

Change agents and use of visual management tools in care process redesign

Implications on working conditions
for operative managers and
healthcare professionals

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Till Fanny-Maj och Ester

Förord

Jag rattar runt i min Fiat 500. Datainsamlingen är klar för dagen. Jag kör en sväng förbi domkyrkan, tittar till mammas barndomshem i Blåsbo, och kör vidare mot Salavägen för att stanna till en stund på ett äldreboende. Jag borde ha köpt med mig något, de där pepparkakorna som han tycker om, men som jag köpte fel sort en gång. Men det är viktigare att jag hinner dit överhuvudtaget, innan jag måste köra hem och hämta Fanny-Maj på förskolan. Jag möts av vänliga leenden i köket. ”– Hej, hej!” När jag kommer in på hans rum ligger han på rygg på sängen med händerna knäppta på magen och med halvöppen mun. ”– Hallå morfar, det är Anna!” Tyst en stund, sedan vänder han blicken mot mig och säger med sin mjuka, goa röst ”– Anna, gullhöna.” Min högra hand på hans höft och den vänstra på hans högra axel och så – hejsan! Nu sitter han på sängkanten. Och jag bredvid. ”– Kära Anna.” Han ser trött ut, men i de där ögonen finns ändå något plirigt och nyfikt. Han undrar hur jag mår. Han undrar vad jag gör just nu, för han vet att jag gjort lite olika saker senaste åren och nyss bytt jobb. Jag förklarar att jag har varit på sjukhuset och intervjuat chefer. Att jag ingår i en forskargrupp, att jag börjat forska och ska bli doktor. Han tittar länge på mig. Får en ännu lite djupare rynka mellan ögonbrynen, lägger sin varma hand på mitt knä, lutar sig mot mig och ler finurligt. ”– Har du belägg för det?”

Det är tillfälligheter som tagit mig hit. Jag minns fortfarande mitt första telefonsamtal med Jörgen Eklund när jag sitter på kontoret på Alfa Inredningar på Kungsholmen och sonderar terrängen för ergonomi-kurser. Tänk att en KTH-professor kan vara så himla trevlig och hjälpsam! Några år senare när jag fått ut min magisterexamen och min första dotter så söker jag en doktorandtjänst. Jag får träffa den professor som är projektledare för forskningsprojektet i vilket en doktorand ska ingå. Vilken energi, och vilken spännande person. Henne vill jag jobba med! Det blir ingen doktorandtjänst då... Men 6 månader senare när jag sitter som frustrerad och missförstådd projektledare på Döbelnsgatan så får jag ett samtal från professorn... ”– Hej Anna, det är Lotta Dellve. Trivs du där du är?”

Mariefred, Oktober 2018

Anna Williamsson

Abstract

Swedish healthcare has been subject to change efforts to increase efficiency in care processes. In the 2000-2010's lean production has influenced healthcare with change approaches such as visual management tools to increase patient flows and efficiency. Most previous research on lean healthcare has focused single hospitals or departments as case studies focusing lean production as successful for efficiency, or "mean" production affecting the work environment. Focus in this thesis though is instead on what strategies and approaches hospitals use in their care process redesign and their associations with working conditions and systems performance. This thesis' overall aim was to assess change strategies and change approaches at strategic and operative levels during care process redesign at hospitals, focusing organization of change agents and use of visual management tools, and its implications for alignment, working conditions and systems performance. Four studies were conducted at five Swedish hospitals, whereof three had lean-inspired change strategies. One qualitative cross-sectional study, one quantitative longitudinal study and two mixed method longitudinal studies are included in the thesis. Data was collected over three years with semi-structured interviews, structured interviews, staff questionnaires, manager questionnaires and photo documentation. Qualitative data were analyzed by content analysis. Quantitative data were analyzed with Wilcoxon tests, mixed models of repeated measurements, ANOVA, and linear regression models. Results showed strategies involve operative managers as change drivers, supported by change agent functions. Change agents' contribution to change depends on e.g. closeness to operative managers due to the change agents place in the healthcare hierarchy, and also clarity regarding roles and responsibilities in change. Change agents with a close collaboration with operative managers, have better preconditions to contribute to alignment between change strategies and change approaches. Hospital care units in the 2010's tend to use lean-inspired operative change approaches also without working with change strategies based on lean. Operative lean approaches show associations with positive working conditions for healthcare professionals. Visual management tools as change strategy has potential to support collaboration and communication within and between organizational levels and is considered to contribute to systems performance and alignment. Visual management tools as a cognitive job resource for operative managers show associations with e.g. lower burnout and more functioning collaboration as well as daily use among nurses show associations with cognitive, social and emotional benefits, perceived systems performance and buffering mental stress. Change agents and use of visual management tools are considered as contributors for operative managers' and healthcare professionals' sustainable work during care process redesign.

Keywords

change leadership, alignment, cognitive, job resources, job demands, collaboration, work systems, sustainable work

Sammanfattning

Svensk sjukvård har länge varit föremål för omorganisationer för att öka effektiviteten i vården. Under 2000-2010-talen har sjukvården tagit intryck av lean produktion och prövat olika lean-metoder för att förbättra effektiviteten i patientflöden. Forskning har studerat fram- eller motgångar vid enskilda vårdverksamheters införande av lean, och hur införandet påverkat effektivitet och arbetsmiljö. Det kvarstår ett forskningsbehov avseende förändringsstrategier och tillvägagångssätt som används i sjukvården, och hur sambanden mellan strategi, tillvägagångssätt och arbetsförhållanden ser ut över tid. Syftet med denna avhandling var att undersöka strategier och tillvägagångssätt, som används vid vårdprocessutveckling på sjukhus. Syftet fokuserade organisering av förändringsledare och användningen av visualiseringsverktyg, och undersökte vilken innebörd det har för arbetsförhållanden och upplevd effektivitet i arbetet för operativa chefer och sjukvårdsprofessionella, samt undersökte vilken innebörd det har för samsyn inom sjukhus gällande processutveckling. Fyra delstudier genomfördes vid fem svenska sjukhus, varav tre sjukhus hade lean som huvudinspiration vid vårdprocessutveckling. En kvalitativ tvärsnittsstudie, en kvantitativ longitudinell studie och två blandat kvalitativa och kvantitativa longitudinella studier har gjorts. Datainsamling genomfördes under tre år och bestod av; delvis strukturerade intervjuer, strukturerade intervjuer, medarbetar- och chefsenkäter och observationer. Kvalitativa data analyserades med innehållsanalys, och kvantitativa data analyserades genom jämförelser inom och mellan grupper med Wilcoxon-tester, mixed models of repeated measurements, ANOVA, och linjär regressionsanalys. Resultaten visade att förändringsstrategier ofta innebär att ansvar för att driva vårdprocessutveckling läggs på operativa chefer. Dessa kan ha stöd från förändringsledare vars möjligheter att stötta beror bland annat på den organisatoriska närheten till de operativa cheferna och på hur tydlig roll- och ansvarsfördelning man har i processutvecklingen. Förändringsledare i nära samarbete med operativa chefer, har bättre förutsättningar att bidra till samverkan mellan strategier och operativa tillvägagångssätt inom och mellan organisatoriska nivåer på ett sjukhus. Vårdenheter på 2010-talet använder lean-inspirerade tillvägagångssätt i sitt praktiska processutvecklingsarbete, även utan en sjukhusövergripande strategi att införa lean. Lean-inspirerade tillvägagångssätt visar sig ha samband med positiva arbetsförhållanden för sjukvårdsprofessionella. Visualisering har potential att stötta samverkan mellan strategier och operativa tillvägagångssätt, och därmed även kunna bidra till systemprestanda inom sjukhus. Visualisering kan tolkas fungera som arbetsresurs för operativa chefer, då de med stöd av visualisering i sitt dagliga arbete generellt har lägre utmattning och bättre fungerande samarbeten. Under- och sjuksköterskors dagliga användning av visualiseringsverktyg hade samband med upplevda kognitiva, sociala och emotionella fördelar samt något bättre upplevd systemprestanda. Visualisering visade även en tendens till att skydda mot mental stress. Förändringsledare och användning av visualiseringsverktyg tolkas som bidragande till operativa chefers och sjukvårdsprofessionellas hållbara arbete vid vårdprocessutveckling på sjukhus.

