functional results, patient satisfaction and costs (Nelson et al. 1996). The ‘5P Framework’ is used to help teams to understand the system and the context in which they operate, and allow them to relate to clear objectives for their joint work. These are important parts to motivate adult learning and understanding (Illeris 2001, Groll et al 2007).
Despite their widespread application, there is ongoing uncertainty regarding whether QIC or the BTM are effective and actually help in the improvement of healthcare (de Silva 2014). Some studies have demonstrated substantial improvement (Dellinger et al. 2005, Howard et al. 2007), whilst other studies have reported on limited or no effects (Landon et al. 2004, Homer et al. 2005). Furthermore, little is known about why QICs are successful in certain cases and what specific components in the quality improvement work are essential to such success (Schouten et al. 2008, Nadeem et al. 2013). These contradictory results indicate that new knowledge is needed to better understand the underlying mechanisms that are involved in QICs.

**Leadership, team development, and context**

A leader in a learning organization is tasked with being a designer, a steward, and a teacher (Senge 1990). Studies have shown that leadership is an important factor in successful quality improvement work (Ovretveit 2005, Aij et al. 2013), and with respect to driving the process of change forward (Berwick 1996). Leaders also need to establish a sense of urgency with respect to the proposed change (Kotter 1996). Ovretveit (2005) argues that there is evidence that supports the importance of leadership in quality improvement, although the evidence that he reports on is not conclusive since there are not many reports on how “high and low levels of leadership” create conditions that support successful quality and safety efforts in healthcare (Ovretveit 2005). In one study of 20 high performing frontline clinical units, it was concluded that the microsystems could be improved if leaders supported the microsystems’ work in meeting and exceeding their patients’ expectations and needs (Nelson et al. 2002). Successful organisations also claim that both current and future colleagues need to have competence in improvement knowledge if better patient (and population) outcomes, better system performance, and better professional development are to be achieved (Batalden & Davidoff 2007b).

Contemporary healthcare systems are so complex that no one individual can change a whole process by herself. But with a whole team with different professions, competencies and skills, change is possible (Thor 2002). Team development is particularly important to the improvement of quality in
healthcare (Grumbach & Bodenheimer 2004, Shortell et al. 2004). Xyrichis and Ream (2008) propose the following definition of ‘teamwork’ in this context. They consider ‘teamwork’ to be:

“a dynamic process involving two or more healthcare professionals with complementary backgrounds and skills, sharing common health goals and exercising concerted physical and mental effort in assessing, planning, or evaluating patient care. This is accomplished through interdependent collaboration, open communication and shared decision-making. This in turn generates value-added patient, organizational and staff outcomes.” (Xyrichis & Ream 2008: 238)

We may now raise the following two important questions with respect to teamwork: Who is on the team? and How do the team members work together? Different characteristics are found to create a cohesive team. These include clear goals with measureable outcomes, clinical and administrative systems, a division of labour, training of all team members, and effective communication (Grumbach & Bodenheimer 2004). Focus should also be made on patient satisfaction, the presence of a team champion, and the involvement of physicians in the team (Shortell et al. 2004). The importance of multidisciplinary teams has also been identified in the research, especially with respect to improving the effectiveness of chronic care (Wagner 2000). Despite the observations made above, there remain many questions to be answered concerning the underlying mechanisms in successful teamwork (Mickan 2005, Bosch et al. 2009, Korner et al. 2015) and the obstacles that team-members face when different professions and fields of knowledge interact with each other in a teamwork setting (Kvarnström 2008).

Another factor that we should consider in the context of teamwork is the team’s and the team-members’ motivation to change. According to Rogers’ (1983) model of ‘diffusion of innovation’, we observe variation among groups of people, which gives rise to various categories such as ‘innovators’, ‘early adopters’, ‘early majority’, ‘late majority’, and ‘laggards’. We note that different people have different ways of embracing new ideas. Development is not supported if there is only one ‘type’ of person in a team. A combination of different types within the team can influence their willingness to try out and adopt new ideas. The same applies to learning
styles. For example, Lewis and Bolden (1989) describe four types of learning style. ‘The activist’ learner likes new experiences, ‘the reflective’ learner considers all options carefully, ‘the theoretical’ learner prefers rigorous analysis before changing, and, finally, ‘the pragmatic’ learner acts on the basis of practical experience.

Leaders and teams are part of the context which influences improvement efforts and it is important to understand that how they act and cooperate can ensure the success of quality improvement and the sharing of successful initiatives (Kaplan et al. 2010, Ovretveit 2011). McCormack et al (2002) argue that context refers to the environment or settings in which change is to be implemented. They categorize the contextual factors into ‘culture’, ‘leadership’, and ‘evaluation’. Similar conclusions have been made by Bate et al. (2008) who state that a number of factors are needed for success, including leadership support, an organizational culture and climate that support improvements, and a strong team-based structure and composition. However, we still lack explanations with respect to how and why these factors are related to each other and how they actually influence improvement work (Bate et al. 2008).

**Team-coaching**

One component of QI work that has been used in the past and has been found to improve QIC is team coaching (Gustafson et al. 2013, Godfrey 2013). In these studies, external coaches were added to the teams to support the QIC. Notwithstanding this, further research on effective QI coaching is needed to develop our understanding of how internal team coaches can be most effectively used in QI work, for example. According to Flaherty (2005), ‘coaching’ is concerned with building relationships with people so as to remove ineffective and counter-productive habits. The goal of coaching is to build new skills, habits, and platforms for collaboration in a changing world. Team coaching is an act of leadership, and it should focus on the performance process and team effectiveness more than on interpersonal relationships (Hackman & Wageman 2005). According to Hackman and Wageman (2005), the team coach should support the team when the team is ready for such support, which is especially important at the beginning of a QI project to motivate the team; at the midpoint of the project for
consultative strategy-related support; and at the end of the project to address new knowledge and skills and how to move on after the project has ended. This afore-mentioned staged provision of support agrees well with the *Team Coaching Model (TCM)* proposed by Godfrey (2013, Godfrey et al. 2013). According to this model, coaching includes exploring the context, building relationships and communicating, and offering actions to support improvements. It also includes providing technical support around improvement tools. Godfrey (2013) suggests three phases in the TCM: the *pre-phase*, the *action phase*, and the *transmission phase*, which are similar to the steps Kotter (1996) described as preparation, execution and completion. In Godfrey’s model, in the pre-phase, the team should get ready to start the improvement work. The coach should clarify the aim of the improvement work, set expectations and a timeline, and start to communicate the improvement methods to the leader and team. In the action phase, the coach should secure and support the improvement team, so as to keep it on track. The coach should also give feedback and reinforce effective meeting skills and roles, and support and teach technical improvement skills, e.g. the PDSA-method. Finally, in the transition phase, together with the team, the coach should reflect on the improvement journey and the goals that have been achieved, and make a plan for how the improvements that were made are to be monitored and sustained (Godfrey 2013). In Godfrey’s research, improvement teams which received coaching according to TCM were compared with teams that did not receive this support. The results indicate greater levels of acquisition of improvement knowledge and skills for TCM-coached teams compared to non-TCM participants (Godfrey 2013). Further research is needed in this area, including research on larger groups and with additional comparisons, including the effects of such coaching on clinical outcomes.

### Quality measurement

The measurement and following up on the provision of healthcare has long been an issue of interest and concern. A breakdown of how care can be evaluated in terms of *result*, *process*, and *structural measures* was suggested by Donabedian in the 1960’s and is still relevant today (Donabedian 1966, Donabedian 1988, Best & Neuhauser 2004). Questions such as *What should
be measured? and How should such measurements be performed? with respect to an organization’s performance have been subject to academic study (Neely 2005) and so has the importance of using the results of performance measurements for improvement (Berwick et al. 2003). One of the three fundamental questions in the model for improvement described above is: How we can know that a change is an improvement? To answer this question we need to measure the improvements (Langley et al. 2009). Accurate and robust methods of measuring change are essential in improvement efforts if we wish to produce reliable results (Nelson et al. 2004, Langley et al. 2009). Multiple measurements are often required to present a balanced overview of different interests and to ensure that the system as a whole has improved. One tool that is of use in balancing different perspectives with respect to measurements is the Clinical Value Compass. This model allows one to present information from four different perspectives; namely, with respect to clinical results, functional results, patient satisfaction, and costs (Nelson et al. 1996). Run charts or statistical process controls have also proved to be useful tools for tracking the results in a changed process, thereby allowing the practitioner to learn from the observed variations. However, these tools require frequent data collection methods over time in order to be useful (Carey 2003, Thor et al. 2007, Perla et al. 2011).

According to James (2003) a shared national measurement framework is essential because current healthcare information systems that is delivered to the different healthcare organizations is not good enough to meet the demand for reporting on performance. This claim corresponds well with McGlynn (2003), who has argued that national quality measures and reporting systems are essential for nations in their efforts to improve the quality of healthcare.

In Sweden, in 2014, 81 National Quality Registries (NQR) existed. These NQRs are run with financial support from the Swedish Association of Local Authorities and Regions. Additional registries are being planned for or are under construction. In 2014, 24 so-called “registry candidates” also received financial support. All registries have to provide an annual report to an Executive Committee and renew their applications for financial support. The committee also gives feedback on the registries, with suggestions for the development and improvement of specific registries. This feedback is an
important part of the quality control of the NQR (National Quality Registries in Sweden 2014). The results from the registries have traditionally been compiled into an annual report for each registry. However, so far, most of the registries have not been useful for improvement in daily practices. As a consequence of this, there is a large untapped potential with respect to the use of these national quality registries for systematic improvement in daily work (Rosén 2010).

The Swedish NQRs have been created by dedicated clinicians who have an interest in monitoring and developing the quality of care (Garpenby & Carlsson 1994). The NQRs have been developed to support a variety of needs in the healthcare system. Therefore, they have different focuses and can be divided into different types of registry. These include: activity registries, diagnostic registries – both for acute and chronic diseases, registries for prevention, and palliative care registries. The overarching vision associated with the NQRs is that they should be an overall support that can be used actively at different levels of learning, improvement, management and governance of all healthcare activities (Rosén 2010, Jacobsson Ekman et al. 2014). The registries should create opportunities for practitioners to improve health services and provide better support for clinical research, but also they should be used to enhance the quality of care (National Quality Registries in Sweden 2014). A NQR contains individualized data concerning patient problems, medical interventions, and outcomes after treatment. The development of the NQR started with a registry for knee replacement in 1975 and one for hip replacements in 1979. In 1989, there were 8 NQRs. When the government and county councils began to give financial support for similar registries from 1990, the number of registries increased rapidly. One success factor for the NQR in Sweden is the inclusion of each patient’s personal identification number, which makes it possible for a researcher or clinician to track individual patients along their journey through the healthcare system (Rosén 2010).

The interest in open comparisons of data on clinical results has also increased and, as a consequence of this interest, since 2006, an annual report Quality and Efficiency in Swedish Health Care, Regional Comparisons has been published by the Swedish National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions (Swedish
Association of Local Authorities and Regions 2013). The report compares healthcare quality and efficiency in the 21 Swedish healthcare regions and county councils by using a shared set of national performance indicators. The report provides information and data for use in the public sphere and supports county councils as they analyse, improve, and manage the healthcare services that they provide.

A recent study argues that while the NQRs constitute important sources of information that can be used in the assessment and development of quality of care and for research, there remain a number of limitations with the Swedish NQRs (Emilsson et al. 2015). There are, for example, variations in the completeness of the data in a large number of NQRs. Participation in each of the registries is voluntary for patients. The number of eligible patients who choose not to participate in these registries has not yet been analysed. Another limitation is that only a few registries obtain data from the primary healthcare sector. Finally, although there are many illness-specific NQRs, many health conditions are still not reported on in a dedicated registry and thus we lack a structured feedback system on these illnesses or health conditions (Emilsson et al. 2015).

NQRs remain an untapped resource for many quality improvement initiatives (Rosén 2010, Emilsson et al. 2015), despite that fact that a rich amount of data is contained in the different registries. There are many different kinds of indicators that could be used for following improvement efforts in these registries. Therefore, the different studies that comprise this thesis have used different NQRs as sources of information that is used to support, follow up, and monitor the results in the improvement efforts that are studied in this thesis. The NQRs that are included in this thesis are: the National Quality Registry for Acute Cardiac Care (RIKS-HIA), the National Diabetes Registry (NDR), and the Swedish Paediatric Diabetes Quality Registry (SWEDIAKIDS). Each registry is described more fully in the ‘Method and design’ section below.
Improvement science

This thesis is written in the field of ‘improvement science’. It is a new academic discipline that is in a “pre-paradigm phase” because of the absence of a uniform definition (Marshall et al. 2013) However, some researchers have proposed various definitions of the discipline, for example:

“Improvement science describes how to reduce the gap between what is actual and what is possible. Improvement science focuses on systematically and rigorously exploring ‘what works’ to improve quality in healthcare and the best ways to measure and disseminate this to ensure positive change.” (The Health Foundation 2011)

The aims of improvement science, according to Marshall, Pronovost and Dixon-Wood (Marshall et al. 2013) are to:

- create practical learning that can make a difference to patient care
- generate local wisdom and generalizable- or transferable knowledge with robust, well-established research methods that can be applied in highly pragmatic ways
- enable local improvement and crucially, produce knowledge with external validity
- contribute to clear and explicit theories of how change happens

Research on improvement is aimed at deepening the understanding of which interventions can improve quality of care, and how and what works where (Crisp 2015). But it also can enable the spread of successful approaches through a deeper understanding of the context in which successful approaches have previously worked. Crisp also argues that the context cannot be eliminated from the scope of such research and that we need to understand how context affects an improvement intervention in the complex setting of a healthcare service. Other researchers have also argued that improvement science should more effectively influence the way in which the health service is structured and delivers patient care (Marshall et al. 2014).

To make improvement science a rigorous science, its epistemological foundations and theoretical basis need to be critically examined so as to ensure its continued development and relevance. Perla et al. (2013) argue...
that improvement science should integrate ideas, concepts, and models from across different scientific disciplines for the purpose of developing more robust improvement models, tools, and techniques with a focus on problem-solving in real world contexts. Furthermore, improvement science should benefit from a shared, standard set of principles and an understanding of the evolution of the science of improvement.

A number of highly-rated researchers and developers of approaches to quality improvement activities have expressed the need for a clearer connection between what is studied and how it is studied (Walshe & Freeman 2002, Davidoff & Batalden 2005, Batalden & Davidoff 2007a, Berwick 2008). With better reporting and robust evaluation techniques, successes can be replicated and, at the same time, interventions that are ineffective can be avoided (Crisp 2015).

There are a variety of terms that are used to refer to subject areas that lie close to the discipline of Improvement Science; for example, science of improvement, implementation science, translational research, translational science, knowledge translation, and research utilization. There is some overlap between these terms. They all refer to systematic studies of what makes improvement effective and represent different ways of narrowing the gap between research and practice.