List of studies

This thesis is based on the following studies.

Study I

Dellve, L., Williamsson, A., Strömgren, M., Holden, R. J., & Eriksson, A. (2015). Lean implementation at different levels in Swedish hospitals: the importance for working conditions and stress. *International Journal of Human factors and Ergonomics*, 3(3-4), pp.235-253

Study II

Williamsson, A., Dellve, L., & Karlton, A. (2018). Nurses' use of visual management in hospitals – a longitudinal, quantitative study on implications on systems performance and working conditions. *Journal of Advanced Nursing* (In press)

Study III

Williamsson A, Eriksson A, Dellve L. (2016). Organization of change agents during care process redesign in Swedish health care. *Journal of Hospital Administration*, 5(3), pp.20-32

Study IV

Williamsson A. (2018). Operative managers' Job-Demands-Resources when redesigning care processes. (submitted manuscript)

Williamsson's contribution

Study I: Williamsson contributed in the writing and analyses process of the paper.

Study II: Williamsson is the corresponding author and designed, performed analyses and wrote the paper with contributions from co-authors.

Study III: Williamsson is the corresponding author and designed and wrote the paper. Williamsson performed the analysis in collaboration with co-authors.

Study IV: Williamsson is the corresponding author, no co-authors.

Williamsson co-planned and participated in collecting all data included in the thesis.

Summary of studies' aims and conclusions

| Study | Aim | Conclusion |
|-------|--|--|
| I | ...to investigate how implementation approaches for improvements of care processes in line with lean production, at strategic and operative levels, in health care organizations are associated with the consequences for working conditions and stress-related health among the employees | The care process redesign implementation strategies varied between the strategic and operative levels. There were associations between a higher use of lean approaches at operative level and increased work resources and decreased work demands. Physical, cognitive and mental stress-related symptoms were only weakly associated with strategic or operative lean initiatives. There was evidence of more beneficial or improved working conditions in relation to higher use of lean approaches at operative levels. |
| II | ...to examine the benefits provided by daily visual management tool use and explore its association to systems performance and working conditions among hospital nurses. | Nurses' daily use of visual management tools implied cognitive, social and emotional benefits. Implementation of daily use of visual management tools was also associated with positive working conditions and clinical engagement and was associated with small but positive differences in systems performance, as well as indicated a buffering effect on nurses' mental stress. |
| III | ... to explore role assignments and conditions of formally appointed change agents contributing to care process redesign in healthcare organizations. | Role assignment and organizing of change agents varied. A position closer to the operative levels, formalized and clarified responsibilities, earned legitimacy and timing supported adaptation and alignment of planned change, such as lean-inspired care process redesign. |
| IV | ... to a) describe hospitals' approaches to use change agents and visual management tools during care process redesign, and b) examine change agents and visual management tools as job resources for operative managers. | Change agents supporting operative managers as job resources in the early change phase associated with lower burnout, and positive organizational outcomes. Visual management tool use associated with lower cognitive demands, lower burnout, and positive organizational outcomes. |

Abbreviations in order of appearance

| | |
|-------|--|
| SOU | Statens Offentliga Utredningar (Swedish government official reports) |
| HFE | Human Factors and Ergonomics |
| NPM | New Public Management |
| OECD | Organization for Economic Co-operation and Development |
| IEA | International Ergonomics Association |
| HTO | Human-Technology-Organization |
| SEIPS | The Systems Engineering Initiative for Patient Safety |
| PDCA | Plan-Do-Check-Act |
| JD-R | Job Demands and Resources (model) |

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1 Introduction

This thesis concerns change leadership and its importance for sustainable work in acute healthcare. As lean production (lean) was typical as an important change management influence for hospitals in the early 2010's, lean implementations were studied, although lean itself is not the main focus in this thesis. The thesis contributes to research by highlighting the implications of practical choices and pursuing of change leadership approaches and tools, and in specific the use of change agents and visual management tools in care process redesign. Further the thesis elaborates on the alignment of change strategies and operative change approaches, and its contribution to the sustainable work for operative managers and healthcare professionals.

The Swedish public healthcare system in its current form has developed over the past 30 years to stay at proportionally the same costs related to the Swedish GDP while being exposed to numerous attempts of reorganization to improve efficiency. By changing demographics due to an increasing older non-working part of the population (Berlin & Adams, 2017), healthcare as a highly important part of the Swedish welfare system will be further put to the test. Like most of the Swedish public sector, healthcare has been and continues to be affected by industrial management concepts. Today's healthcare is influenced by and has repercussions from diverse industrial concepts and more or less ideology-based models adapted to the local context of a specific healthcare setting. In 2011 the physicians' branch magazine published a note saying way over a majority of Swedish hospitals claimed to have adopted lean in their improvement work (Weimarsson, 2011). Researching the effects of these kinds of management concepts is difficult, not only from a production efficiency perspective, but also from a human factors and work life perspective. There is diversity in how lean is translated into different contexts and settings, and even the definition of and what to implement when implementing lean is somewhat unclear (Brännmark et al., 2012; Pettersen, 2009). Since context matters in implementing change and the description of the lean interventions in previous research often are incomplete (Brännmark & Eklund, 2013; Kotter, 1995; Statens Offentliga Utredningar (SOU), 2016) it makes generalizations difficult. Very few change efforts succeed in changing and reaching sustainable change (Burnes, 2004; Kotter, 1995), which points to the importance of carefully choosing strategy when implementing change. Engaging managers and healthcare professionals to participate and contribute in the change process, is crucial in order to prioritize what changes to be done and to reach alignment, that is a common understanding of goals and strategies between different organizational levels and

processes contributing to the performance of and within the work system (Kotter, 1995; Larsson, Sjöberg, Vrbanjac, & Björkman, 2005; Semler, 1997; von Thiele Schwarz & Hasson, 2013). Alignment per se is also crucial for the sustainability of change and the sustainability of the work system (Kotter, 1995; Semler, 1997; von Thiele Schwarz & Hasson, 2013; Zink, 2014).

This thesis considers sustainability in work to be closely related to the perceived systems performance and working conditions of employees. The working conditions for Swedish healthcare professionals and managers on the operative level at hospitals are described as strained by, for instance, understaffing and an overflow of patients (SOU, 2016). Mental stress, physically demanding work environments, and pressure to work with improvements are part of everyday work at hospitals (Berntson, Wallin, & Härenstam, 2012; Holden, 2011; Skagert, Dellve, Eklöf, Pousette, & Ahlborg, 2008). This leads to healthcare professionals perceiving healthcare as insufficient, their working conditions as unsatisfactory and further to increased turnover (SOU, 2016). This in turn may affect not only the work environment for healthcare professionals, but the efficiency and the care quality and thus the systems performance for the healthcare work system as a whole. Previous research on implementation of change in healthcare is much focused on research-based health interventions following a program logic of an intervention (see for example Damschroder et al., 2009; von Thiele Schwarz & Hasson, 2013). Organizational changes in healthcare such as lean implementations however seldom have the characteristics of research-based interventions following a program logic (Brännmark et al., 2012; Pettersen, 2009). Case studies on lean in hospitals also show that the sustainability of change, the alignment of change, and the top management change strategies reaching the hospital floor, differs (Andreasson, Eriksson, & Dellve, 2016; A. Eriksson, Holden, Williamsson, & Dellve, 2016; Holden, Eriksson, Andreasson, Williamsson, & Dellve, 2015). Consequences are also likely to be different depending on what aspects or parts of lean that is implemented (Dellve, Eriksson, Fredman, & Kullen-Engstöm, 2013). This thesis is taking its departure out of a systems perspective within the research discipline Human Factors and Ergonomics (HFE) (Karlton, Karlton, Eklund, & Berglund, 2017) when examining what, and how care process redesign was pursued in Swedish hospitals in the 2010's. Theories within the HFE field are combined with theories regarding alignment as well as job demands and resources when implementing change in healthcare. Thus this thesis adds to research by having a three dimensional perspective of change affecting the hospital work system both vertically and horizontally. It elaborates on 1) strategic management change initiatives and 2) operative level change approaches, in specific the use of change agents and use of visual management tools, and 3) its contributions to alignment and associations to operative managers' and healthcare professionals' sustainability

in work. The studies were conducted at five Swedish hospitals of varying sizes and strategies for care process redesign, during the years 2012-2014 – a period in time when lean as management concept had influenced the Swedish public sector for over a decade.

1.1 Aim

This thesis' overall aim was to identify change strategies and change approaches at strategic and operative levels during care process redesign at hospitals, focusing organization of change agents and use of visual management tools, and its implications for alignment, working conditions and systems performance.

This was pursued by conducting four studies included in the thesis that together answer the following research questions:

- A. What are the change strategies chosen by strategic managements at hospitals, and further what are the change approaches pursued at the operative levels, during care process redesign?
- B. How do operative change approaches associate with perceived working conditions and systems performance for healthcare professionals during care process redesign?
- C. What are the preconditions for change agents to contribute to the alignment of top management change strategies and operative change approaches within hospitals during care process redesign?
- D. How are operative managers' use of change agents and use of visual management tools associated with perceived working conditions for operative managers in care process redesign?

Table 1.

The studies in which each research question was investigated.

| Research question | Study I | Study II | Study III | Study IV |
|--------------------------|----------------|-----------------|------------------|-----------------|
| A | X | | X | X |
| B | X | X | | |
| C | | | X | X |
| D | | | | X |

1.2 Delimitations and definitions

The studies included in the thesis concerns the organizing of Swedish acute care hospitals undergoing care process redesign. When referring to organizing of healthcare organizations it entails the organizing at different organizational levels of a hospital, including the county council or region wherein a certain hospital is placed. It does not, for example, include primary care or care given by municipalities within the county council or region. Healthcare professionals and managers from different organizational levels are contributing informants in the thesis, while patients are not. When referring to healthcare professionals it includes assistant nurses, registered nurses and physicians while e.g. physiotherapists, occupational therapists and medical secretaries are not included. When referring to operative managers it includes first line managers and second line managers. A first line manager is managing a certain care unit, while a second line manager is managing a group of units and their respective first line managers. Thus operative level means e.g. decisions or actions taken closer to or at the hospital floor. Management on the hospital or county council level is referred to as top management or strategic management, and strategic level thus means decisions or actions (on e.g. implementing lean) taken at the upper level in the hospital organization. Care process redesign is here defined by a top-down initiated organizational change pursued with the goal of increasing the efficiency of care processes in healthcare, e.g. the pace of patients moving within the hospital while simultaneously receiving high quality care. Care process redesign is described further in the background. A healthcare work system where the interactions between and within the organizational levels are well coordinated with high care quality, efficiency and work environment is considered as a work system with high systems performance. The term work system and systems performance is also further elaborated on in the background. When using the term ‘change strategies’ it is considered as the way strategic management plans for and organizes the basis for care process redesign at a hospital, e.g. using lean as major inspiration or arranging change management education for managers. And when using the term ‘change approaches’ it refers to the methods and tools for care process redesign (e.g. different lean tools such as visual management tools) pursued at the operative levels at a hospital.

2 Background and theoretical framework

2.1 Governance in Swedish healthcare

A functioning and effective healthcare is an important part of the Swedish welfare (SOU, 2016). Swedish healthcare is divided between county council (or regional) responsibility for primary and hospital healthcare, and municipality responsibility for elderly care and social care (SOU, 2016). Swedish healthcare is financed by public means, i.e. mainly county council taxes. Between 1950 and 1980 healthcare increased its part of the Swedish GDP from 3% to 9% (Norbäck & Targama, 2009). After 1980 the healthcare tax-levels have fluctuated slightly over the years, but the percent of GDP has remained constant. To keep tax-levels at a more or less steady state, focus has been on reducing healthcare costs, and thus challenging the way healthcare is organized. The new public management (NPM) reforms made its entrance in the OECD (Organisation for Economic Co-operation and Development) world in the 1980-1990s and is said not be seen as a single management concept, but a set of principles influenced by different industrial management concepts that should be possible to evaluate (SOU, 2016). Some of the characteristics of NPM are; practicing tight cost control, being structured in a “flat” way, seek to use market mechanisms, i.e. introduce competition between public providers or privatize services previously undertaken by the state, being performance driven by using performance-related systems, and increasing control of public means (Pollitt, 2000).

During the 1990s the industrial concept lean production (lean) sprung from the Japanese Toyota Production System also made its entry as management concept in various industries, and in time the public sector. The characteristics of lean in industry have its similarities with NPM but while NPM puts emphasis on resource efficiency as means of cutting public costs, lean upholds flow efficiency as the key to minimize time waste, shorten production times, and just-in-time production steered by customer demands (Liker, 2004).

2.1.1 Healthcare as a sustainable work system

The Human Factors and Ergonomics (HFE) research field has multidisciplinary roots and originates to a great extent from the socio-technical systems theory where HFE naturally should be considered in the design of work systems (Carayon, 2006; Karlton et al., 2017). The research area is defined by the International Ergonomics Association (IEA) as follows:

“Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.”

(IEA, 2016)

To understand the performance of a work system it is important to understand how the different sub-systems Human, Technology and Organization affect each other, referred to as the HTO-concept by Karlton et al. (2017). Karlton and co-authors (ibid) argue that the human sub-system must be considered on equal terms as the technical and organizational sub-systems. The interaction between these sub-systems must further be understood, as the sub-systems are all inseparable in a certain activity that affects the overall systems performance (including the well-being of the work force) (ibid). The HTO concept thus broadens the perspective from looking at isolated factors, to focusing interactions between sub-systems that may be inhibiting or facilitating improvements or developments of a work system (Eklund, 2003; Karlton et al., 2017; Rollenhagen, 1997).

The design of a work system can have positive effects in terms of high-quality output and employee well-being and motivation, or have negative effects such as low-quality output and high stress load on employees. According to the HFE model of “balanced work organizations”, an organizational system could also be seen as consisting of five elements: the individual, tasks, tools and technologies, physical and social environment, and organizational conditions (Carayon & Smith, 2000). To reach balance and goals, as well as learning within an organization, continuous change with the participation of the organization’s members is necessary (Carayon & Smith, 2000). The systems engineering initiative for patient safety (SEIPS) combines different HFE models and healthcare quality models and presents how work systems (including the five elements of the balanced work organization (Carayon & Smith, 2000) effects the pursuing of processes in healthcare (i.e. care processes and other processes) and thus the outcomes (i.e. quality of care, patient safety, employee and organizational outcomes) (Carayon et al., 2006). The HTO concept is also used to analyze the effects of a balanced interaction between different hierarchical levels in health care systems in terms of the interaction between the sub-systems humans, technology and organization and its importance for good systems performance (Karlton, 2014).