According to Pearson (2010) the complexity of evidence translation has promoted the development of the new fields of translation science, implementation science and improvement science. Pearson argues, however, that there are distinguishing features between these fields. Translation science moves from the conducting of experiments, through clinical trials, to actual patient care. Implementation science refers to the study of the methods that are used to support the movement from research findings to routine care. Improvement science, on the other hand, seeks to identify improvement work and strategies, and evaluate their effect(s) in a healthcare system.

Multidisciplinary research that can integrate different ideas, concepts, and models is essential for the development of research methodologies that can be used for the purpose of developing robust improvement models. Improvement science can be the important link to the evidence that is related
to “what works” with respect to improved evidence uptake, compliance with guidelines, and improved patient outcomes in real world contexts (Pearson 2010, Perla et al. 2013).

Many quality improvement interventions are like ‘black boxes’ that are difficult to reproduce in a new context. Improvement science should be responsible for the tasks of the systematic accumulation and synthesis of knowledge of successful improvement initiatives (Marshall et al. 2013). Once this is done, interventions that were previously seen as ‘black boxes’, can be analysed and understood, enabling the research to explain what made the intervention successful. The overall goal of improvement science is, therefore, to ensure that quality improvement efforts are based on evidence (Shojania & Grimshaw 2005).

Quality improvement research strives to bridge the gap between ideal care and actual care. There are a number of proposed strategies that could improve the research on quality improvement activities. For example, there is a need for closer collaboration between academic researchers and medical services, so that practice-based research can be conducted. Quality improvement research also involves taking advantage of the experience that is available from other industries, sharing responsibility between managers and health professionals for the improvement work, and engaging patients as active participants in the improvement process (Ting et al. 2009).

An important question in improvement science is: Do the improvement efforts need to be different in different contexts? Successful improvement work is often very difficult to replicate in new contexts (Dixon-Woods et al. 2013). Data on the particular context in which improvement work is performed is thus needed if one is to fully understand the setting that the study was undertaken, and how improvement work might be generalizable to other settings. This knowledge can help to speed up and spread the improvement work and ideas (Ovretveit 2011).

One challenge that improvement science is faced with is the evaluation of improvement work in progress. This process of evaluation requires a different approach than randomized controlled trials (RCT). Berwick (2008) argues for the use of, for example, Pawson and Tilly’s (1997) evaluation ‘Realistic Evaluation’ model. In this model, it is assumed that outcomes are
obtained on the basis of ideas and opportunities (mechanisms) for a specific group (context). Thus, new methods of evaluation are needed in the reality in which improvement efforts are carried out, with many different changes being implemented by multidisciplinary teams, in complex systems.

Berwick (2008) also suggests that a wider range of scientific methodologies needs to be embraced; thresholds for action that is based on evidence should be reconsidered; there needs to be a rethinking about trust and bias, and academics and frontline caregivers need to respect each other.

There exist several studies on the importance of implementing quality improvement rigorously. In the area of implementation science, several frameworks or principals have been developed to help the researcher understand the translation from evidence to practice (Damschroder et al. 2009, Tansella & Thornicroft 2009, Schackman 2010). These frameworks are aimed at providing the researcher and other practitioners understand and define the components that are important to and needed in the implementation of changes, including the organization, context and settings, characteristics of people involved, and the process in which the changes are implemented. One framework that is often used for implementing evidence-based practices is the Promoting Action on Research Implementation in Health Service (PARIHS) framework. This framework includes three key elements that may influence a successful implementation. These key elements are: Evidence, Context, and Facilitation (Rycroft-Malone et al. 2002a, Rycroft-Malone et al. 2002b, Harvey et al. 2002, McCormack et al. 2002, Rycroft-Malone 2004). The PARIHS framework was reviewed in 2010 (Helfrich et al. 2010). 24 articles examined how the framework has been applied so far. The conclusion was that, overall, it was a useful framework, but there is a need for clarity with respect to the definitions of terms used in the framework. It was also remarked that the framework needs to be tested more rigorously.

There is a large variation in quality improvement research, the design of improvement work, and how such work is evaluated. A review made in 2009 showed that there exists a substantial variation in the design of improvement work and highlighted a number of shortcomings in the examination and evaluation of quality improvement effectiveness (Alexander & Hearld 2009). Another large review, including 107 studies, focused on factors that may
affect the implementation of improvements (Alexander & Hearld 2011). The conclusion of this large-scale study stated that there are several gaps in studies on quality improvement work. There is a lack of a holistic framework which could guide the researcher to capture interactions between the many factors that are involved in improvement work. Therefore, it is essential that we develop improvement science into a strong discipline which would benefit from a more systematic use of theories in the planning and evaluation of quality improvement interventions (Grol et al. 2007).

In summary, QIC may be considered to be a temporary kind of learning organisation where teams from different organisations are brought together to work on improvement on a specific topic. Despite its widespread use, the effectiveness of QIC remains questioned (Hulscher et al. 2013, Nadeem et al. 2013). Against this backdrop, this thesis aims to contribute to improvement science, with respect to QICs in particular, by using quality registries as a source of valuable information.
Rationale for the thesis

As discussed above, there is a pressing need for effective and widespread improvement efforts which address quality and safety problems in healthcare. Quality improvement collaboratives (QICs) – introduced through the Breakthrough series model (BTM) – represent an approach that is often applied. QICs have been used in diverse contexts over the past 15-20 years. However, the value of the QIC approach is still questioned because it is resource-intensive and the results that are generated by this approach are divergent; sometimes they are very good and sometimes they are limited. Research in this area has not, so far, clearly shown when and how QIC works (Schouten et al. 2008, Nadeem et al. 2013, Hulscher et al. 2013). How registries, like the Swedish National Quality Registries, can be used to support QIC and thus contribute to improvement in healthcare also needs to be deeper examined. Organizational changes, together with the individual adaptation of knowledge, are needed to achieve optimal adherence to evidence-based guidelines. But again, further research is required to really understand and estimate the effectiveness of alternative strategies (Grimshaw et al. 2004), including how QICs can foster learning at the team level and at the organizational level (Weggelaar-Jansen et al. 2015). This thesis, therefore, addresses how QICs, by involving the use of NQRs, can help teams improve clinical quality.
Aims of the thesis

The overall aims of this thesis were to examine if and how Quality Improvement Collaboratives (QICs), supported by quality registries, can contribute to quality improvement in healthcare, and to examine how QICs differ between different types of care. A further aim was also to examine what learning and new understanding emerged in the application of QICs in these different settings.

Research questions

- What impact might a QIC supported by data from a national quality registry have on participants’ adherence to national guidelines and on clinical outcomes in an acute healthcare process, and how does such a QIC work? (Study I)

- What impact might a QIC supported by data from a national quality registry have on participants’ adherence to national guidelines and on clinical outcomes in a chronic disease, and how does such a QIC work? (Study II and Study III)

- How does a QIC relate to the participants’ learning and development of new understanding, and how might teams and team coaches enhance QICs in healthcare? (Study IV)
Method and design

Design

This thesis incorporates the results of four studies drawing on empirical data from three different Quality Improvement Collaboratives (QICs). These QIC involved teams from numerous hospital and primary care units in Sweden. The studies include quantitative registry data, and qualitative data regarding the conduct of the QICs. The thesis adopts an interactive research approach so as to enable learning for the researcher as well as for practitioners who may wish to partake of the results of the studies.

The interactive approach that was adopted in this thesis reflects a choice made by many contemporary researchers in their desire to become more closely involved in the research context and with the participants. This is a result of the researchers’ aim “to study with” rather than “to study about”. For example, Nowotny et al. (2001) discuss Mode-I and Mode-II as descriptions of two different models which can be adopted when undertaking research that is based on different epistemological beliefs. Mode-I represents the more traditional academic approach where the researcher searches for objective- and general knowledge in a long-term perspective. This knowledge is developed sequentially, by first generating new knowledge and then transferring it to practice. Consequently, however, it takes a long time for new knowledge to be utilized in practice. In our rapidly changing society with its increasing complexity, Nowotny et al. (2001), advocate that we adopt Mode-II knowledge, which is problem-based and multi-disciplinary. Here, learning, understanding, and changes that are relevant for both the researcher and the practice are intertwined and take place simultaneously (Aagaard Nielsen & Svensson 2006).

The interactive research approach

Interactive research has developed from action research (Coghlan & Brannick 2014). Action research was initially introduced by Kurt Lewin
who emphasized the practical benefits of research and created projects in real workplace settings (Gustavsen 2002). Action research is, as the name suggests, an approach to research that incorporates both action and the creation of knowledge and theories, at the same time. Action research is also always conducted in collaboration between a researcher and participants from the system that is being studied (Coghlan & Brannick 2014). Action research is performed in a cycle of four steps: constructing new ideas, planning action, taking action and evaluating action. In this type of approach to research there are multiple cycles, with each cycle operating in parallel. One cycle may be characterised as working and describing in relation to the aims of the project while another cycle may describe the steps in relation to how the action research project itself is progressing. This construct provides “learning about learning” (Coghlan & Brannick 2014). This structure, of parallel cycles, corresponds well with Ellström’s (2007) model of Knowledge Creation through Interactive Research, but there are also some differences in the approaches, for example, the nature of researcher’s interaction with the practice.

Interactive research is characterized as research with practitioners, not on practitioners or for practitioners. Interactive research is a continuous, joint learning, and problem-based process between participants (within an organization) and researchers. Furthermore, it includes continuous integration between research and practice (Svensson 2002a, Aagaard Nielsen & Svensson 2006, Larsson 2006). Common knowledge is created via collaborative inquiry as the researchers and participants generate research questions and analyze data together. The aim of such research is the creation of new knowledge that is both theoretically developed and practically useful (Aagaard Nielsen & Svensson 2006). In interactive research, the researcher also supports the development of healthcare and offers participants access to the theory of critical review, guidance, and reflection. Svensson (2002b) argues that development-oriented and interactive research needs an epistemological basis that appeals to pragmatism, i.e., the claim that knowledge is contained in action (experience) without any underlying theory and to critical realism that aims to explain basic conditions in society, (e.g., social mechanisms, patterns, structures, and regulatory systems). Svensson also argues that analysis and conclusions can be built on abduction. According to Svensson, (2002b: 179-180) refers to the process where “a
phenomenon is described in a new way (recontextualisation) when it is (in an abductive way) put in a new context. The logistics of abduction is built on creativity – to see a new context, to interpret the meaning, to perceive a new relationship, to explain relationships – to give new meaning to what is already known”. Interactive research provides opportunity for more equal participation when it comes to argumentation, analysis, and conclusions, which should facilitate the development of theory-building that employs abductive logic (Svensson 2002b).

Argyris and Schön (1996) examined the characteristics and behaviour of several researchers in an attempt to understand why some knowledge may exist but is not used in practice. In their research, they state the need for joint activities between researchers, consultants, and practitioners if scientific knowledge is to be understood and used. With this background in mind, an interactive design was found to be an appropriate approach for the studies incorporated in this thesis.

The interactive research approach in this thesis
The interactive research approach was created by forming a project management group for the Quality Improvement Collaboratives (QIC) with representatives from the NQR steering groups and subject experts together with quality improvement experts. Three different QICs were conducted with support from three different NQRs. Teams from hospitals and/or primary care units were invited to participate in the QIC. I was part of the planning and leadership group whilst I taught improvement knowledge during the learning sessions, i.e., I had a practical role in this process. The research was planned together with my supervisors and clinical researchers. My proximity to the QIC provided me with insight into the activities that took place in the empirical contexts that I studied.

The interactive approach in this thesis was inspired by Ellström’s (2007) model of Knowledge Creation through Interactive Research (Figure 5). The figure describes two knowledge cycles, a research system and a practice system, integrating with each other in parallel. The result of this interactive research approach produces common conceptualizations of the research object.
In this thesis, the interactions between the researcher, the registry-holder, the project-leader, and the practitioners in the different collaboratives have, in each cyclical process, increased our knowledge of how to design and implement a successful QIC, especially with respect to the identification of what is of importance to the QIC. The shared conceptualizations and interpretations of what was learned during the QIC created knowledge and fed back into the next cycle, in the research system and in the practice system.

![Figure 5. A Model of Knowledge Creation through Interactive Research (Ellström 2007).](image-url)

**The collaborative improvement methodology and design**

The methodology and design of the interventions that are reported on in this thesis was informed by a quality improvement collaborative (QIC) inspired by the Breakthrough series Model (BTM) (Kilo 1998, Wilson et al. 2003). This original model follows a structure which includes a number of learning sessions and follow-up meetings (Figure 6), in our case, during a period of 18 months. The design of the QICs is described below. Teams from hospitals and primary care units across Sweden taking care of patients with acute
myocardial infarction (Study I), adults with diabetes mellitus (Study II), and children and adolescents with diabetes mellitus (Study III and Study VI) were invited to participate in three different QIC.

Figure 6. A quality improvement collaborative with a number of learning sessions (LS) and follow-up meetings (FM) (Bojestig & Peterson 2007) with inspiration from the Breakthrough series Model (Kilo 1998, Wilson et al. 2003). Team coaching (used only in Study III and Study IV) was inspired by the model developed by Godfrey et al (2013).

Learning Session 1
At the first learning session, focus was placed on creating an increasing understanding of the need for improvement in healthcare. All of the participants were informed of the existence of the gap between what clinical research indicates as possible to achieve, and what is performed in everyday practice. At this initial seminar, the teams also clarified their project objectives, and established their own goals for the work that was to be done. The team used the 5Ps framework to analyse their own unit in terms of its purpose, patients, professionals, processes, and patterns (Nelson et al. 2007). The Clinical Value Compass was then used to identify what might constitute a balanced view of measurement in terms of clinical status, functional status, patient satisfaction, and costs (Nelson et al. 1996). The teams mapped their own patient processes with the use of flow-charts, which identified the sequential steps in a process (Nelson et al. 2007). To identify problem areas, the teams used the cause-and-effect diagram, first described by Ishikawa (Ishikawa 1976) and was thus called the ‘Ishikawa diagram’. These mappings were completed as one of the homework assignments for
this session. Other subjects that were addressed during this learning session included the importance of good team-work and good meeting skills.

**Learning Session 2**

During the second learning session, the teams participating in the QIC analysed the processes that they had previously identified, and they discussed the problems and improvement areas they found in the Ishikawa diagram, flow-charts, and baseline measurements that were provided to them. To decide where to start, the teams could use the ‘pareto principal’ (Deming 1986). The teams then started to work with the “model of improvement”, also called the “PDSA-cycle” (Langley et al. 2009), and they made an action plan for the particular improvement ideas they planned to start testing at home. During this learning session, the importance of measuring the improvement and the use of run-charts or control-charts was discussed (Carey 2003).

For the homework assignment for the next learning session the team members were asked to continue to work with planning, to prioritise the actions that they were to start with, and to start testing their ideas on a small scale before implementing them in their daily work.