The interaction between different organizational levels within an organization can be interpreted as the collaboration and communication within the work system and when it includes communication and understanding of common goals it may further support systems performance. But there is also a risk of the interaction being malfunctioning or not working in the direction towards the organization’s goals or visions, and thus interaction could inhibit e.g. change or improvement initiatives. Alignment theory connected to systems theory is described by Semler (1997) as the extent to which strategy, structure, and culture is combined to create a synergistic whole making it possible to achieve the goals in the organization’s strategy. Align-

ment within the organization is reached when the organization is successful in summoning its members, processes and structures into a stable common understanding of the vision and concrete goals of the organization (von Thiele Schwarz & Hasson, 2013). Alignment creates a stability which aims at achieving the organization's target outcomes (ibid), and which presupposes well-functioning interactions between and within the organizations levels, such as e.g. certain care processes involving different medical specialties and departments within a hospital. Alignment theory further describes alignment as vertical, horizontal, or diagonal. Vertical alignment is reached when the organization's members at all levels in the hierarchy knows what and why a certain behavior is needed in order to contribute to the common goals of the organization (ibid), i.e. common understanding between strategic and operative levels regarding goals and visions in a hospital. Horizontal alignment is described as the alignment between different processes within a work system (ibid), e.g. collaboration between certain hospital departments with the aim of shortening a patient's time from diagnose to treatment. And diagonal alignment can be seen as a mix of horizontal and vertical alignment where the superior executives in their behavior act as role models for the lower levels in the organization (ibid). Diagonal alignment thus means that for instance the strategic management of a hospital sets a good example in work which further facilitates the wanted behavior or initiative among peers and subordinates at the lower hierarchical levels (the operative level) in the hospital (Dellve, 2018).

Sustainable development was described by Brundtland as development meeting the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). Sustainable work systems thus mean to regenerate all resources utilized in the system, and that the development of resources in one part of the system is not on the expense of exploiting the resources in another part of the system (Zink, 2014). Berlin and Adams (2017) suggests the following for work places that are aiming towards social sustainability; 1) attract and stimulate individuals, 2) Integrate and support groups, and 3) retain and give recognition to teams (p. 253). Based on Docherty and co-authors' (2009) assumptions of personal development through work being a human right, human and social sustainability is one of the foundations of economic sustainability and a prerequisite for securing ecological sustainability. Accordingly, sustainable work systems (or organizations) are not 'eternal structures' but striving to reach a higher level of complexity (i.e. the degree of which resources are integrated and able to respond unified to meet challenges) while maintaining its functional capability (Kira & van Eijnatten, 2008). Thus sustainable change as described in this thesis does not refer to the organization being fixed in its new form after changing, but proceeding to evolve as a changeable sustainable work system. And further in this thesis alignment is considered to be a common understanding and united direction between different organizational levels in the organization to strive for sustainable change. Consequently alignment is considered closely related to systems performance as it is described for example in the SEIPS model (Carayon & Smith, 2000) or the HTO concept (Eklund, 2003; Karlton et al., 2017; Rollenhagen, 1997).

Accordingly change in healthcare depends on alignment in order for healthcare to be a sustainable work system.

2.1.2 Healthcare stakeholders

The healthcare stakeholders are described by Glouberman and Mintzberg (2001) as representing four different logics in the healthcare work system. The *Community* logic entails healthcare politics and funding, i.e. the state-, county council-, or community-level management (here known as top management or strategic management at strategic level). The *Control* logic entails e.g. hospital prerequisites and hospital-level management (here known as operative managers at the operative level). The *Cure* logic entails the medical responsibility for patients, that is the physicians, and the *Care* logic entails the nursing responsibility, the registered nurses and assistant nurses working close to the patient at the operative level (ibid). The second line managers (clinic or department managers) are considered being closer to the *Cure* logic, while the first line managers (unit managers) are closer to the *Care* logic.

2.1.3 Managing and/or leading in healthcare – the control logic

The stakeholders representing the four different logics may have a common explicit goal of delivering safe and efficient healthcare to patients, but have their different views on how to prioritize and what to focus on in everyday work (Glouberman & Mintzberg, 2001). Differences between managements' and professionals' opinions (and even within different professions) on what quality in care entails raises challenges in translating change concepts and models from strategic levels to operative levels' local contexts (Wiig et al., 2014). Commitment to change and willingness to accept a strategy or innovation to be used within an organization has to do with its employees' view of how it will fit and fulfill certain goals in line with their own values (Cameron & Green, 2012; Klein & Sorra, 1996). It also depends on the implementation climate within the organization; the ensuring of employee skills, providing incentives for engaging and disincentives for not engaging and the removing of obstacles when engaging in implementation (Klein & Sorra, 1996). It has been shown that hospital managers that develop a supportive infrastructure embracing four complementary enabling dimensions have been more successful in enabling quality improvements at the clinical level (Karlton et al., 2018). A prerequisite for employees' engagement would be giving them appropriate conditions for engaging by having the time to familiarize themselves to the new innovation or concept, and to allocate time for objectives, and also an understanding of how to effectively contribute to it. This sort of alignment is conceptualized as the individual's 'line of sight' (Boswell, 2006). The understanding of one's contribution to fulfilling the organization's objectives is highlighted as important not only for alignment, but also for the well-being of staff (Boswell, 2006, Dellve, 2018). One part of

being manager is thus to provide opportunities for employees to become followers, so that the manager can act as a leader.

Management research describes the term ‘management’ as an organizational assignment, a dot in the organization chart or hierarchy, and being a manager would thus mean to hold a position assigned to monitor, command and control progress within an organization (Jackson & Parry, 2011). ‘Leadership’ on the other hand is described as influencing others to work towards a common goal and drive change in a commonly wanted direction, and thus a leader would be more visionary, creative, strategic and able to attract followers (Larsson et al., 2005; Yukl, 2009). Management and leadership related to change can be seen as follows: Change management being the formal management with the mandate to make decisions regarding change processes, while change leadership is what is needed to gain followers to change the organization in the wanted direction. Change management and change leadership are different things but equally important for a change to succeed and be sustainable (Gill, 2002). Managerial conditions such as planning, goal-setting, time, knowledge and competence are equally important as is the right leaders being in place to lead the way and bring people with them to spread the word (Gill, 2002). Change leadership can be seen as involving two roles: the instrumental; and the charismatic (Graetz, 2000). These two roles can be understood as a mix of management and leadership where the operational and technical mind-set meets the strategic, visioning and value-based mind-set (Graetz, 2000). First line managers within the hospital setting has a special role of both handling strategic and structural tasks as well as keeping up with the clinical work and being part of the clinical entourage to keep legitimacy among healthcare professionals (Dellve & Wikström, 2009). The hospital setting though gives little time for first line managers to get regular support from upper management levels and this may lead to stress (Dellve & Wikström, 2009; Tengelin, Arman, Wikström, & Dellve, 2011; Wikström & Dellve, 2009) and other problems within the working environment, but could also give rise for ideas of how to improve and support managers’ development work.