The teams continued to follow the joint project measurements and submitted them to the project management group regularly. Between the learning sessions, the teams talked about their work and their proposals for change at home, in an attempt to garner support from their colleges and leaders.

**Learning Session 3**

At the third learning session, the teams shared their results and reported on the lessons that they had learnt so far. The sharing of ideas and results was an essential part of all of the learning sessions and was conducted in mixed groups. During this learning session, the teams analysed and reflected on the improvement work and the consequences it may have had on their daily work. They were also inspired to come up with new ideas by accessing a variety of known change concepts (Langley et al. 2009), for example, how to meet patient expectations, manage variation, change the work environment, and improve work flow.
Learning Session 4
During the fourth learning session, focus was placed on discussing the “psychology of change”, so as to deepen the participants’ understanding of why it can be difficult to change habits. This is considered to be an important part of profound knowledge, according to Deming (1994). Participants also planned how they would proceed with new ideas, to further improve their performance.

The basic design of each session was the same through all three QICs. In Study I, however, two different approaches were adopted. In this study, the team was randomly divided into two groups. Group A followed the structure of the sessions described above, but Group B only participated in two learning sessions and, instead, received support via the internet, using a web-based communication platform. The team received the necessary information and could communicate with both the project-leaders and with each other using the web-based platform.

Follow up meetings
For the first follow-up meeting, which took place about six months after the final learning session, the teams compiled an interim report. They discussed their results and shared ideas with each other about how to continue and how to sustain the results that they had achieved thus far. Six months later, there was a final follow-up meeting where the teams presented a final report and a poster with the results of their improvement work.

The sequence of events described in the QICs above differed from a traditional BTMs developed by the Institute of Healthcare Improvement in Boston (IHI) (2003). For example, the number of learning sessions was increased, and a long follow-up period and two follow-up meetings were added.

In a traditional BTM, faculty are recruited to identify appropriate aims, measurement strategies, and a list of evidence-based changes. In our QICs, we included the registry holder as a faculty member but the teams were also offered the possibility of identifying potential changes that they wanted to test themselves.
Team coaches
In all three collaboratives, one or two facilitators who supported the teams between the learning sessions were present. They helped the participants with the NQR, advised them on how to retrieve data and how to use different improvement tools. The contact with the facilitators was mainly through telephone calls or an occasional site visit. This was useful, but not sufficient for the progress of the improvement. In our last QIC, a team coach was therefore added, in the light of what had been learnt from previous research that had been conducted in the Bridging the Gaps project (Godfrey 2013) which showed increased success in QI when coaching was added. The coaching model that was inspired by the model developed by Godfrey et al. (2013) was introduced into the third collaborative (Study III and Study IV) (Figure 6). Each team selected one person to be the team coach who was then tasked to strengthen and support the team’s improvement work. The team coach received extra training and support before the program started, in a pre-phase. During the action phase and transition phase, the coaches were further supported so that they, in turn, could effectively support their teams at home. In addition, the team coach facilitated communication with the team’s department management so as to ensure that the work that they were doing received local support.

NQR used as measurement systems in the QIC
The measurements that were made in the three QICs were based on the indicators that are followed by three different NQRs; namely, the RIKS-HIA, NDR, and SWEDIABKIDS.

The National Quality Registry for Acute Cardiac Care (RIKS-HIA) started as a regional registry in 1991, and was further developed in 1995 to the status of a NQR. Since 2008, every hospital in Sweden has been part of this registry. RIKS-HIA’s registration is limited to actions taken during hospitalization as a result of a patient suffering from an acute myocardial infarction. For each patient, about 100 different indicators are registered in RIKS-HIA. Indicators include: examinations, medications, previous diseases and diagnosis, but also demographics and risk-factors. In 2008, four separate quality registries, including RIKS-HIA, in the area of coronary care were subsumed under one national quality registry, namely, SWEDEHEART. In
2014, well over 90% of target inpatients were registered in SWEDEHEART (SWEDEHEART). RIKS-HIA was used in Study I.

The National Diabetes Registry (NDR) was created in 1996 by the Swedish Association for Diabetology. In Sweden, about 4% of the population suffers from diabetes mellitus (National Diabetes Registry 2014). The NDR is used in both primary care and in departments of internal medicine. In 2014, approximately 360,000 patients with diabetes were registered in the NDR, including about 90% of all patients in Sweden with diabetes (based on an estimated diabetes prevalence of 4%). 90 departments of internal medicine and 1178 primary care units are listed in the registry (National Diabetes Registry 2014). In the NDR, we can find information, for example, on patient diagnosis, treatment, laboratory results, and about patient experiences of living with diabetes and healthcare quality. NDR was used in Study II.

The Swedish Paediatric Diabetes Quality Registry (SWEDIABKIDS) includes all patients with diabetes, younger than 18 years old, regardless of the type of diabetes suffered by the patient. Thus we can find information about patients who suffer from Type 1 diabetes, Type 2 diabetes, MODY (Maturity Onset Diabetes in the Young), secondary diabetes, and other less common forms of diabetes. All of the 43 paediatric diabetes clinics in Sweden send data to this registry. For 2014, data from almost 7000 patients were analysed. SWEDIABKIDS provides a unique opportunity for researchers and clinical practitioners to follow children with diabetes and compare results from different clinics, because this registry includes information about the total population of young diabetes sufferers. The registry shows a wide variation in the results of treatment and in the treatment options that are chosen (SWEDIABKIDS). SWEDIABKIDS was used in Study III and in Study IV.

In the different NQRs, the participants were able to extract their own data online and to follow the results of the improvement efforts. In RIKS-HIA, a special module, the QC-module, was built for the team so that they could follow special indicators for 10 or 20 patients at a time (for example, see Figure 7). The module made it possible to continuously follow the results of their improvement efforts through statistical process control (SPC).
Settings and participants

The participating teams in the different studies provided care for different patient groups and therefore different NQR were used in the studies (Table 1).

Study I presented an analysis of five different treatments for acute myocardial infarction (AMI). RIKS-HIA was used to follow the results of the treatments that were administered. All of the hospitals in Sweden that treated patients with AMI and used RIKS-HIA were invited to participate in the QIC. Twenty-one hospitals accepted the invitation, one hospital dropped out before the QIC started, and another closed during the study. The remaining 19 hospitals treated 3786 patients in total. A control-group of 19 hospitals was then selected from the remaining hospitals using RIKS-HIA. These control group hospitals were stratified (according to whether they had in-house angiography or not, and according to historical treatment levels) and matched to the intervention hospitals. The participating teams included doctors and nurses, with four people in each team, totalling 76 people. The nineteen teams who participated in the QIC were also randomly divided in
two groups. Group A met for four learning sessions during the first six months while group B met for just two learning sessions. Group B received additional support via an internet-based communication platform. During the follow up period, both groups received the same kind of support, for example, phone support and follow up meetings.

In Study II, an invitation to participate in the second QIC went out to all of the hospitals and primary care units in Sweden that used NDR. In total, 23 teams joined the project; 16 teams from primary care units (PCU) and seven teams from internal medicine departments (IMD). The sizes of the units varied. Participating PCUs had between 56 and 462 diabetes mellitus (DM) patients, while the IMDs had between 220 and 857 DM patients enrolled when the project started. In total, approximately 8100 patients were included in the study. At the baseline, patient characteristics were similar at units participating in QIC and non-QIC units in the NDR. Multidisciplinary teams of three to seven people (in total 92 team-members) participated in the QIC, including physicians, nurses, secretaries, physiotherapists, and dieticians.

In Study III and Study IV, all of the 43 paediatric diabetes departments in Sweden were invited to participate in the third QIC. Twelve departments accepted the invitation. In 2010, about 30% (2302/7660) of DM patients in Sweden were cared for at the participating clinics. The number of patients varied between departments, from 53 to 516. The teams contained between four to thirteen people, including physicians, nurses, secretaries, physiotherapists, and dieticians. In total, 80 people participated in this QIC.

In all of the three QICs, the membership of the teams remained the same throughout each QIC and the team members participated in all of the learning sessions, with a few exceptions; for example, when staff members changed jobs. In addition, colleagues and co-workers at the participating units were also involved in the improvement work.

**Research method and study design**

The present thesis consists of a compilation of articles and is thus divided into four sub-studies. Each of the studies employed different methods,
designs, and analysis to address different research questions. For an overview, see Table 1

**Table 1. Overview of study characteristics**

<table>
<thead>
<tr>
<th>Study</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Improving guideline adherence through intensive quality improvement and the use of a National Quality Registry in Sweden for acute myocardial infarction</td>
<td>Improvement of diabetes care using a national quality registry: design, successes, and challenges in a collaborative intervention</td>
<td>Improved results in paediatric diabetes care using a quality registry in an improvement collaborative: a case study in Sweden</td>
<td>Learning from a successful Quality Improvement Collaborative. Why did it work? – Experience from teams and team coaches who improved their care for children with diabetes</td>
</tr>
<tr>
<td>Quality registry used</td>
<td>RIKS-HIA</td>
<td>NDR</td>
<td>SWEDIKIDS</td>
<td>SWEDIKIDS</td>
</tr>
<tr>
<td>Study design</td>
<td>Controlled prospective Multicentre study</td>
<td>Case study Descriptive</td>
<td>Case study Descriptive</td>
<td>Case study Mixed method Sequential Explanatory</td>
</tr>
<tr>
<td>Study population</td>
<td>19 hospitals/76 team-members/3786 patients (2940 patients in the control-group)</td>
<td>7 PCU 16 hospitals/92 team-members/8160 patients</td>
<td>12 hospitals/80 team-members/2302 patients</td>
<td>12 teams / 12 team coaches</td>
</tr>
<tr>
<td>Method of data collection and analysis</td>
<td>Registry data Final reports Quantitative</td>
<td>Registry data Final reports Evaluations Qualitative</td>
<td>Registry data Final report Content analysis Quantitative</td>
<td>Focusgroup interviews Team exercises Inductive Content analysis</td>
</tr>
</tbody>
</table>

Study I was a controlled prospective, multicentre study. This design was chosen because the 19 hospitals included in the study were compared with an equal number of control hospitals.

In Study II, Study III, and Study IV, a case study design was used because the aim was primarily to answer questions with respect to *How is it done?* and *Why does it work?*. According to Yin (2009) a case study investigates a phenomenon within a real-life context. In a case study, the researcher uses multiple sources of data over time, through detailed, in-depth data collection.
A case study can have both a quantitative and qualitative approach, and can be explanatory, exploratory, and descriptive (Yin 2009, Creswell 2013).

A case study can include either a single case or multiple cases, depending on the purpose of the study. A single case study may provide knowledge about the complexity and uniqueness of a particular case (Stake 1994), and multiple cases may provide more compelling evidence (Yin 2009). To work with a case study demands an identification of the case (Creswell 2013). The specific case studies that are included in this thesis are defined as single case studies, because this approach is the preferred approach when a critical case is to be tested, and it makes it possible for the researcher to investigate deeper into the case’s complexity and uniqueness. Even though multiple centres participated in the program in the different studies, the specific case that is studied is the QIC itself.

In Study IV, a mixed method case study design was used. Mixed method is a research design that includes the collection of both qualitative and quantitative data in the one study. The data that is collected is integrated during the research process (Johnson & Onwuegbuzie 2004, Andrew & Halcomb 2009, Castro et al. 2010). There are several reasons for choosing a mixed method research design, according to Andrew and Halcomb (2009). They propose six primary reasons for this choice: confirmation, complementarity, initiation, development, expansion, and enhancement of significant findings. Several of these reasons were important to Study IV. For example, in this study, the qualitative data confirmed and complemented the quantitative results from SWEDIAKIDS, and thus enhanced the overall findings in the study.

Mixed methods can be classified into two major categories: *sequential* and *concurrent* (Creswell et al. 2003, Castro et al. 2010). In a concurrent mixed method design, the collection of both types of data are made at the same time, although one type of data often is given more weight (Kroll & Neri 2009). Sequential design, on the other hand, involves multiple phases of data collection where either the qualitative or quantitative data is collected at an initial stage, and the other type of data is collected at the next step. There are three types of sequential designs: *sequential exploratory*, where the quantitative data collection is followed by the qualitative data collection;
sequential explanatory, where the qualitative data collection is followed by the quantitative data collection; and sequential transformative, when a theoretical perspective is present (Creswell et al. 2003).

In Study IV, we used a sequential explanatory design. We collected the relevant quantitative data from the NQR and then we collected the qualitative data by conducting team exercises and focus-group interviews.

Data collection and analysis

The four studies that are included in this thesis include both qualitative and quantitative data. Study I, Study II, and Study III focus on data that was extracted from the NQR so as to evaluate the result(s) of the interventions. The teams’ final reports were used to identify the types of improvements that were made and the important lessons that had been learned.

Study IV addresses the question of: What was really happening during each intervention? A mixed methods research design was used (Creswell et al. 2003, Johnson & Onwuegbuzie 2004, Andrew & Halcomb 2009, Castro et al. 2010), which included interviewing focus groups and other interviews in combination with data that was extracted from the NQR. A mixed methods research design legitimates the use of multiple approaches in answering a research question.

Focus-group interviews were conducted as a means of collecting data for Study IV. Conducting focus-group interviews is a research technique where data is collected through group interaction. A focus-group refers to a group discussion arranged by a researcher. The group discussion can be structured to varying degrees by the researcher (Kitzinger 1994, Wibeck 2000, Kreuger & Casey 2009). Focus-group interviews were chosen partly because they worked in practice and within the time constraints of the study, but also because conducting such interviews is an appropriate method when participants in a specific group share similar thoughts about a phenomenon or have some experiences in common with each other (Wibeck 2000, Yin 2011). Another reason why one might choose focus-groups is that one might expect participants to express their opinions more freely when they are part
of a group (Yin 2011). A focus-group should not include less than four people and not more than six (Wibeck 2000), although, in some instances, some groups can range to as many as twelve participants (Kreuger & Casey 2009). The group has to be small enough for everyone to be able to express their opinion and large enough to ensure some diversity of opinion within the group (Kreuger & Casey 2009). Since twelve coaches participated in the study, it was decided that two groups of six were appropriate. A focus-group interview needs to have a moderator who can persuade the group members to express their opinions, but exert a minimum amount of control over the group (Kitzinger 1994). A moderator and an observer were selected to support the discussion in each focus-group. Neither the moderators nor the observers had met the coaches before or were involved in the improvement collaborative. The interview guide that was used by the moderator outlined broad, open-ended questions. The discussions in the focus-groups lasted for about 50-60 minutes and were digitally recorded and then transcribed verbatim.