In the light of previous research on healthcare managers’ working conditions in relation to the four different logics in the healthcare work system (Glouberman & Mintzberg, 2001) there seems to be a problem. And it seems to be starting higher up in the hierarchy in how well hospital managers (control logic) respond to financial and quality challenges (demands from community logic) and succeed in supporting change management through alignment between the community logic and the cure and care logics (Burnett et al., 2016; Karlton et al., 2018). The operative managers representing the control logic are expected to be part of the change management as they are having a formal management position. But they are at the same time constrained by budget and policy that is governed by stakeholders representing the community logic. Operative managers that manage to stay close to and have legitimacy among healthcare professionals could have great importance not just for change management but also for change leadership during care process

redesign. The question though is if the operative managers have the preconditions to be change leaders when their mandate as change managers is limited by constraints from the community logic, and by the operative managers' own working conditions.

2.1.4 Co-leadership – the cure logic and the care logic

The law of codetermination (in Swedish: medbestämmandelagen – MBL) was legislated in 1976, and easily put it increased the employees' influence over decisions on how to govern and lead work at the workplace (Landsorganisationen i Sverige (LO), 2018). This law is an important part of 'the Swedish model' which is the foundation of the Swedish welfare system and has the goals of prosperity, equity and gender equality (Ministry of Finance, 2017). The development within management has over the last 40 years in Sweden gone from increased employee power and democratic leadership in the -70's, highlighting the importance of employee engagement, motivation and initiative to create prosperous companies in the -80's, to scale down the hierarchical layers in organizations and instead create flat organizations with fewer management levels and increased responsibility in functional teams in the -90's (Tengblad, 2010). A shared co-leadership where employees are taking part of decision making and where there is a shared responsibility in developing the organization is described as a more optimal way of organizing. The manager is not described as rationalized but has a different role executing a coaching (Andreasson et al., 2016) and servant leadership (Dellve, Andreasson, Eriksson, Strömberg, & Williamsson, 2016; Gunnarsdóttir, Edwards, & Dellve, 2018), supporting the employees by e.g. taking the healthcare professions' values and needs into account when prioritizing. Leadership quality has also been highlighted as important for social capital which in turn is closely related to healthcare professionals' general work engagement but also specific engagement in clinical improvements (Strömberg, 2017).

While research shows that nurses and physicians have a positive view on improvement work, their incentives to engage in improvement work differs (N. Eriksson et al., 2016). But although these professions' attitudes are positive the working conditions for healthcare professionals as well as for operative managers makes it hard to combine the routine of patient work or managing with improvement work. The need to 'control and evaluate' which followed NPM is said to be the root cause to the administrative burden in healthcare (Pollitt, 2000; SOU, 2016). Swedish healthcare professionals testifies about an increased work pace, less time for patient work and more time spent on administrative tasks (SOU, 2016). Meanwhile operative managers work as shock-absorbers being pressured by strategic management to initiate improvements and drive change, and by healthcare professionals on the operative level focusing on patient work (Dellve & Wikström, 2009; Skagert et al., 2008). Thus operative managers asks for mentorship and support in their roles to handle conflicting logics (Wikström & Dellve, 2009).

2.2 Strategies and approaches to change healthcare

2.2.1 Healthcare change management and change leadership

To succeed in changing an organization you need employees that contribute to change (Kotter, 1995), and applied to healthcare the contribution is very often done on top of ordinary every-day tasks (SOU, 2016). The stakeholders of the Swedish healthcare are obliged by Swedish law to participate in the development of the healthcare system, as well as they are obliged to participate in research (SOU, 2016). However, as highlighted in the SOU report “Effective healthcare” (2016) there is no explicit connection between the obligation to participate in developing, and the obligation to participate in researching healthcare. According to the report, the formulation of the legislation is unfortunately passive since it points towards the county councils or municipalities as participators rather than responsible stakeholders, and thus the responsibility for initiating change is unclear (SOU, 2016).

Change management literature describes organizational change as either planned, emergent or a mix of both (Burnes, 2004; Bamford & Forrester, 2003; Lewin, 1947). The idea of planned change was formulated by Lewin in the 1940’s. Lewin meant that in order to change the organization (i.e. the members of the organization) it needs to go through three phases were a) the organization “unfreeze” and previous routines and principles of how business is run is let go, b) the organization goes through change were new routines are set from a fixed plan of implementing the new ideas, and c) the organization “refreeze” and the changes are fixed within the organization (Lewin, 1947).

The Consolidated Framework for Implementation Research (CFIR) analyzes the implementation of an intervention by dissecting five domains; intervention characteristics, outer setting, inner setting, characteristics of individuals and implementation process (Damschroder et al 2009). The outer setting is described as external conditions such as policies, cosmopolitanism and peer pressure affecting the implementation while the inner setting is described as the structural characteristics, culture and implementation climate of the organization. The implementation process constitutes the barriers and facilitators in the planning, engaging, executing and evaluation of the implementation (Damschroder et al 2009). The evaluation itself is divided into implementation outcomes, i.e. adoption and sustainability, and client outcomes, i.e. assessing whether the intervention has reached its goal in for example improving working conditions for healthcare professionals and managers (Brownson, Colditz, Proctor, 2012). This describes a more or less ideal way of implementing planned change according to an evidence-based intervention and which when it comes to organizational change interventions is unlikely to work. Change management research following Lewin show that his notion of planned

organizational change did not take into account the fact that change seldom comes without resistance and following the ideal fixed plan. As contrast the following change management research meant that creation of organizational meaning is an emergent process that gradually forms its goals and action plans according to prioritizations and needs within the organization (Bamford & Forrester, 2003; Esain, Williams, & Massey, 2008).

Change process theory as described by Van de Ven and Poole (1995) is divided into four ideal-type developmental theories; life-cycle theory, teleological theory, dialectical theory and evolutionary theory. While the two first mentioned (life-cycle and teleological) operate on a single entity, the two following (dialectical and evolutionary) operate on multiple entities (ibid). The life-cycle theory describes change as evolving through a pre-defined natural logic where change stages cumulates over time and matures. Change is described as latent within the entity, each stage of change is a natural sequel to the prior stage, and each stage is necessary to take in a fixed order to reach the optimal end result. The teleological theory is described as goal-monitored where the single entity defines the goal or end-state, and the entity itself works purposeful towards that certain defined goal, and step by step monitors the progress to reach the goal. The dialectical theory builds on the notion of organizations consisting of counterparts, colliding forces and events, and change has its origin in at least two parties' interacting when synthesizing a thesis and an anti-thesis to end up in a common compromise of how to proceed change. The evolutionary theory builds on the notion of organizations evolving continuously by cumulative random events, variations, selections and retentions (ibid).

Hospitals implementing sparsely researched management concepts are likely to start off with a notion of a planned change that sooner or later emerges to an iterative change process (A. Eriksson et al., 2016). The introduction of a planned change with strong influences from industry reminds of the implementation of an innovation, and the emerging change progress of implementing management concepts can be compared to the acceptance of and use of innovations in new settings. Thus parallels can be drawn between change research and innovations research. The common way of introducing medical innovations to practice is to design and conduct a randomized controlled trial to be sure to implement an innovative new drug as an evidence-based intervention (Brownson et al., 2012). Following the conventions of implementing evidence-based interventions has some resemblance to life-cycle theory when following a fixed plan, i.e. the program logic of the intervention (Van de Ven & Poole, 1995). Randomized controlled trials of organizational changes are for many reasons impossible to conduct. So when implementing organizational change it makes it hard to stay true to the conventions of how to implement innovations or interventions, and organizational change cannot be seen as a single entity change (as change according to life-cycle theory). No fixed recipe on organizational change can fit all organizations and Lewin's ideas of planned change can be considered hard to apply in care process redesign. Thus a certain extent of trial and error is to be expected, and organizational change in this thesis is

considered to be based as a whole on multiple entity dialectical theory (Van de Ven & Poole, 1995).