For Study IV, data was also generated through an exercise that all of the team-members participated in. A printed manual for the exercise was handed out to all of the teams which instructed them how to use their responses to a question in a systematic manner. All of the teams were asked to write answers (both individually and jointly, as a team) on sticky notes to the following question: What do you perceive has affected your registry-based improvement efforts and contributed to the results that you have achieved in this project? Each team was directed to post their notes on a whiteboard or a wall with brown paper where the team members could move their notes around, and categorize them. The teams then prioritized the notes that they thought detailed the most important contributions. The results were analysed and merged into different themes with respect to what the team members thought facilitated the QI work, and in terms of the obstacles that the team members felt that they had faced in this work.

Quantitative data analysis

The quality indicators that were used in the evaluation of the different QICs were obtained from the three NQRs: RIKS-HIA, NDR, and SWEDIAKIDS.
The data primarily consisted of pre- and post-intervention data and were compared within each registry. This was compared with a control-group (Study I), or with the mean of the data obtained from the rest of the reporting units in the country (Study II and Study III).

In Study I, five quality indicators which represented different treatments in the acute phase of an acute myocardial infarction (AMI) were studied. “Target patients” were identified as patients with indications for all five treatments. Data was measured at a baseline before the project started and after the completion of the intervention. The indicators that were chosen for the project were treatments that had been recommended in national- and international guidelines (Braunwald et al. 2002). Four treatments were well-established indicators, whilst the fifth medication, Clopidogrel, was, at the time of the study, a newly recommended treatment.

The level of quality in care delivery that was used in the first study was measured as the proportion of the target patients (out of the total number of eligible patients) who received the treatment at discharge from hospital, or who received the treatment or diagnostic procedure during hospitalization after an AIM. The following quality indicators were tracked in this population:

- ACE-inhibitor at discharge
- Lipid-lowering therapy at discharge
- Clopidogrel at discharge
- Heparin or LMWH during hospitalization
- Performed coronary angiography

Baseline measurements for the intervention hospitals as well as for the control groups were drawn retrospectively from RIKS-HIA. The level of adherence to treatments that follow the national guidelines was evaluated for all patients younger than 80 years who received a discharge diagnosis of AMI. The goal for the teams participating in the QIC was that 90% of the target patients should get treatment according to guideline.

In Study II, data on quality indicators from NDR was collected for Glycosulalated Haemoglobin A1c (HbA1c), blood pressure (BP), and Cholesterol bound to Low Density Lipoproteins (LDL), thereby mirroring
key areas in the national guidelines (The National Board of Health and Welfare) for DM care, which are informed by the use of descriptive statistics over time, stratified by participating healthcare provider units. \(HbA1c\) refers to ‘glycated haemoglobin’ and gives an overall picture of the patient’s average blood glucose level over a period of time. The patients were divided into three groups: patients with DM type 2 who were treated at PCUs (QI-PCU type 2), patients with DM type 1 who were treated at IMDs (QI-IMD type 1), and patients with DM type 2 who were treated at IMDs (QI-IMD type 2). Aggregated data from all of the units in these groups was analyzed in the study. Data from the participating teams’ patients was compared with the NDR national average for the quality indicators, for the same patient groups during the same time periods, so as to control for any secular trends. The patients were followed over three time periods. Period 1 was defined as the patient’s first visit after the start of the QIC. Period 2 was defined as the time when the last value in the QIC period was entered, and Period 3 the last value that was entered in the long time follow up, up to 1 year after the QIC had ended.

An analysis was also made of the two IMDs team and the three PCUs team with the best improvements in \(HbA1c\) to find common improvement areas.

In Study III and Study IV, the main result was the quality indicator, \(HbA1c\). Other quality measures such as severe hypoglycaemia, and ketoacidosis, together with process measures such as the documentation of smoking habits and the degree of physical activity, were also followed by the teams. One main target defined by the participating teams was to increase the proportion of patients with \(HbA1c < 57 \text{ mmol/mol}\). since this measure is known from previous research to be linked to long term diabetes complications (The Diabetes Control and Complications Trial Research Group 1993).

**Qualitative data analysis**

Content analysis is a systematic and objective way to describe and quantify phenomena (Down-Wambold 1992, Krippendorff 2013). According to Krippendorf (2013: 24) “content analysis is a research technique for making replicable and valid inferences from text (or other meaningful matter) to the context of their use”. Reasons for using content analysis are, for example,
that it is context sensitive in the sense that it allows the researcher to process texts that are significant, meaningful, informative and representational to others, and that it can cope with large volumes of data (Krippendorff 2013). In Study II and Study III, a content analysis of the team’s final reports were made according to Graneheim och Lundman (2004) because of the structured way of using the method for analysing documents. In Study IV, a qualitative inductive content analysis, according to Elo and Kyngäs (2008), was conducted on the transcription of the focus-groups’ interviews. This method was chosen because the method supported a structured method of analysis in the whole analysis process, and divided it in three main phases: preparation, organizing, and reporting.

In Study I, Study II, and Study III, data was collected from the texts that constituted the teams’ final reports. The texts were condensed into meaning units and then abstracted into themes, so as to identify and summarize the number of change concepts that were associated with success in the QIC.

The analysis of the material generated by the focus-group interviews in Study IV was made during the three main phases mentioned above (Elo & Kyngas 2008). In the first phase, the transcribed texts were read through several times by the author, so as to familiarise myself with the data. Meaning units that contained information that were connected to the purpose of the study were highlighted in the text. The units of meaning may have consisted of one or more sentences, or just a part of a sentence. In the next step, the organizing of the qualitative data started. The texts were read through again and codes, notes, and headings linked to the purpose of the study were written in the margin. The meaning units and codes were entered into an Excel spreadsheet and categorised. In the next step, the categories that were similar to each other were grouped into broader, higher order categories. In the final step, these categories were merged into three main categories.

The results of the team-exercises were analysed and themed into different categories with respect to what the teams had prioritized as being the most important facilitating actions for success and the most important obstacles to success in the improvement efforts.
Ethical considerations

There are a number of important ethical guidelines and regulations for researchers to consider who conduct research that involves human beings (CODEX). The declaration of Helsinki (WMA Declaration of Helsinki 2004), established the foundation for ethical research projects worldwide. This declaration emphasizes the importance of independent review of the research, respect for the individual, and informed consent. Another contribution to ethical research is the Principles of Biomedical Ethics which states four ethical principles: respect for autonomy, beneficence, non-maleficence, and justice (Beauchamp and Childress 2001). These ethical principles are of importance to all research.

According to Swedish law, ethical approval is needed for studies which include sensitive personal data or when the study involves a physical or mental intervention by a research person. The phenomenon that is studied in this thesis is the connection between quality registries and quality improvement work. The study thus lies on an organizational level, and is concerned with what happens in quality improvement collaboratives and how national quality registries can contribute to improving the quality in the provision of healthcare. This study is not concerned with the treatment of individual patients.

A guide to ethics in research that was developed by the School of Health Sciences’ Ethics Committee in Jönköping, Sweden (2012), states that improvement work is not research that needs to undergo an ethical review from a regional ethical review board. There is, however, an ongoing discussion of how the ethical issues of using quality improvement methods in healthcare should be managed, and thus there is a need for clarification of this issue (Lynn et al. 2007).

I made efforts to conduct the research that is included in this thesis according to the above-mentioned ethical principles, and I have followed the Swedish law on ethical approval concerning research on humans (2003:460). Study I was approved by the Ethical Committee of Uppsala. For Study II, an ethical application was submitted to the Ethical Committee of Gothenburg (Dnr 300-08) which concluded that this research was not subject to the law on
ethical review. This committee left an advisory statement, stating that they had no objections to the research.

Notwithstanding the responses from the ethical committees mentioned above, ethical principles were considered and discussed with the various participants in each of the studies. The teams were informed that a researcher should follow the research program from the point of registration to the quality improvement collaborative. Written consent from the responsible manager was required to join the program. All of the information about the patients consisted of data that was routinely collected at regular visits with physicians or nurses and consisted of the data that was usually registered in the NQR. No additional data, investigations, treatments, or visits were conducted to collect data for the studies. The NQR has to follow the law on the treatment of data concerning individuals (The Swedish Data Protection Authority). Patients are informed by the caregiver that participation in the NQR entails that research may be carried out on the data, but that it is also voluntary to participate in the NQR. Because of this, for studies that refer to data that appears in the NQR and involve already-established treatments and are only aimed changing work practices and procedures, consent is not required from each patient. All of the clinical data that was analyzed in this thesis was made completely anonymous and aggregated to the group level. Statisticians linked to the registries or the teams themselves received the data from the NQR in an anonymized form and on the group level, which made it impossible for them to derive the identity of specific patients. Data from the teams’ final reports was analyzed qualitatively using content analysis and was not expected to contain any sensitive information, but notwithstanding this, only the summary of the changes that teams performed was used.

The last study that was conducted used focus-group interviews with the team coaches, and a group-exercise with the teams at the final seminar. Additional information about the focus-group interviews and the group-exercise with the teams was given at the penultimate follow-up meeting and was included in the invitation to the last follow-up meeting. The information contained the purpose of the study and the fact that participation was voluntary. The team coaches had to give their consent to participate in the focus-groups interview. The materials that were collected from the group activity, the material on tape, and the transcribed material from the focus-group
interviews were handled confidentially and secured in a way that no unauthorized person could gain access to the material.

The potential benefit to the patients and the individual teams that were involved in this research was the proposed improvement of procedures and working methods, so that patients might receive the treatment they should receive, according to national guidelines. The purposes of the study were also to develop a model of how NQRs can be used in systematic improvement work and ensure adherence to guidelines in more treatment areas; and demonstrate a better use of the data that is included in the NQR, and also improve the use of tax-money and resources spent on feeding data into quality registries. Since no new treatments or medications were tested in these studies, it was deemed that no risk to individual patients existed. A risk could still have been that the focus on one specific patient group may have resulted in other patient groups not receiving the same medical attention. This risk was considered to be small and the benefits compensated for the possible risks. The participating teams benefited from the studies because they were provided with the opportunity to improve their procedures and working methods for the selected patient groups, which also may have led to improved satisfaction in their work. On the other hand, working with improvements of their daily activities and changes in their habitual work practices and procedures may have be experienced as stressful for the staff, and these activities may have taken time away from patient care. However, during the QICs, the teams received support so that they could discuss and deal with these issues. Consequently, the benefits enjoyed by the participants compensated for the risks that they took.

**My role as an interactive researcher**

Helgesson (2006) highlights several factors that are important to ensuring objectivity in research projects. These include a number of important ethical aspects that the researcher should take into account in an interactive research approach where the researcher a pre-understanding of the object of study and actively participates in parts of the work which is being studied. It is important for the researcher to conduct research with an awareness and openness that makes it possible for the reader to follow the research process
and understand the choices that were made. Other ethical aspects that the
researcher should consider are the researcher’s trustworthiness with respect
to keeping confidentiality during the research process and the researcher’s
ability of preserving impartiality (Westlander 2006). One issue that
confronts the interactive researcher is the problem of finding the balance
between scientific interest and the need to practically support practice.
Interactive research can capture many aspects of what really is happening
during the improvement work and contribute to the development of the
work, but it requires an additional ethical consideration that takes into
account the researcher’s more active role (Paoletti 2014).

I have been working with quality improvement in health care for many years
and I have been part of several QICs. My role in these QICs was to organize
the learning sessions and to educate the teams in improvement knowledge.
My role as a researcher with close involvement in the QICs that form the
basis for the studies that are included in this thesis has been perceived as
something positive, because of my pre-understanding of working with
quality improvement. Westlander (2006) argues that researchers with
experience from previous quality improvement work can contribute to a
deeper understanding of improvement efforts. Meanwhile, ethical
considerations were made to ensure both participation and transparency,
while respecting the team’s autonomy and confidentiality.

To maintain a proper distance between the research and practice in the
interactive research, the researcher performed a number of different actions:

- The statistical data from the NQR was harvested by the teams
  themselves or by a statistician from the NQR. The results were
  presented to me, as the researcher, on an aggregated group level.
- The focus-group interviews were performed by an outside moderator
  and an observer. Neither the moderators nor the observers had met
  the team coaches before or had been previously involved in the QIC.
- Although I, as a researcher, compiled, analyzed, and interpreted the
data from the focus-group interviews, team exercises, and the teams’
  final reports, the credibility of the results were further strengthened
  through validation by other researchers in our team.
By using the mixed methods design, a triangulation of the results was made which made it possible to validate the different designs and findings within the project. Validity and trustworthiness are discussed further under ‘Methodical considerations’.
Findings

This thesis addresses whether and how three different QICs which were supported by national quality registries (NQRs) could contribute to the improvement of quality in the provision of healthcare. Overall, the results in Study I showed that it was possible to improve the quality of care in the acute process of AMI. Study II showed that in a chronic disease, other factors, such as more active patients were required to fully succeed in reaching the project’s goals. Study III demonstrated that it was possible to improve clinical results with respect to chronic diseases, but that specific actions and support were required to do so. Study IV presented a number of different aspects of learning and understanding that are needed for a QIC to succeed.

Quality improvement in an acute process
(Study I)

The aim of Study I was to evaluate the effects of applying a multidisciplinary team-based QIC to the use of evidence-based treatment and diagnostic procedures in the acute process of AMI, together with the use of a modified NQR.

Nineteen teams participated in the program. These teams were randomly divided into two groups, Group A and Group B. These groups were offered a different number of learning sessions. The two groups showed no differences with respect to the overall results of the study, and, consequently, the results of this study were presented for the whole group of 19 teams.

The results from the teams were compared with a matched control group that included the target patients for the specified range of treatments or diagnostic procedures. 3786 AMI patients aged less than 80 years were cared for at hospital, and 2940 AMI patients were cared for in the control group. At baseline there were no significant differences in adherence to the
treatments between the intervention group and the control group. The results showed a significant improvement in four out of five treatments/diagnostic procedures. The fifth treatment (Lipid lowering) was already at a high level, so the improvement potential in this area was quite small. After the QIC was completed, there was a significant improvement in how the 19 hospitals which were included in the QIC had closed the baseline gap (to the goal of 90% adherence to guideline), compared with the 19 hospitals that were included in the control group.

Another important result in the study was the fact that the patients in the target group should have received all five treatments to be ‘well treated’ according to the national guidelines. In the intervention group, 10 out of 19 teams closed the gap by at least 50% simultaneously for 4/5 intervention targets; 5 teams closed the gap by at least 50% for 5/5 intervention targets. No team in the control group closed the gap by at least 50% for either 4/5 or 5/5 intervention targets.

The overall result of the study showed that, with systematic improvement work, it is possible to improve a care provider’s adherence to national guidelines. The QIC was developed during the time of the project and adapted to the conditions of the AMI. The national registry (RIKS-HIA) was also improved with the addition of the new QC-module which enabled the continuous monitoring of the teams’ own data.

The teams made different changes in their organisations so as to be able to achieve their goals. These changes included, for example, changing the way that they used the registry, providing information and education to staff members and patients, developing checklists and protocols that were used to follow the guidelines, and following up on results regularly. Another special change that was made by some of the teams was the creation of a pre-printed list containing the names of all of the medications that patients might potentially receive. The physicians had to actively de-select a medication if a specific patient was not to receive the medication. This was a simple way to ensure that the patients received all of the medications that they should receive.

The overall findings show that this method works for the development and improvement of an acute process, to get treatments and procedures in place.
Quality improvement in diabetes care for adults (Study II)

The QICs in Study II were presented and conducted in a manner that followed the same structure as described above for Study I. What was different was that the teams in Study II were working with a chronic disease, diabetes mellitus (DM), instead of the acute process described in Study I. The national registry for DM care for adults, NDR, was used. For these chronic patients, care included regular visits to physicians and nurses, and self-care. Another difference, compared to the AMI QIC, was that Study II involved outcome measures, such as HbA1c, instead of process measures. Study II involved both primary care units and departments of internal medicine.

Indicators from NDR for Study II were analyzed over time by participating healthcare provider units. Patients were divided into three groups: DM type 2 patients who were treated at Primary Care Units (QI-PCU type 2), DM type 1 patients who were treated at Internal Medical Departments (QI-IMD type 1), and DM type 2 patients who were treated at Internal Medical Departments (QI-IMD type 2). Data from the QIC teams’ patients were compared with the national average for the same patient groups. The indicators that were followed in the project, HbA1c, blood pressure, and LDL-cholesterol were selected from areas that were highlighted in the national guidelines as important in DM care.

Study II showed improvements for the whole group in terms of blood pressure and in LDL-cholesterol levels, but no effects on HbA1c were observed. For the individual teams, a variation in the improvements was observed, and some of the teams also improved in terms of HbA1c.

Although all of the primary care teams improved all of their results during the project, as seen in the long-term follow up period, they experienced problems in maintaining their results or continuing to improve. For the IMD teams, the results with respect to LDL-cholesterol and blood pressure (QI-IMD type-2) continued to improve in the long-term follow up period, which may indicate that they had implemented successful mechanisms for change.
and that they had integrated these changes into their regular work so as to achieve long-term results.

A post-hoc analysis was undertaken of the changes that were made among the two QI-IMDs and the three QI-PCUs whose patients exhibited the greatest improvements with respect to HbA1c and blood pressure. This analysis was performed in an attempt to identify changes that were unique to these teams (Table 2).

Table 2. Changes made among the two QI-IMDs and the three QI-PCUs whose patients exhibited the greatest improvements in HbA1c and blood pressure

<table>
<thead>
<tr>
<th>The teams that improved the most</th>
<th>Indicator</th>
<th>Common changes</th>
</tr>
</thead>
</table>
| Two QI-IMD teams                 | HbA1c     | - actively gave their patients information and discussed target levels of HbA1c with them  
|                                  |           | - improved their HbA1c testing procedure so that results were available at patients’ visits  
|                                  | Blood pressure | - used the “diabetes profile”, a printed copy of each patient’s values was given to the patient at the visit, to discuss at appointments  
|                                  |           | - used documented action plans and individual targets for their patients  
| Three QI-PCU teams               | HbA1c     | - changed their way of using the NDR (e.g. on-line registration together with patients, regularly followed up on their own results and discussed them in the team)  
|                                  |           | - sent an information letter to patients before visits to help patients prepare  
|                                  | Blood pressure | - used information letters that were sent to their patients, which focused on lifestyle issues (e.g., diet, physical activity, and smoking habits)  
|                                  |           | - emphasized the importance of teamwork (e.g., they met regularly and discussed their NDR data so that team members would be able to quickly act on them)  

The case study design that was used in this study made it possible to identify improvements from different sources. A number of different success factors from the teams were identified in Study II:

- Teamwork, getting everyone involved. In the primary care teams, teamwork highlighted the need for other team-members,
particularly nurses, to step in if there were not enough physicians available.

- Review their own data iteratively over time
- Analyze and reflect over the results
- Make changes in the work process, test a lot of ideas
- Learn from others
- A structured improvement program and facilitation helps
- Leaders help by showing interest and asking for results

Quality improvement in diabetes care for children and adolescents (Study III)

Study III reported on a national QIC that was supported by SWEDIABKIDS, the NQR for children and adolescents. It involved teams from a number of paediatric departments and included an analysis of both outcome measures and process measures.

Study III had the same structure as the previous two studies, with teams participating in a QIC. What was different in this study was that the teams nominated a team member to be the internal team coach. The team coach received training in quality improvement tools before the program started, and was given an assignment in the preparation phase, implementation phase, and delivery phase of the project.

Table 3. Results from the SWEDIAKIDS-QIC.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>2032</td>
<td>2004</td>
<td>2119</td>
</tr>
<tr>
<td>Mean age</td>
<td>13 ± 4,1 years</td>
<td>13 ± 4,1 years</td>
<td>13 ± 4,1 years</td>
</tr>
<tr>
<td>Males</td>
<td>53%</td>
<td>53%</td>
<td>53%</td>
</tr>
<tr>
<td>Mean HbA1c &lt;57 mmol/mol</td>
<td>31,4%</td>
<td>35,5%</td>
<td>41,1%</td>
</tr>
<tr>
<td></td>
<td>(p&lt;0·05)</td>
<td>(p&lt;0·01)</td>
<td></td>
</tr>
<tr>
<td>HbA1c CIQ-team Improvement between period 1-2 and 1-3</td>
<td>&gt; 1,8 mmol/mol (63,9–62,1 mmol/mol) (p&lt;0,01)</td>
<td>3,7 mmol/mol (63,9–60,2 mmol/mol) (p&lt;0,01)</td>
<td></td>
</tr>
<tr>
<td>Hba1c non-QIC Improvement between period 1-2 and 1-3</td>
<td>0,9 mmol/mol (64,0 – 63,1 mmol/mol) (p&lt;0,01)</td>
<td>1,7 mmol/mol (64,0 – 62,3 mmol/mol)</td>
<td></td>
</tr>
</tbody>
</table>
In contrast to Study II, this study demonstrated excellent results with respect to HbA1c among all of the participating teams (Table 3).

Compared to other centres in Sweden, (which taken as a group also improved), the improvements for the QIC teams were larger. However, other results (process measures) were followed by the QIC teams during the program. Many of the centres achieved the goal of reducing the frequency of severe hypoglycaemia and/or ketoacidosis (range 0.6 % - 4.8 %) and only two centres increased the frequency of these events (0.9 % and 1.4 %, respectively). Five of the centres attained the goal of ensuring that all their patients participated in some kind of physical activity of more than 30 minutes duration at least once weekly.

The specific themes of the actions that were taken by the teams were information, including communication inside the unit but also educational communication directed towards patients and staff, the creation and distribution of guidelines specific to newly-debuted DM or patients with high HbA1c, appointment planning and access, including individualized planning, health-promoting activities, and improved use of the NQR and teamwork.

What actually works in quality improvement?
(Study IV)

In Study IV, the aim of the project was to investigate key components in learning and to develop a new understanding of what contributes to the success of a QIC. In addition, how teams and team coaches can enhance QICs in healthcare was also investigated.

The findings in Study IV describe the findings from both the actual results with respect to HbA1c, but also experiences shared by the teams and the team coaches with respect to what they considered to be of importance to their learning and understanding of what contributed to their success in a QIC. Note that the results with respect to HbA1c (also described in Study III) showed significant improvements in Period 2 and Period 3 of the intervention, compared with Period 1 for the whole group.
The main findings from the exercise where the teams used post-it notes (to record what had affected the registry-based improvement efforts and contributed to the result) showed that there are some common themes that are important for success, but also some obstacles for success in a QIC. For example, eleven out of twelve teams prioritized ‘engagement in the team’ and ‘the structure of the QIC’ as important factors for success. Eight teams had prioritized ‘support from a team coach in the team’ and ‘having the time for improvement work’ as important. ‘Management support’ and ‘having clear goals’ were also deemed important. The obstacles that were referred to included ‘a lack of motivation in the whole team’, and that ‘the time to work with the improvements was not enough’. The team members also reported on experiencing ‘problems with the registry’ and ‘how one was to extract statistical information from the registry’.

The findings from the team-exercise were mostly confirmed by the interviews in the focus-groups with the team coaches (presented in Table 4). In the analysis of the focus-group interviews, we found that learning and understanding within the organization, learning and commitment within the team, and learning about and understanding the structure of improvement knowledge were deemed important factors for the teams’ success in the QIC.

Table 4. Example of findings from interviews with team coaches

<table>
<thead>
<tr>
<th>Main-category</th>
<th>Generic-category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning and understanding within the organizational context</td>
<td>Changes in the organization</td>
</tr>
<tr>
<td></td>
<td>Diffusion of knowledge</td>
</tr>
<tr>
<td></td>
<td>Leadership support</td>
</tr>
<tr>
<td>Learning and commitment within the team</td>
<td>Everyone participates in the team’s efforts</td>
</tr>
<tr>
<td></td>
<td>Shared responsibility</td>
</tr>
<tr>
<td></td>
<td>Continued commitment</td>
</tr>
<tr>
<td>Learning about and understanding the structure of improvement knowledge</td>
<td>Learning how to use improvement tools</td>
</tr>
<tr>
<td></td>
<td>Understanding of role of the team coach</td>
</tr>
<tr>
<td></td>
<td>Changes in working routines</td>
</tr>
<tr>
<td></td>
<td>Learning from each other</td>
</tr>
<tr>
<td></td>
<td>Time for improvement work</td>
</tr>
<tr>
<td></td>
<td>Evaluation and monitoring the improvements</td>
</tr>
</tbody>
</table>
In the focus-group interviews, the team coaches reported that ‘learning and understanding within the organizational context’ were important factors for success. This involved sharing a common picture of the context, getting support from leaders and acceptance from the rest of the department. This was sometimes expressed as being crucial to work proceeding in a QIC project.

Another factor that was identified by the team coaches was ‘the diffusion of knowledge’ with respect to the concept of quality improvement to other parts of the organization. Other staff members became interested in their work and wanted to do the same for another patient-group. The diffusion of knowledge to other parts of the department, for example, to the inpatient units was also important to establishing a common way to work with patients. As the other staff members saw the benefits of the QIC, it became easier to spread ideas about how such improvement work is performed.

A problem that emerged in the organization of the QICs was staff-turnover. The QIC persisted for 18 months, and during this time there were a number of staff members who changed work. In some teams, this was a major problem, but if part of the team’s membership remained stable, then the team members still managed to keep up the improvement work.

The second main category that was identified by the team coach focus-group was the importance of ‘learning and commitment within the team’. The team coaches pointed out the importance of everyone participating in the team’s efforts, not just at the learning sessions but also at home. The team coaches also claimed that everyone had a responsibility to be part in testing different changes. For some teams who had to travel some distance to attend the learning sessions, they found that the learning and the level of commitment to the team benefitted from this, because of the time they got to talk with each other and get to know each other. They felt that the journey time provided them with the time to work on and plan for the different changes they were going to test more in detail.

At the last learning session, when the focus group interviews took place, the need of ‘continued commitment’ was discussed. The teams felt that they were not finished with the QIC; they felt that they needed to move on and continue with the improvement work and keep up the good results.
The final main category that was identified was the ‘learning about and understanding the structure of improvement knowledge’. This was the category that was discussed at most length, and it was noted that it contained six generic categories.

A category that was seen both as a success factor and also an obstacle was the ‘learning how to use improvement tools’. The team coaches recognised the benefit of using the systematic tools but felt that it was a lot to take in and learn in the beginning. Some tools were identified as being more useful than others, for example, the Ishikawa diagram and the PDSA-cycle.

The team coaches also discussed the ‘understanding the role of the team coach’. They felt they had been accepted as a team coach and that they had kept the improvement work on track in many ways. They wished they had received some more education or support from the project leader, even though they felt that the ‘coach lunches’ and phone-meetings in between the learning-sessions were useful. They also felt that the role as a coach had helped them to grow on an individual level, for example, as a leader.

Important to improvement work were the actual ‘changes in the working routines’ and the coaches gave several examples of what they had changed and how they had implemented these changes. They discussed the importance of being able to test different ideas, and they reported that they had learnt that they do not need to hesitate in rejecting an idea if it did not work as they wanted it to work.

‘Learning from each other’ and sharing ideas were two of the benefits that were discussed in the QIC. The team coaches pointed out that sitting in mixed groups and discussing in detail which ideas they had tested at their home clinic was the most effective way of obtaining new ideas. The learning and sharing between the teams also resulted in quite similar action plans being adopted by the different teams.

Another important issue for the team coaches was the possibility of ‘getting enough time for improvement work’. A benefit of going away from one’s place of work and travelling some distance to the learning sessions was that they participants had the time and the whole team’s attention in working
with the QIC. During the journeys to the learning sessions, there were no distractions.

The final category in Study IV was the importance of ‘evaluating and monitoring the improvements efforts’. Since the teams used a national quality registry to support and follow their work, it was an important tool to work with. Many of the team members had to revise their routines for using the NQR. Some teams also started to use the registry more actively in their practical work, together with their young patients and parents, to follow individual results. But all the teams had to learn how to extract their own data from the registry and how to follow this data over time. Some teams struggled with how to extract their own data, though this could be done in different ways and the results, therefore, could look different. However, the team coaches claimed that it was essential to regularly look at the data and discuss it with the team.

The overall findings of the studies

The overall aim of this thesis was also to examine what learning and new understanding occurred in the application of QICs in different settings. Taken together, the four studies that are included in this thesis show that participation in a systematic QIC which employs the support of a quality registry can enhance adherence to guidelines and improve clinical results in healthcare, for both acute processes and chronic diseases. However, the results of the various studies also show that there were different challenges to the three collaboratives, which indicates that differences in the organizational context, in the character of the care, or what kind of indicators are being followed can influence the QICs and participating teams’ results. The interactive approach that was used in this research project has helped the researcher to harness insights from the different QICs and use this learning in a developmental way. Thus, the QIC in study III builds on the learning from the QIC design in study II, which used the learning and experience from the QIC design in study I. These insights are presented in Table 5 and are further illustrated in Figure 8.
Table 5. The interactive research approach with learning during and after each QIC – with reference to the conceptualization and interpretation of each research objective brought forward into the next QIC design

<table>
<thead>
<tr>
<th>QIC I</th>
<th>QIC II</th>
<th>QIC III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improvement area for the QIC</strong></td>
<td>Improving acute process – AMI</td>
<td>Improving chronic diseases – DM type 1 and DM type 2 in adults</td>
</tr>
<tr>
<td><strong>NQR</strong></td>
<td>RIKS-HIA</td>
<td>NDR</td>
</tr>
<tr>
<td><strong>Indicators</strong></td>
<td>5 different treatments/tests</td>
<td>HbA1c, BP, LDL</td>
</tr>
<tr>
<td><strong>Team</strong></td>
<td>19 teams – 4 people in each team</td>
<td>23 teams – between 2 and 8 people. No restriction on the number of participants</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td>2 facilitators (divided across Group A and Group B)</td>
<td>1 facilitator supporting 23 teams</td>
</tr>
<tr>
<td></td>
<td>Extranet to support 10 teams in group B</td>
<td>No extranet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Examples of Learning in the Practice System**

<table>
<thead>
<tr>
<th>Pre-collaborative preparation</th>
<th>Learning from each other</th>
<th>Measurement and NQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No special preparation before start</td>
<td>Time for chairing ideas between the groups</td>
<td>Start to look at the data in NQR. The use of the time-series diagram. Special QC module.</td>
</tr>
<tr>
<td>Visit from facilitator to secure the use of NDR</td>
<td>Mixed group discussions</td>
<td>Secure input data in the NQR. The use of the time-series diagram.</td>
</tr>
<tr>
<td>Team coach preparation phase</td>
<td>Mixed group discussion, but also for different professions</td>
<td>Secure input data in the NQR. For each change put it in the time-series diagram</td>
</tr>
</tbody>
</table>

**Examples of Learning in the Research System**

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Study I involved process measures taken from only one acute care episode, while in Study II and Study III, outcome measures were followed over time for a group of patients. In Study I, the improvements were statistically significant for the group in total. In Study II, the results showed improvement in BP and LDL, but were limited for HbA1c for the group in total, although there were individual teams who improved. In Study III, the whole group improved. In Study I and Study III, only hospital teams were included in the studies, while in Study II there were a mix with primary care units and hospital teams.