Organizational change is said to have a high risk of failing (Burnes 2004; By, 2005). Change failure when implementing new innovations can have many underlying causes such as social factors in the organization, or the innovation not fitting the target (Klein & Sorra; 1996). Both the social factors and the innovations fit-to-target should therefore be dealt with when implementing change. To fit-the-target, you also need insight in the organization and bridging between the strategic level and the operative level in the organization (Dellve, 2018; Karlton et al., 2018). Adaptability within an organization is defined as a sensitivity and tolerance for different views within the organization, the willingness to experiment and tolerate failure, and further being able and willing to respond quickly to changes within the organization (Gill, 2002). Considering the oft closed chambers when strategic management formulates a planned top-down change strategy by influence from a certain management concept, certain elements of single entity life-cycle theory are likely to be seen. By studying industry and other good examples of e.g. hospitals that has implemented the same concept, the methods and tools from the concept are being adopted to be implemented at the own hospital. As mentioned before, change seldom comes without resistance though, and strategic management is then forced to have a more teleological approach when formulating their change strategy. For a change strategy to be adaptable to needs in the organization strategic management further needs a dialectical approach when launching the change strategy to the employees. Also, to enhance learning and innovation during change the organization need a balance between structure and creativity, which depends on different critical factors, i.e. that the strategic management gives opportunities for risk taking and time for idea generation (Ekvall, 1996). Opportunities like this can be hard to find in hospitals were the work pace is high and were taking risks can have ethical constraints. This could make it hard to allow dialectic emergent change, and adaptation of the change strategy to a local context.

In By's (2005) review and synthesis of Kanter's, Kotter's and Luecke's steps towards successful organizational change the similarities between the researchers "change recipes" are highlighted. Emergent change involves the organization members in various ways from creation of a vision, to creating a sense of urgency, communication in an honest way, and develop enabling structures and be open for monitoring and adjusting the strategy to problems occurring in the organization (By, 2005). Similar to the innovation research highlighting the need to take time for idea generation the creation of a vision needs time to capture the true "common sense" of the change which is central in the communication between leaders and employees (Kotter, 1995; Moon, 2009). Studying employees' work motivation at primary care units implementing a financially driven national reform, researchers found that the work motivation of staff was influenced by individual, organizational and socio-cultural factors (Kjellström, Avby, Areskoug-Josefsson, Andersson Gäre, & Andersson Bäck, 2017). Kjellström and co-authors (*ibid*) concluded that there is

a need for leaders to integrate the reforms with the employees' values and inspirations, and further support employees in translating organizational goals or visions into practice. The perceived sense of urgency (Kotter's first step) or actuality of the change vision, from the employees' point of view, is crucial for the leaders' empowering of others to act on the vision (Kotter's fifth step) and for the leaders to gain followers at all (By, 2005; Kotter, 1995). Later change management research supports this, meaning that "(...) 'leadership' without 'management' is insufficient for optimal organizational performance" (Jackson & Parry, 2011, p33).

2.2.2 Lean production, process-orientation and care process redesign

In the late 1990's and further in the 2000's the principles of value flow, flow efficiency, cutting waste and focusing the customer also reached the public sector including healthcare. One of the cornerstones in lean healthcare is the notion of resource efficiency working against flow efficiency (Modig & Åhlström, 2011). NPM principles claimed that being efficient in the use of resources within the organization, meant e.g. making sure the surgeon is scheduled in a way that the surgeon's expertise is fully used when being scheduled. Lean healthcare points to resource efficiency having negative effects on the efficiency of the patient flows, e.g. the patients wait in line to go to surgery (Modig & Åhlström, 2011). The healthcare system of for example a hospital is historically organized in medical specialties (silos) and the healthcare economy is arranged accordingly (Norbäck & Targama, 2009; SOU, 2016). Thus the resource efficiency is supported by the economy following the specialty and not the patient. A patient's way from diagnose to treatment, e.g. from triage at the emergency department, via radiology and surgery, to intensive care can be described as a process moving horizontally in the healthcare system, across different organizational silos in the hospital. Lean principles adapted to the healthcare context is said by its proclaimers to be the road to salvation, putting the patient in the center and focusing value-adding time for the patient and reducing waste (such as waiting times) to increase the horizontal flow efficiency (Modig & Åhlström, 2011).

The typical lean method or tool "value stream analysis" can be used as a method to examine and describe a certain patient or diagnose group's care process within a hospital (Liker, 2004). To minimize waste and bottle-necks found in the value stream analysis and increase value flow and flow efficiency for that certain care process, the care process needs to be redesigned. Lean is talked of as a "philosophy" or "state of mind" running through the whole value-chain in the production (Liker, 2004). But lean is also known as a set of methods or tools to increase efficiency in production. A top management (county council or hospital management) can choose to use lean as main change strategy in care process redesign. Hospitals can further have their different ways of implementing this change strategy within the hospitals, and then choose to use different change approaches for their implementation (A. Eriksson et al., 2016). Further on the operative level, certain lean activities

or approaches can be used either with or without a connection to the top management's change strategies (Andreasson et al., 2016).

Examples of lean approaches are among others:

- Continuous improvement – e.g. by using a plan-do-check-act (PDCA) structure to follow the progress of certain improvement suggestions
- Value stream mapping – mapping the value adding and non-value adding activities in a certain process in order to reduce non-value adding time or resources (i.e. reduce waste)
- Rationalizing – e.g. eliminating waste by removing middle hands in a value stream
- Standardization – cleaning up and structuring a work station or certain work process
- Values – working with the company core values and focusing customer value
- Team development – developing the work of a certain team by engaging the team to contribute and participate in developing their own work
- Visual management – visualizing production flow, mistakes and standards in order to support understanding and learning in work

(Liker, 2004; Womack & Jones, 2003)

Working with different lean approaches on the operative level without corresponding to and being subsidized by a lean change strategy set higher in the management hierarchy is labelled as “tool-box lean” (Brännmark et al., 2012; Pettersen, 2009). Some researchers claim that lean tends to have detrimental effect on work pace, workload, work intensification and stress when used in industry (Brännmark & Håkansson, 2012). Others uphold the potentials of lean healthcare where lean methods and tools can offer ways of clarifying work processes, develop a shared understanding among healthcare professionals which in turn would support communication, and define care processes which would create value for its customers (i.e. patient) (Mazzocato, Savage, Brommels, Aronsson, & Thor, 2010). Little is known though about the associations between lean healthcare and working conditions in the healthcare work system (Dellve et al., 2013). Research on lean hospitals highlights the potential positive effects lean could have on both efficiency and working conditions but still there is a lack of empirical longitudinal research supporting this relation (Hasle, Nielsen, & Edwards, 2016; Holden 2011). International and Swedish research concerning ways of implementing and organizing lean healthcare shows that a common way of doing so is by using different kinds of visual management tools (Holden, 2011; Mazzocato, 2010). There is also a lack of research on the possible effects from certain lean tools (e.g. the ones mentioned above). Against the conviction of the “true lean believers” that lean cannot be defined by its tools or methods or that these tools and methods cannot be separated

from one another, there may be a possibility that some lean approaches alone can have impact on workers' health and working conditions (von Thiele Schwarz, Stenfors-Hayes, Augustsson, & Hasson, 2013). Research on lean implementations in the public sector has for example shown value stream mapping as well as standardization to be associated with employees' engagement in development, and job satisfaction. That is if there was an underlying balance between job demands and job resources at the work place (Lindskog, 2016). To the worse visual follow-up boards used in combination with higher job demands inhibited both managers' and employees' job satisfaction (ibid). Value stream mapping has also been shown to be associated with work-related flow, performance and conditions for innovative learning (Fagerlind Ståhl, 2015). Further Fagerlind Ståhl (ibid) means that these positive associations with value stream mapping are explained by the individuals at the workplace being gathered around a collective activity. The analysis conducted in a value stream mapping activity is often displayed with some kind of visual management tools (Liker 2004). This opens up for further questions regarding whether it is the visualizing part in the value stream analysis that is positively contributing to the employees' working conditions.