The results of the studies also showed that the quality registries were a useful tool for monitoring the measurement and result of the improvement efforts, but the differences in the structure of the three registries also appeared to be a challenge for the teams, in terms of how they were to retrieve data from the registry and how they were to use the registry together with patients. The teams also experienced the problem with registering the data when it is not possible to directly transfer data from the medical record to the NQRs.

One of the main findings of the studies is that a QIC makes it possible to share ideas and concepts between teams. A QIC creates time for the team members to get to know each other and it provides them with the opportunity to learn and understand improvement knowledge.

Study III and Study IV indicate the benefit of having an internal team coach to facilitate the work, for example, in supporting the use of improvement tools and in structuring the work. Being a team coach also lead to personal growth, and some of the coaches discussed how they might continue in a leadership role, in one way or another.

Other common success factors that were captured in the final reports included clear goals, testing many ideas, learning from others, reviewing data over time, analysing and reflecting over the data, management support, and holding regular meetings at home.

Some of the things that were learnt from the QIC in Study I were used in the redesign of the QIC in Study II. For example, these included the need to ensure that the data contained in NQR was properly registered and how one might retrieve data from the NQR and analyze this data. Therefore, in the
second QIC, the facilitator visited the teams before the first learning session and taught the teams how to use the NQR. For the QIC that was used in Study III, this was further developed in what was called ‘the pre phase’. Furthermore, from the QICs in Study I and Study II, participants learned about the difference between using process measures compared to outcome measures. Consequently, the design of the third QIC contained both process measures and outcome measures.

The lessons learnt from the use of facilitators in Study I and Study II, in combination with knowledge gained from other research (Godfrey 2013), resulted in the team coaching model that was used in the third QIC.

Triangulation with different data sources that complement the quantitative and qualitative results of each of the separate studies that are included in this thesis increases the explanatory power of the findings.
Discussion

Sometimes new scientific findings, best practice or clinical guidelines are easily implemented in practice. Most of the time, however, improving patient care is not easy, particularly if an innovation requires complex changes in clinical routines, better collaboration among disciplines, changes in patients’ behavior, or changes in the organization of care.

Grol et al. (2007)

The research in this thesis lies in the field of improvement science, which is a young academic field that includes a wide range of initiatives to better understand the use of quality improvement (QI) philosophy and methods to improve care. The thesis complements and adds new understanding of previous research by highlighting how one might bridge the gaps between what we know from research and what is actually practiced in healthcare with quality improvement initiatives, and why and how QI initiatives seem to work or not.

The empirical data used in this thesis was based on three different Quality Improvement Collaboratives (QICs) that focused on both an acute healthcare process and a chronic disease. Improvement knowledge is based on many different subject areas that lie outside the field of healthcare, such as psychology, sociology, pedagogy, and organizational theories. Nadeem et al. (2013) argue that, to maximize the effectiveness and practical relevance of QIC as a change strategy, understanding the specific features that drive change is a necessary next step. The contribution made by this thesis is the deepening of learning and developing a new understanding of how QIC may be used for the improvement of healthcare and the identification of what is important for success.
Improving clinical results with support from NQRs

The main goal for the various QICs (Study I, Study II, and Study III) that are reported on in this thesis was to improve clinical outcomes by drawing on national guidelines. The research focused on how NQRs can be used in QICs to achieve better outcomes for patients.

Study I, Study II, and Study III describe how adherence to guidelines increases and improves clinical results with the application and use of a systematic improvement method in combination with quality registries as measurement support. Previous results from QIC initiatives are mixed, with some good results and some more limited results, which has placed the claimed effectiveness of QIC under some degree of critical scrutiny (de Silva 2014, Schouten et al. 2008). These findings have also given rise to questions about what features a QIC should have if it is to lead to success (Nembhard 2009, Walshe 2007, Nadeem et al. 2013). There are some studies that have tried to answer these questions, but many studies also identify ‘a need for further research’ in this area (Weggelaar-Jansen et al. 2015, Walshe 2007). The present thesis aims to do just that.

The Swedish NQRs provide an underutilised source of valuable information that can profitably be used by improvement efforts to follow the results of such efforts, since much of the data included in these registries is entered for every patient, sometimes every day.

Organizational context and care characteristics

Study I, Study II, and Study III showed improvement in clinical results even though the results in Study II were more limited with respect to one of the indicators. In Study II, the QIC focused on DM in adults and showed, for example, that there were difficulties in influencing patients in adopting certain lifestyle changes which would improve their HbA1c (Thorpe et al. 2013). Schouten et al (2008) clearly state that they could not identify the mechanisms that were responsible for the results and the variation in the results in their report on QICs. When we compare Study I, Study II, and Study III, we note that there were differences between working in a QIC on
an acute process compared to a QIC on a chronic disease. Other unanswered questions are whether specific components, organizational contextual, or site characteristics enhance the effectiveness of a QIC or not (Schouten et al. 2008).

Study I followed the onset of treatment in an acute process in conjunction with that a patient getting an AMI. The measurements that were studied in this case were process-measures. Adherence to treatment targets increased significantly and was significantly better in the QIC hospitals, compared with the control group. The study showed significant improvements in four out of five treatments. The fifth was already very frequently used and the potential for change was thus relatively low. Working with bundles of treatments (getting several treatments in place at the same time) has been presented in different studies (Resar et al. 2005, Nguyen et al. 2007, Lindsay et al. 2013) and has been described as useful in implementing a package of treatments. However, in our study, it was difficult to get to all five treatments in place at the same time. Despite this, the teams who participated in the QIC succeeded to a higher level than the control group.

The improvement efforts reported on in Study I have created benefits for patients in the long-term, which have been shown to exist in a follow-up study (Carlhed et al. 2009). The increased adherence to guidelines in the hospitals that were part of Study I, with improved AMI care, resulted in a significant reduction of mortality and morbidity, without an increase in complications (Carlhed et al. 2009).

Study II describes a QIC with medical departments and primary care units that took care of diabetes patients with both type 1 and type 2 DM, which, to the best of my knowledge, is unique, since previous studies often focus merely on one type of unit or disease (Shojania et al. 2006, Schouten et al. 2010). Taking care of patients who suffer from a chronic disease however, requires cooperation between hospital care and primary care providers (Wagner 2004). The QIC in Study II, with mixed teams, provided an opportunity for practitioners to share experiences and ideas so that they could together improve the treatment and care of diabetes patients across primary and secondary care units. The teams in Study II improved performance with respect to two national DM guideline targets among their patients compared to other units in the NDR. This suggests that the QIC
helped teams to close the gap between ordinary clinical practice and evidence-based guidelines and contributed to the provision of better care and better clinical outcomes. At the same time, the impact of the QIC was limited regarding HbA1c levels, which has also been found in other studies (Schouten et al. 2010). This indicates that there exists a number of challenges in the improvement of care for patients with DM, with its substantial reliance on self-care and co-production of care, compared to the acute care that is provided for patients with AMI, for whom more of the care is directly related to caregiver actions during hospitalization.

Study III, however, showed improvement in HbA1c for children with DM. One reason for this, compared to adults with diabetes, could be that the teams participating in the QIC found a new ways to more actively engage the parents in supporting and encouraging their children to make lifestyle changes and to teach their children how to best take care of themselves. Even though there remains some uncertainty with respect to the effectiveness of educational programs (Murphy et al. 2006), parents’ involvement in this area is stimulated and developed through the QICs. The positive results that are reported on in Study III for children with diabetes have continued, both for the teams which participated in Study III and for those teams who participated in a second QIC with focus on children with diabetes (Samuelsson et al. 2015).

Questions regarding the influence that the organisational context or character of the care may have on the outcomes of a QIC may be raised, since the different QICs produced different results. Several researchers have pointed to the context as an important aspect to consider in quality improvement work (McCormack et al. 2002, Ovretveit 2011), but the aspects of acute care or chronic care has not received the same attention with respect to their influence on the outcomes of quality improvement work. In Study I, the settings were inpatient departments for acute care. The teams who participated in that project came from units where the focus was on how to take care of patients with cardiac diseases. The teams made good results. On the other hand, in Study II, two-thirds of the teams came from primary care units, where diabetes patients are only one part of the patient populations that they take care for. One challenge that may face a PCU is that they have many different patient-groups to take care of, and thus it is more difficult to
remain focused on one specific patient group. A study of improvement in primary care found a higher compliance rate with guidelines if they were easy to follow, did not require new knowledge and skills, were evidence-based, and were compatible with existing norms and values (Burgers et al. 2003). This indicates that changes in primary care need to be simple and fit well into the whole group of primary care patients. In Study III, the settings were paediatric departments where diabetes is the most common chronic disease and the team is usually well-identified. Thus, like the case for AMI patients, it may be easier for these staff members to keep their focus on, and update their knowledge about, this disease.

Measurement and the use of NQR

The overall results from the three QICs point to the fact that different types of indicators take a different amount of time before changes in results can be observed. The process measures in Study I (getting several medical treatments in place at one time) showed instant results, whilst the indicators in Study II and Study III (improving HbA1c) changed more slowly.

To get medical treatment in place, staff need to create and use solid plans or checklists/protocols. But in the case of improving HbA1c, the patient also needs to be involved in making lifestyle changes. This proved to be harder to implement. Care teams thus have an intermediary role in supporting their patients in their change efforts. Adults with diabetes check their HbA1c maybe once or twice a year, thus there is a delay in observing results with respect to the initiated change. Children, on the other hand, are followed up on more often, and thereby the results of the changes were observed more often, which can be one of the reasons why the HbA1c for this patient group was improved. Measures are essential to improving a process. The effects of changes need to be followed during the improvement efforts (Batalden & Davidoff 2007, Elg et al. 2013). The results also indicated that the paediatric teams worked more intensively with influencing children and their parents to be more physically active, and it may have been the case that the parents were more alert with administering the medication, etc. Therefore, having a number of driving-/process measures in place, such as the correct administration of medication or other treatment which provides fast results
and makes it easier for teams to observe the effects of the different changes, may be essential to every type of quality improvement initiative.

Continuous measurement over time is an important issue in confirming whether changes that have been introduced have actually improved the care. Using online measurement in a NQR proved to be a particularly useful tool in following the results of the different QICs. There were, however, some challenges to this. James (2003) has highlighted some important elements in establishing functional information systems. He argues that data should be collected from one source only. This is a major problem for the system of NQRs in Sweden, where most data is registered both in the NQR and in the electronic medical record. This double registration was highlighted by the team coaches in Study IV as a problem. Consequently, the direct transmission of data is an important improvement to work for. Another improvement that is needed in some of the NQRs is the ability to present data over time in run-charts or control-charts, for example, which has been proven to be important (Carey 2003, Thor et al. 2007, Perla et al. 2011). The test of the QC-module in RIKS-HIA was an attempt to make it easier to follow the specific indicators in the project over time. This was deemed to be very successful according to the teams and should be adapted by other NQRs. The NQR, however, is collecting data on-line and data can be aggregated for higher-level reports, which also is an important function, according to James (2003).

The team coaches who were added to the QIC in Study III primarily regarded the quality registry as a facilitator for successful change management by providing data over time. This enabled teams and managers to monitor performance, as changes were introduced. For some of the teams, this increased the participants’ interest in the data and the statistics on the performance of the QIC (Study IV).

The findings in all three of the studies (I-III) suggest that the QIC helped the teams to close the gap between ordinary clinical practice and evidence-based guidelines, and thus contributed to the provision of better care and better clinical outcomes. In summary, how effective and fast the results were improved by the QIC efforts partly depended on the particular field of healthcare they were performed in and what type of measures were used. To
have a measurement support system, such as an NQR, was, also crucial to the results that were obtained in our studies.

Learning from the QIC and its application

The different studies confirm that different types of knowledge are needed to improve healthcare, as, for example, described by Batalden and Stoltz (1993) in terms of ‘professional knowledge’ and ‘improvement knowledge’. Professional knowledge mirrors, for example, the knowledge the teams have with respect to the guidelines for the different diseases. Improvement knowledge may include knowledge of the different components of the QIC. The findings also confirm the “formula” of how generalizable knowledge, together with the context of an organization, produces results (Batalden & Davidoff 2007). Generalizable knowledge of how to take care of patients with AMI or DM is well-documented in the national guidelines in Sweden. These guidelines, together with the improvements that were made by the teams in their specific contexts, created new results that were measured in the different NQRs. The different studies imply that evaluation of the measured performance in the different QICs provides a learning experience and a creation of new understanding, back in each step of the formula (Figure 9).

![Diagram](image)

**Figure 9.** New learning and understanding was created back to each step in the “formula” from Batalden and Davidoff (2007).

The results that were obtained in the different QICs gave feedback to the scientific evidence/best practice for the treatment of different diseases and informed the teams how to best create their local guidelines, for example.
Learning also took place with respect to how the teams should plan for changes and how they might improve their plans, whilst supporting the particular context. The results also provided learning opportunities with respect to the QIC itself, and how it needed to be executed and developed.

**The application of QIC**

Integrated into the QIC methodology are the notions of ‘learning in collaboration with others at different levels’, ‘individual learning’, ‘learning within the network of participating teams’, and ‘learning in the team’ (Ovretveit et al. 2002, Weggelaar-Jansen et al. 2015). The results from this research has brought knowledge and understanding to important factors and benefits that are difficult to reach by other means especially with respect to how learning leads to improvement. These studies have also given direction to practitioners in how to work and succeed in QIC (Study IV). The team coaches in Study IV stated that it was helpful to use QI tools such as the PDSA-cycle, the Ishikawa diagram, the clinical value compass, and the 5Ps in their analysis of their organization, although they struggled with them in the beginning of the project. The systematic nature of the approach helped them to test different ideas. This corresponds well with knowledge and skills needed in the continuous improvement (Ellstöm & Kock 2005), the ‘experiential learning theory’ (Kolb 1984) and with the Model for Improvement (Langley et al. 2009), where testing, studying and learning, and finally taking actions based on new knowledge takes place. The learning and development of a new understanding of the specific needs that exist within the organization, management support, and how to create engagement and motivation in the teams, along with the structure of the program are important components of a QIC (Study IV). This learning and creation of new understanding of the improvement effort is supported by the way adults learn through experience-based learning and by a motivation to change when it concerns their own daily work (Sandberg & Targama 1998, Ellström 1992, Illeris 2001). For example, learning about the structure of an improvement effort makes it easier to learn in collaboration with others when sharing problems and ideas. This corresponds well with learning both on the individual level and at the organisational level (Senge 1990).
The QIC followed a structure which included a number of learning sessions. In other studies of QICs, the level of detail in description varies with respect to the number of learning sessions and didactic training sessions, which makes it difficult to compare and make conclusions about what is the best approach to use (Nadeem et al. 2013). In Study I, the teams were divided into two groups. One of the groups received only two learning sessions, instead of the four sessions that the other group attended. The results of the QICs were similar for the two groups, which could indicate that the number of learning sessions could perhaps be limited to save on costs in some instances. However, the needs may vary in relation to the complexity in the intended changes and the former experience of improvement work among the teams.

**Leadership and teamwork**

The theory of the clinical microsystem has been foundational for the teams’ understanding of where in the healthcare system/context they work and where they are expected to improve. Important aspects of the clinical microsystem are the notions of ‘leadership’ and ‘teamwork’ (Nelson et al. 2002). According to our results in Study IV, but also from the lessons learned in the teams’ final reports in all three QICs (Study I, Study II, and Study III), we can confirm what other research shows: leadership support is crucial to success (Nelson et al. 2002, Ovretveit 2005, Aij et al. 2013, Godfrey 2013). The team coaches clearly pointed to the importance of management support, the need for management to create a positive culture for improvement, asking for plans and results, and giving the team permission to spend time on the QIC whilst making it clear for the rest of the unit that the QIC is prioritized work (Study IV).

The number of team members varied in the three QICs. In Study I, there were four team-members in each team; the recommendation was two physicians and two registered nurses. In Study II, the team decided themselves how many should join the QIC, and the number of participants and the professions that were represented in the teams varied. Some teams were complete with physicians, nurses, a dietician, a secretary, a physiotherapist, etc. being represented. In Study III, the recommendation
was that the whole team participated in the QIC and the variation in terms of the number of team members and the professions that were represented was therefore large. The number of team members who participated in the QIC and joined the learning sessions could have influenced how easy it was for the teams to implement new ideas in the everyday practice. For success to be achieved, the whole team needs to be committed and involved, both in the development of new ideas but also testing them in practice (Grol et al. 2007). On the other hand, the changes that the teams proposed and implemented also progressed very differently, where some teams showed clear plans and changes early on the process, while for other teams, this process took a little longer. This could be due to the composition of the team, in line with Rogers’ taxonomy of ‘early adopters’, ‘early majority’, etc. (Rogers 1983), or the personal learning style of the team-members (Lewis & Bolden 1989).

To succeed in improving the care for patients with chronic disease, a multidisciplinary team is crucial (Wagner 2000). According to Wagner (2000), such teams ensure that critical elements of care that physicians may not have the time to do well are competently performed. For example, these elements may include protocol-based regulation of medication, self-management support, or intensive follow up. In Study II, there was example of a primary care unit with hardly any physicians who had time for the diabetes-patients and where, instead, a nurse took on a large responsibility for these patients. Notwithstanding this state of affairs, this primary care unit produced results which ranked among the best in the whole QIC.

**Learning from others**

One of the most important factors associated with achieving success, according to Study IV, was the joint learning and sharing of ideas and experiences during the learning sessions. During the learning sessions, the teams were provided with the opportunity to sit and talk in mixed groups and create a learning network, in which participants both contributed and received information. The QICs supported a kind of “communities of practice” (Wenger et al. 2002, Cox 2005) or “clinical communities for QI” (Dixon-Woods et al. 2011, Aveling et al. 2012) which took place outside the organized activities. For example, the learning sessions required that the
teams travel to the venue, which gave them time to really get to know each other. The team members thus had time to discuss issues with each other and reflect over the work that they were doing, and make plans for improvements and actions. During the lunch breaks, other breaks, and evenings at the hotel, the teams meet and talked with each other. In communities of practice, a tacit understanding can develop, but also a sense of personal satisfaction from knowing colleagues who understand each other’s perspective (Wenger et al. 2002). The QIC supported different types of knowledge and skills. The teams need the theoretical knowledge that is compiled in the national guidelines, and practical knowledge in testing different ideas for change with the help of the PDSA-cycle. The structure supported the learning and doing, and by doing, the teams created a new understanding. This supports the idea of a community of practice by learning from each other. This increases the chances of success. This corresponds well with Kotter’s (2012) updated strategy for change, in which he calls for an agile, network like structure in the improvement of an organization.

**Team-coaching**

Facilitators who supported the teams were used in all three QICs. The use of such facilitators is a well-known strategy to increase the chances of success (Alemi et al. 1998, Thor et al. 2004). In the third QIC, this approach was further developed and the team selected one team-member to be an internal team coach who was mandated to support the teams in the QIC process. This was shown, in Study III and Study IV, to be a successful approach. Different studies have shown the benefit of having a coach who supports the teams in QIC (Gustafson et al. 2013, Godfrey et al. 2013). Unlike previous studies, the coaches in our study were *internal* and recruited from the teams themselves, although there is empirical support for the use of either internal or external coaches (Norman 2015). To have a team coach selected from the team was recognized as a success in itself, from both the team-members and from the coaches themselves. Having an internal team coach was also reported on as a benefit for increased learning and understanding of improvement knowledge. The team coach was a support for the team, but in addition, these participants gained individual leadership training and experienced personal development.
QIC is a method that is widely used but also has been subject to critical review (de Silva 2014), because of the varying results it produces in relation to levels of investment. Therefore, it is important that we develop a profound understanding of how QIC works and what components of the process can be identified as directly contributing to the success of a QIC (Schouten et al. 2008, Nadeem et al. 2013). This research has given some insight into the “black box” that QIC is sometimes perceived as, and has clarified a number of important factors for learning and understanding how QIC can be used and adapted in different contexts.

Methodical considerations

Three different QICs were studied where different NQRs were used, namely, the National Registry for Myocardial Infarction Care (RIKS-HIA), the National Diabetes Registry (NDR), and the Swedish Paediatric Diabetes Quality Registry (SWEDIABKIDS). The design of the QICs was inspired by the BTM (Kilo 1998, Wilson et al. 2003).

The interactive approach that was adopted in this research project has supported joint knowledge creation for research on what works for whom and why, but it has also supported learning and understanding of the practical use of QICs. This knowledge can be useful for a registry-holder when starting a new QIC. The individual pre-understanding of the interactive researcher has been seen as an asset rather than an obstacle in the different studies, since such a researcher, who possesses experience from similar quality improvement efforts, can contribute to a deeper understanding of the prerequisites of development and how the learning process might be organized (Westlander 2006).

The interactive approach was inspired by Ellström (2007). His theory of ‘knowledge creation’ was elaborated upon to involve learning in the different QICs and from the different studies. The learning and creation of new understanding in the different studies involved both single-loop learning and double-loop learning (Argyris & Schön 1996). Some changes made in the improvement process could be characterised as learning to perform a given task better, i.e., it took place under the present system of working and
thinking. Rules and routines were modified within the prevailing system. On the other hand, most of the proposed changes needed double-loop learning (Argyris & Schön 1996), since the improvement required support for changes in already-established patterns and behaviours. Double-loop learning is concerned with re-designing the system, instead of just correcting it.

Triple-loop learning, identified by Rushmer et al. (2004), refers to the process of learning about learning; so-called ‘meta-learning’. Meta-learning contains two different parts: specific learning about a specific change that may be useful somewhere else, and more generalized learning that can apply to other learning situations in a more generic way (Rushmer et al. 2004).

Figure 8. A modified model for Knowledge Creation through Interactive Research, originally developed by Ellström (2007). This figure illustrates how the different QICs and NQRs yielded new knowledge and understanding from insights gained in each QIC – i.e. the “meta-learning” that took place.

For comprehensive results, each QIC was analyzed through the results from the clinical evaluation that each team performed and for the whole group, but also on the learning and understanding from the concept of QIC. The QICs
were continuously modified after each learning seminar to optimize the process. After each QIC, the project-group analyzed what had happened during the QIC, and the insights that were generated there were used to improve the next QIC, as new “ingredients” were added (Figure 8).

The research questions that are posed by the researcher should guide the choice of method that is ultimately used. The studies were designed to capture quantitative results, to see that the improvements suggested by the team actually worked, but also the qualitative experiences of the work, so as allow the researcher to obtain to a more profound understanding of how QIC works and how it can be performed. Consequently, a mixed method research design was chosen. There are several reasons why a researcher might choose a mixed method design, including confirmation, complementarity, development, expansion, and enhancement of significant findings (Andrew & Halcomb 2009). In the light of the research questions that were posed in this thesis, several of these reasons were of importance. The quantitative results were followed in the various quality registries and compared with the control groups, and with other units in the country who used the registry. For the qualitative analyses, content analysis was used. The mixed method design in this thesis was employed to validate the findings generated by each method, through evidence produced by the others (Andrew & Halcomb 2009). For example, the team members’ and the team coaches’ experiences were compared with the results generated from the national quality registries.

Kuhn’s theory of science is based on theories developed by paradigms that follow one another (Kuhn 1970). A paradigm shift is a scientific revolution in which a given structure is replaced by another. Improvement science is currently in a ‘pre-paradigm phase’ (Marshall et al 2013). The form of this science is still being created. In organizations that are tasked with the organisation and provision of care, I perceive a trend towards multi-professional and interdisciplinary work, which integrates subject knowledge from different sciences such as nursing, social work, medicine, and dentistry, as well as from social and behavioural sciences. In order to deal with the increased complexity associated with the provision of care, improvement science (as a broad and multidisciplinary, emergent research field) can provide knowledge about complex issues, but will need further development
of the methods and theories that it employs. The methodological contribution of the present thesis is the use of an interactive approach to identify and record learning as it occurs in ‘real life’, with specific reference to developing a deeper understanding of the benefit QICs can contribute to improving the organisation and provision of care combined with real time data. Another important contribution is also our increased understanding of what needs to be taken in account in different contexts where a QIC is applied.

There are limitations in the research project. For example, the hospitals that participated in the different QICs all volunteered to participate, which might be argued to be instances of self-selected bias and, in some sense, influence the results of the QICs. This is discussed further below.

**Validity and trustworthiness**

In researching QICs, it is important for the researcher to reach well-founded conclusions about the effects of the interventions. The studies, therefore, need to be designed with this in mind. The quality of research can be assessed via different perspectives on testing and analyzing the research. For example, the assessment of a piece of research’s *validity* is one way of establishing the quality of the research. *Validity* can be divided into *construct validity, internal validity, external validity, reliability, and statistical conclusion validity* (Yin 2009, Creswell 2013, Kazdin 2014). These perspectives are mainly suitable for quantitative research. Keeping the different types of validity in mind is helpful to the researcher in formulating research questions when designing and carrying out a study (Kazdin, 2014). An alternative way of assessing the quality of qualitative research is *trustworthiness*, which can be divided into *credibility, transferability, dependability, and conformability* (Lincoln & Guba 1985, Creswell 2013).

**Validity**

Validity describes whether a conclusion, explanation, interpretation, or other kind of statement is accurate and reliable (Yin 2011). *Internal validity* concerns the extent to which an intervention can be considered to account for the results, changes, or group differences (Kazdin 2014). Threats to internal validity include factors or influences other than the independent
variable that is used to explain the results. ‘History’ is another potential threat to internal validity. ‘History’ refers to effects of events that are common in the everyday lives of the participants, events in the news, or common experiences that might be used to explain or contribute to the results (Kazdin 2014). For example, in Study II and Study III, we followed the patients who suffered from diabetes, for 18 months. During this time, different events take place in society, for example, different types of diets were discussed in the media and carbohydrate counting became popular, which may have affected the HbA1c results, instead of the interventions that are described in the studies.

‘Maturation’ is another potential threat to the validity of a study, especially when the study lasts for a long time. It refers to the fact that subjects of a study may grow older, stronger, and wiser (Kazdin 2014). During Study III, the children grew older and given this, it should be noted that diabetes can be harder to manage in some ages, for example, with teenagers. This could have some influence on the result in the study. Notwithstanding these observations, both history and maturation would appear in the same way in both the QIC hospitals and in the rest of the units that our teams were compared with. Consequently, history and maturation should not be seen as factors which might negatively influence the validity of these studies.

‘Testing’ and ‘instrumentation’ can be other potential threats to internal validity. ‘Testing’ refers to the fact that tests can be influenced and therefore be performed differently at different times (Kazdin 2014). In Study I, there was no specific test, only the process was measured, i.e., whether patients had received the treatments or not. For Study II and Study III, the one evaluation end-point was HbA1c. The same method was used for all the teams and in the hospitals and primary care units that the results were compared with. On the other hand, there could have been changes over time in the method in which HbA1c was analyzed, something that could not be predicted.

Another threat to internal validity is ‘selection bias’ (Kazdin 2014). In our studies, there is a kind of selection bias on the team level, since the team voluntarily participated in the QIC. Therefore one could argue that only those practitioners who were already positive towards the QIC and wanted to improve their provision of care participated. To prevent this threat to the
internal validity of the studies, a control group was matched to the intervention teams in Study I, and in Study II and Study III the results were compared to hospitals and primary care units in the rest of the country that used the same NQR. The baseline data shows that the intervention teams and the control group were at the same level at the start of the intervention. Participating in the QICs changed the results (positively) for the intervention groups, and we can therefore state that the QICs were successful. Another threat that can be linked to selection bias is ‘diffusion’ or ‘imitation of treatment and reactions of controls’ (Kazdin 2014). This can be a problem in the types of studies included in this thesis; for example, the total number of professionals who are members of paediatric teams that work with children with diabetes is quite small in Sweden. They meet regularly and discuss treatments, etc. This led to improvements being shared in non-participating teams, but the differences between the participating teams and non-participating teams was still significant, and since the overall aim with improvement is to provide improvements for the whole population, on a practical level, the spread was advantageous for this population. This spill-over effect with respect to improvements in non-enrolled hospitals is known from other studies too (Hansen et al. 2010).