The value of defining lean is important in the lean research context, since the use of lean as label when redesigning healthcare sometimes tends to end up in conceptual confusion (Brännmark et al., 2012). Research on lean implementation and effects of lean have dealt with questions regarding what lean actually is, what it actually stands for, what "true" lean is and how the level of lean can be measured. Running towards the end of the 2010's lean as management concept is more seldom mentioned in healthcare. As time passes new management trends comes and goes overlapping each other and questions are raised concerning whether it is the content of the concept that is important or if the implementation process itself and change approaches is what matters for working conditions in healthcare. When researching the working conditions and the possibilities for healthcare professionals to contribute to change, there is a need to lift one's eyes from the conceptual confusions of different management concepts (including lean) and focus on exploring the content of what is implemented and how, when redesigning healthcare. Focus in this thesis is thus not set on describing the degree of how much or how right lean or not lean a hospital is. Focus is set on the change strategies and approaches of hospitals working with care process redesign at a time in history when lean was a major inspiration for, and highly influenced the healthcare system.

2.2.3 Organizational means of increasing alignment

When assessing change strategies of hospitals, this thesis takes on a holistic view on change assessing the strategic management choices of strategies and vertical alignment of strategies within a hospital. In order to achieve change there is also a need to understand the prerequisites for operative levels to engage in change and further understand horizontal alignment in a hospital.

With top management having the utter responsibility for change there could be a risk for a predominant focus on planned top-down initiatives, rather than emergent and opportunistic bottom-up initiatives from the operative levels. The encouragement of bottom-up initiatives in the organization and the distribution of change responsibility within the organization could mean increased job demands (Bakker & Demerouti, 2007) pressuring the managers at the operative levels into taking responsibility for change.

The job demands and resources-model (JD-R model) by Bakker & Demerouti, (2007) categorizes aspects of the work environment as job demands (e.g. emotional or cognitive), and job resources (physical, social or organizational). While job demands are predictors of burnout, job resources can balance job demands and thus prevent burnout (Bakker, Demerouti, & Sanz-Vergel, 2014). Burnout can be defined by exhaustion, disengagement and inattentiveness, and its antecedent is work engagement defined by vigour, engagement and attentiveness (or absorption) (Hultell & Gustavsson, 2010). The JD-R model further suggests that work engagement as motivation, and burnout affect the outcomes of an organization (Bakker et al., 2014). As job demands increase in a changing work environment and the decision latitude is kept at a constant somewhat low level, the job strain in the healthcare work system increases. And according to Karasek (1990) the low decision latitude combined with high job demands increase the risk of an unhealthy work environment. The JD-R model (Bakker & Demerouti, 2007) as well as the SEIPS model (Carayon et al., 2006) and the HTO concept (Karlton et al., 2017) connects working environment issues within the work system to the efficiency and overall systems performance, which in the healthcare system reflects the quality of treatment, care and safety for the patients. The patients are not heard in this thesis but the healthcare professional representing the care logic are (Glouberman & Mintzberg, 2001). Further the care logic entails the professionals working closest to the patients and guarding the patients' interests.

Change agents – change strategy and change approach

According to Kotter (1995), one of top managements' biggest mistakes when initiating change is to disregard emotions of the organization members (or employees) and not take into account the likely initial or prolonged resistance that follows with a force of change and which may affect different organizational outcomes (Kotter, 1995). Resistance among the healthcare professions is a powerful inhibiting force during change in healthcare. When looking at healthcare professionals' engagement in proposing suggestions for improvements it has shown that lack of engagement partly has to do with conflicts, ambivalence, lack of interest over time and that the healthcare professionals prioritized other time-consuming tasks (Greenfield, Nugus, Travaglia, & Braithwaite, 2011). Physicians and nurses have different views of how and why to engage in improvement work (N. Eriksson et al., 2016). A central challenge for managing change in the healthcare sector has in several studies been described in terms of competing logics (managerialism versus professionalism) due to strong healthcare professional groups' resistance to change

(Choi, Holmberg, Löwstedt, & Brommels, 2011; Lindgren, Bååthe, & Dellve, 2013). Second line managers are often the managers of physicians. And physicians as a professional group show interest in improvement work (N. Eriksson et al., 2016), but have tended to avoid engaging in organizational development work that does not contribute to their own professional fulfilment (Lindgren et al., 2013). Since second line managers very often also are physicians themselves and identify themselves first and foremost as physicians and not as managers (Andersson, 2015) their representing of the cure logic comes before their representing of the control logic. There could be a risk that these second line managers perceive engagement in development work as hindering the fulfilment of their managerial duties. And the engagement in improvement work is thus coloured by them being physicians (N. Eriksson et al., 2016).

A top management that is perceived as distant to the operative level and uncomprehending of reality on the hospital floor could encourage influential individuals (e.g. healthcare professionals) to the empowering of others to react rather than act on the vision (Choi, Holmberg, Löwstedt, & Brommels, 2012; Hendy & Barlow, 2012; Holden et al., 2015). Top management that works with continuous follow-up and evaluation on results at the operative levels may be perceived by operative managers as responsive and interested, but could also be perceived by operative managers as controlling and increasing the managers' administrative burden (i.e. cognitive or emotional job demands).

Using the JD-R model as a theoretical lens in this thesis, different key functions in healthcare can be seen to serve as organizational or even social job resources for operative managers. The change management literature differs in terminology concerning the formal and informal change supporting leaders, and also their power within their position, and legitimacy among healthcare professionals and managers (McCormack et al., 2013). Both devotees and opponents naturally come out of any change effort (Gill, 2002; Kotter, 1995) but not just anyone turns out to be an informal leader. Someone who masters methodological skills of a certain change strategy or concept is described as the change agent, which promotes, drives and facilitates change and thus supports adaptation and alignment of the change strategy (Damschroder et al., 2009; Esain et al., 2008; McCormack et al., 2013). Lunenburg (2010) concludes in a literature review that a change agent's success in driving and promoting change among other things depend on the change agent's hemophily, empathy, and proximity. In other words how alike the change agent and the employees are, how skilled the change agent is in understanding other people's emotions and points of view, and the physical and psychological closeness between the change agent and the employees in the organization. Further the change agent should have the promoting characteristics (i.e. acting as a change role model and thus being able to earn respect and credibility) needed to fit the organizational context and the culture in change (McCormack et al., 2013). The 'champion' on the other side is in contrast to the formally assigned change agent described as an experienced professional, which is a regular part of management or

staff that is committed to the top management's change strategies and who is eager to influence colleagues (Damschroder et al., 2009; Greenfield et al., 2011). Without a formal change managing assignment, the champion could be seen as an informal change leader, someone who has the power of either being a formal leader as a manager, or being an informal change leader with legitimacy among his or her own peers (i.e. the own professional group) (Greenfield et al., 2011). In this thesis the change agent is described to be formally assigned but not a manager, the function could be seen as that of a formal leader without the power of being a manager.