*External validity* concerns the extent to which the results of a study can be generalized or further extended to apply to other people, settings, times, measures, and characteristics (Kazdin 2014). Each particular study will present its own specific sample characteristics and the threat made by external validity concerns whether a study, and its specific sample characteristics, can be generalized to another sample. One concern with respect to external validity is whether the sample excludes different groups of patients (Kazdin 2014). In our studies, we used data from NQRs which include the whole population. The coverage in the registries that we used is very good (100% coverage for SWEDIAKIDS, and about 90-95% for NDR and RIKS-HIA), and no extra effort was required of participating teams to collect data for the study. They used the registries as part of their regular clinical practice.

Another threat to external validity is ‘multiple-treatment interference’. When more than one intervention or treatment is used in the experimental design, it can be difficult to draw any conclusions (Kazdin 2014). In our studies, many
different change concepts were implemented in an attempt to achieving the goal of improving adherence to national guidelines. It was not possible to demonstrate exactly which one of the change concepts actually improved the results, but as an overall result, we can state that the teams who participated in the QIC improved on the specific indicators significantly (more so than the control group or rest of the country) and we therefore come to the conclusion that the QIC were effective. External validity also raises the question of the timing of the measurement (Kazdin 2014). An important question in our research is: *Will the results of the interventions persist over time?* The benefit of using a NQR is that it makes it possible to continue to follow the data. Long-term follow-up studies have been made with respect to all three studies, and have been (or will be) published, for example Carlhed et al. (2009).

*Construct validity* addresses the question that, given the intervention was responsible for the change, *What specific aspect of the intervention or arrangement was the causal agent? What was the conceptual construction underlying the effect?* (Kazdin 2014). For example, merely giving attention to and having contact with the clients or patients can be a threat to the validity of a study, *if the attention instead of the specific intervention affected the result of the study*. In our studies, there could have been such a threat to the validity of the studies if the teams had other support in their improvement efforts than just participating in our QIC. But the fact that we compared the results with a control group (Study I) and with the rest of the country (Study II and Study III), with the same opportunities to have support at home, should increase the validity. Another problem is the notion of ‘experimenter expectancies’ (Kazdin 2014), but since we used data from the NQRs which the research team did not have any influence over, this threat was diminished.

*Statistical conclusion validity* addresses the question of whether relationships between the QIC and the clinical results exist and how well the research project can detect the effects of such relationships (Kazdin 2014). A threat to statistical conclusion validity is, for example, a low statistical power, which can lead to a low probability of detecting a difference from the intervention. In our studies, we evaluated a number of teams (Study I: 19 teams; Study II: 23 teams; and Study III: 12 teams) which may seem to be
small groups. But the teams took care of large groups of patients in total (Study I: 2900 patients; Study II: 8200 patients; and Study III: 2300 patients). Therefore, the statistical power was considered to be strong in these studies. Furthermore, variability in the procedure and subject heterogeneity (Kazdin 2014) was considered. The use of NQRs provided a rigorous level of standardization in the registration of the different variables. The unreliability of measures can also be a threat (Kazdin 2014), but in our cases, HbA1c for example, was considered to be a very robust and accepted measure that is used in evaluating how well diabetes patients are being managed. This measure is also used worldwide.

**Trustworthiness**

The quality of the qualitative part of the studies will be discussed with respect to its trustworthiness. **Credibility** corresponds to the internal validity of a study and describes how believable the results are. The principal of triangulation refers to the search for at least three ways of verifying or strengthening the findings (Yin 2011). In the present research, the credibility of the findings is increased by different data sources, including data from the NQRs, the teams’ final reports, and focus groups interviews. As a researcher, it is also important to become aware of one’s own pre-understanding to achieve credibility in the studies. Recognition of this pre-understanding makes the starting point for the interpretation of the results of the QICs clear (Kvale & Brinkmann 2009). One way to strengthen the credibility further, is allowing the material to be analyzed by different people. For example, by triangulation, once the author has compiled, analyzed, and interpreted the data, it is then validated by other researchers (Kvale & Brinkmann 2009). This was done for the different studies in this thesis by the different authors of the articles.

The **transferability** of the findings of a study is an empirical question that depends on the similarity between the context of the study and another context, or the same context at another time (Lincoln & Guba 1985). Qualitative research often tends to focus on a phenomenon in a specific context. The question that arises is whether the results of such a study are applicable to contexts other than the context that has been currently investigated. According to Yin (2009) a case study contributes to an analytical generalization and can be enhanced by other thoroughly-described
cases. In the different studies included in this thesis, we have tried to describe the context in some detail. Research on several cases also makes the study more robust than just a single case, and increases the possibility of generalising the results to other cases (Yin 2009). Taken together, the findings in the different case studies in this research have provided increased knowledge about QICs in general.

Interpretation involves analyzing and assigning meaning and significance to different phenomena (Alvesson & Sköldberg 2008, Hansson 2011). Alvesson and Sköldberg (2008) argue that a good interpretation forces people to think. It builds on and confirms people’s beliefs, but also challenges and questions these beliefs. Interpretation should be based on knowledge and previous experience (Ödman 2007). In this context, pre-understanding is also important, which can include theories, frameworks, concepts, and values. According to Alvesson and Sköldberg (2008), researchers always bring their own frames of reference to their work and produce interpretations that are based on these frames of reference. My pre-understanding has therefore been seen as an advantage for the present research with respect to providing a deeper understanding of what happens in QICs. This also forms an important part of the interactive research approach.

*Dependability* is achieved if it is possible to replicate the research study. This can be achieved if the researcher has provided the reader with a clear and thorough description of the steps and decisions that were taken in the research process, and by clearly explaining the underlying theories, assumptions, and context of the study. Triangulation be also be used with reference to *dependability* by using several different methods or data sources (Guba & Lincoln 1994). The dependability of this research has been achieved through the provision of detailed descriptions of the study design, the QIC methodology, and the QIC design.

The issue of *conformability* with respect to interpretive research addresses the question of whether or not the findings of a study are meaningful and applicable, and extend understanding (Giddings & Grant 2009). Greenhalgh et al. (2004) pose a number of questions about how quality improvement innovations can be implemented and sustained, and they suggest the use of in-depth, mixed methodological studies to achieve this. In the mixed method
design, the purpose is to confirm the findings from different data collection methods, thereby increasing the validity of the findings (Andrew & Halcomb 2009). Since the different studies employed both qualitative and quantitative data collection methods, the findings and conclusions of the studies are strengthened. Whilst quite a few studies use the mixed method design (Wisdom et al. 2012), in Study IV, we found it a useful method to complement, confirm, and enhance our results from the other studies.
Conclusions and implications

As practical experience and previous research has shown, there are a number of challenges to improving healthcare. The application of systematic improvement methods can help, but many questions remain regarding what is needed in order to achieve success. This thesis demonstrates how Quality Improvement Collaboratives (QICs) which are supported by quality registries can contribute to quality improvement in healthcare. The thesis has revealed that there exist differences in QICs that are directed towards an acute process and QICs that are directed towards the treatment of a chronic illness. This research indicates what is needed with respect to learning and the creation of new understanding in QICs and their application.

Clinical results and use of quality registries (QRs)

The Quality Improvement Collaboratives (QICs) have an impact on the adherence to national guidelines and, according to the different studies included in this thesis, the following conclusions and implication can be drawn:

- A QIC together with the support of a QR can help teams to close the gap between ordinary clinical practice and evidence-based guidelines, and thus contribute to the provision of better care and better clinical outcomes.
- Changes that require action from the teams (e.g., medication or treatment) gave results more quickly, compared to actions conducted by the patients (e.g., life-style changes).
- The different organizational contexts and characteristics of the care that is provided in an acute process compared to a chronic disease were found to give rise to different challenges when changes for improvement are proposed and implemented, and thus need a customised QIC and customised improvement measures.
• National Quality Registries (NQRs) can be used successfully to support and follow improvement efforts. Essential factors to this success include the ability of the teams to retrieve their own data continuously, in real time, from the registry and to easily create their own run-charts, for example. Another request from the team coaches was the possibility of transferring data directly from the medical record to the relevant NQR.

Sweden has a unique resource with its approximately 100 different national quality registries. Many of these NQRs show a wide variation in results, and are not used to the extent that they should in systematic improvement efforts. This thesis, therefore, contributes to our understanding of how national quality registries and similar measurement systems may be used in future improvement efforts, by using the different indicators contained in the registry and by monitoring changes over time.

Learning from QICs and their application

There were a number of new things that were learnt and new understandings related to the QICs and their applications.

• Important factors for achieving success in a QIC were the learning and creation of new understanding of the organisational context, including leadership support and support from the rest of the department or primary care unit.
• The team composition, how the team works together, who does what, and what changes are required were important ingredients for success.
• Learning about adopting a systematic approach to quality improvement was essential to success. When a team learned how to use the QIC different tools, they saw the benefit of the structure. They also learned about how the work should be done at home with small scale changes being made in an incremental fashion, the meeting structure, and the fact that they should continuously follow up on their work. All of these points were seen as benefits in the QIC.
• The learning and commitment from the teams were important aspects with respect to the success of the QIC. Everyone needed to be part of the work.

• There were benefits offered by a QIC which are difficult to offer in other ways. The QIC offered time for the teams to focus on a specific problem or patient group, time for the teams to discuss and reflect over the different changes they had made, time for the team members to get to know each other and become a tight-knit team. The time that was available to the teams was not just during the learning sessions, but also during the time around the sessions, on travelling to the learning sessions, evenings at the hotel, and during lunch and other breaks.

• “Communities of Practice” were formed during the projects, which supported learning with and from others. The phenomenon of learning from the tests and changes that others had made spread throughout the group. Future research is needed to find how the concept of ‘communities of practice’, when linked with a QIC, can be applied and supported in improvement efforts.

• An internal team coach was a success, even though they had a relatively short introduction to coaching, compared to many external coaches described in other studies. On the other hand, the internal team coach with knowledge of the organisation could continue the work and spread it to other areas as the initial project comes to an end.

The implication for practice from the results in this thesis suggests that QICs can be very effective, but that their effectiveness depends on a number of factors. The process or theme that is chosen for the improvement work, the commitment from the management and team, together with the support from a team coach are important. Other important factors include the particular indicators that are chosen to follow, and the presence of a real-time measurement system that provides continuous feedback of results. Finally, the way the QIC is carried out and whether it is possible for teams to acquire improvement knowledge are also of great importance.

This research has not focused on how patients can contribute to quality improvement and the redesign of care services. No patients actively
participated in the different learning sessions. An attempt in that direction was introduced in the last QIC, where patients and families were involved through reference groups or were asked for their opinions on the different improvement ideas. Patient-centred care demands much more involvement from patients. This includes the co-production and co-design of decisions about their own care, but also in the team and in the improvement work. An implication for both practice and research is, therefore, to involve patients in every step of planning and execution of improvement efforts, and then study the results. Further research is needed on how patients can be part of registering their own data, even if some attempt has been made in this direction (Hvitfeldt et al. 2009).

In summary, the research reported on in this thesis has added to the existing evidence that QICs, together with NQRs, or similar quality measurement systems, can help teams improve healthcare. To be effective, QICs need to be adapted to several contextual factors such as the nature of the care and the patients concerned.
Systematiskt förbättringsarbete med stöd av nationellt kvalitetsregister


I Sverige finns ett stort antal nationella kvalitetsregister som samlar kvalitetsvariabler för olika processer och patientgrupper. Även om flera av dessa register har funnits länge och använts för uppföljning och klinisk forskning har de inte i så stor utsträckning använts till systematiskt kliniskt förbättringsarbete. Det övergripande syftet med denna avhandling var att
undersöka om och hur systematiskt förbättringsarbete med stöd från nationella kvalitetsregister kan bidra till kvalitetsförbättringar inom häls- och sjukvården. Syftet var också att undersöka vilket lärande och ny förståelse som framkom vid systematiskt förbättringsarbete i olika typer av verksamheter.

Det empiriska materialet som undersöks i denna avhandling kommer från tre ”genombrottsliknande” kvalitetsförbättringsprogram med deltagare från olika sjukhus och vårdecentraler i Sverige. I varje kvalitetsförbättringsprogram ingick support från ett nationellt kvalitetsregister: Nationella kvalitetsregistret för akut hjärtinfarktvård (RIKS-HIA); Nationella Diabetesregistret (NDR); och Nationella Barndiabetesregistret (SWEDIABKIDS).


De studier som ingår i avhandlingen visar att ett systematiskt kvalitetsförbättringsarbete med stöd av ett nationellt kvalitetsregister kan öka följsamheten till nationella riktlinjer och bidra till bättre kliniskt resultat och därmed en bättre häls- och sjukvård (Studie I, Studie II och Studie III). Viktiga framgångsfaktorer var lärande av och förståelse för det organisatoriska sammanhanget, strukturen i förbättringsarbetet, samt vikten av team och chefers engagemang (Studie IV). En intern team-coach som utsågs i teamet visade sig också vara viktigt faktor för att lyckas (Studie IV).

Sammanfattningsvis kan det konstateras att olika förbättringsarbete har olika utmaningar, exempelvis när det gäller att förbättra inom en akut process kontra för en kronisk sjukdom, men även vid utvärdering med hjälp av processmått jämfört med utfallsmått. Viktiga förändringskoncept är t ex
att säkra inmatningen i registret, kontinuerligt uttag av data för att titta på resultat, checklistor/ritlinjer för vården, utbildning/information till medarbetare. Kvalitetsregister är ett bra stöd i förbättringsarbetet men behöver säkra att data är online för att öka möjligheten till kontinuerlig uppföljning, att data automatiskt kan överföras från datajournal till kvalitetsregistret och det behöver vara enkelt att ta ut sina egna data och följa resultatet över tid. Samtidigt bidrar kvalitetsförbättringsprogrammet till ett ökat lärande mellan teamen när ”community of practice” bildas där utbyte av erfarenheter, idéer och reflektioner kan ske.

Denna avhandling kan förhoppningsvis bidra till hur nationella kvalitetsregister kan användas i systematiskt förbättringsarbete och ge underlag till vilka faktorer som är viktiga att överväga och ta hänsyn till för att lyckas, och samtidigt vetenskapligt bidra till utvecklingen inom Improvement Science.
References


of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality, *Crit Care Med.*, 35(4), 1105-12.


Norman, A-C. (2015) *Towards the creation of learning improvement practices: Studies of pedagogical conditions when changes is negotiated in contemporary health practices.*, Doctoral thesis Linnaeus University.


Rosén, M. (2010) *Översyn av de nationella kvalitetsregistren - Guldgruvan i hälsooch sjukvården*


SWEDEHEART [online], available: http://www.ucr.uu.se/swedeheart/ [accessed 2014-08-21]


Thor, J. (2002) [Improvement of knowledge should be used when working for changes of health care], *Lakartidningen*, 99(34), 3312-4.


Woolf, S.H. and Johnson, R.E. (2005) The break-even point: when medical advances are less important than improving the fidelity with which they are delivered, *Ann Fam Med*, 3(6), 545-52.