The notion of organizational change driven by a top-down or bottom-up approach, is challenged by Nonaka (1994) describing a third approach, the middle-up-down approach. Unlike the other two approaches where the leaders act as commanders or sponsors respectively, the leaders in a change process with a middle-up-down approach are described as catalysts to facilitate organizational knowledge (ibid). Research on quality improvement in four European hospitals applied and adapted Nonaka's three management models (Karlton et al., 2018), where hospital managers were referred to as middle managers (control logic) in relation to the national and county council top managers (community logic) and the operative bottom level (care and cure logics). It was shown that with a middle-up-down management model, hospital managers had better opportunities to align national regulations with clinical front-line reality by infrastructural support and guidance and to create a common understanding regarding what quality improvement entails (ibid). The driving force here was not the top management (as in top-down) or the entrepreneurial individual employees (as in bottom-up), but multidisciplinary teams supported by dialogue with middle managers and boundary spanners (ibid).

The role of the change agent, or other key functions such as e.g. champions, which contributes to the change drive can besides being considered a job resource for operative managers, be understood in relation to 'The indirect leadership model' by Larsson and co-authors (Larsson et al., 2005; Larsson & Eid, 2012). By modifying the model in accordance with the focused change agent theories used in the thesis it highlights the filters in the communication paths between the different hierarchical levels in the hospital setting, and puts the change agents in center of the communication paths (labelled as link in the original model) (Figure 1).

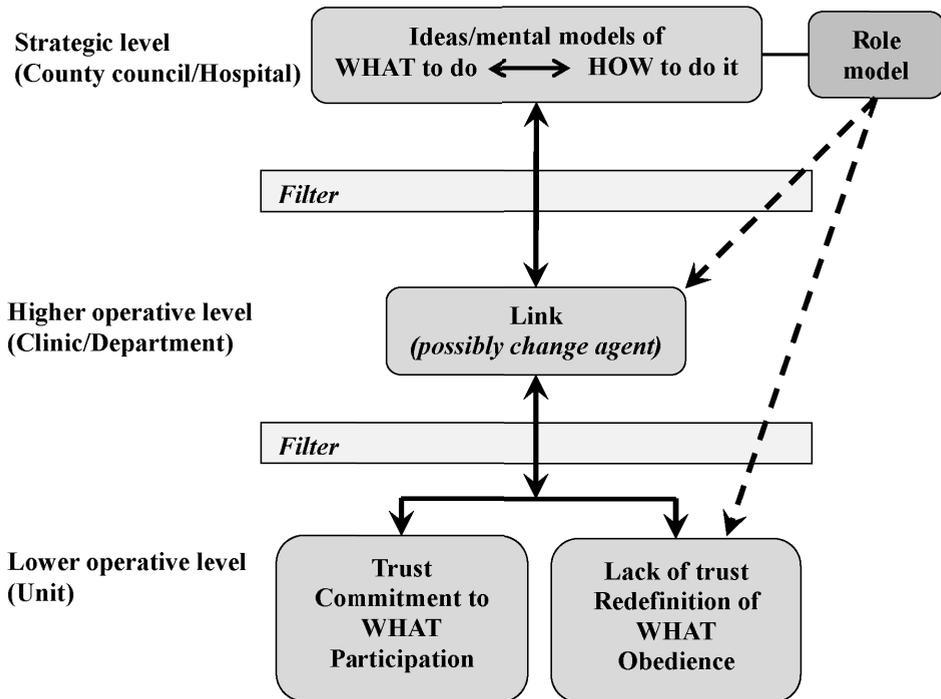


Figure 1. Modified version of The indirect leadership model. Originally from Larsson et al. (2005), adapted in Larsson & Eid (2012), here applied to a hospital setting.

When implementing planned change in healthcare, and applying the change steps from change management researchers (By, 2005), the initiatives and the vision or change strategy could come from e.g. county council or hospital top management (here strategic level), and is more or less expected by the initiator to be accepted and implemented at the lower hierarchical levels, i.e. the operative levels in the hospital (A. Eriksson et al., 2016). According to the indirect leadership model the impact from strategic level to implement change at lower levels in the organization is being promoted through two pathways; *the link* and *the role model* (Larsson et al., 2005; Larsson & Eid, 2012).

The link, described to be a set of subordinate managers or an individual, passes the message from strategic level further down the hierarchy and closer to the operative levels (Larsson & Eid, 2012). The individual could be a change supporting function, e.g. a change agent or a champion with or without the formal assignment of being a driving force in change according to the change strategy set by the strategic level. The filtering taking place when the change strategy is being communicated with the lower, operative levels could be a conscious strategy chosen by the link to protect the operative level from being overloaded with information, and to condense the

essence of the message from the strategic to the operative levels. In cases where the link has legitimacy among and an understanding of the operative levels the filtering could also mean the link is leaving out information that the link predicts could induce resistance among operative levels and thus inhibit the implementation. For example a change agent or as described by Choi and co-authors (2012) a champion could avoid mentioning the strategic level's economic incentives as motives for change when communicating the vision in order to avoid inducing resistance among healthcare professional groups at operative levels. This could presumably be reflected in operative managers' satisfaction with how their hospital is being governed. And vice versa, the link could cover certain backs at the operative levels e.g. a certain group resisting change, by filtering the communication back to the strategic level. However, filtering of information and knowledge in an organization could keep the employees from timely information that, if being served to them, could enhance their possibilities to understand problems in the organization. This filtering also opposes the idea of increased honesty inducing change (By, 2005). If applied to healthcare professionals a more open communication concerning the problems in the organization would perhaps enhance the healthcare professionals' line of sight (Boswell, 2006) and further affect the vertical alignment within the hospital (von Thiele Schwarz & Hasson, 2013).

The role model is described to be "more image-oriented" which means that the strategic level influence downwards in the hierarchy by being favorable (or sometimes un-favorable) role models for the operative levels (Larsson & Eid, 2012). The importance of strategic management as favorable role models or leading the way in change and stating a good example is known (Graetz, 2000), as is the importance of building vertical trust and accountability to enhance social capital within an organization undergoing change (Strömgren, 2017). According to alignment theory, strategic management acting as role model would not only work vertically but also horizontally, by enhancing diagonal alignment (von Thiele Schwarz & Hasson, 2013).

The organizational outcomes of change are among other things affected by the culture, the trust and the relationships within the organization (Klein & Sorra; 1996; Strömgren, 2017). As stated by Stiernstedt in the governmental report of Effective healthcare (SOU, 2016), a culture built of trust and collaboration is seriously threatened when focusing on costs and short-term budgeting in the healthcare system. Social capital was defined by Lin (1999, page 35) as "resources embedded in a social structure which are accessed and/or mobilized in purposive actions". Further Kristensen and co-authors defined social capital as emotional values such as respect, social reciprocity and trust between employees (horizontally) as well as between management and staff (vertically) (Kristensen, Hasle, Pejtersen, & Olesen, 2007). Social capital is also positively associated with clinical engagement in work with care quality and patient safety (Strömgren, 2017). Working towards a common goal increases motivation to strive towards higher set goals

instead of settle for less (Gittel, 2002). Gittel describes relational coordination in the following way:

“Relational coordination reflects the role that frequent, timely, accurate, problem-solving communication plays in the process of coordination, but it also captures the oft-overlooked role played by relationships.”

(Gittel, 2002, p 1410)

Higher levels of relational coordination among cross-functional healthcare professional groups have been shown to be associated with improved care quality and shorter hospital stays (Gittel, 2002). Boundary spanners described by Gittel (2002) to enhance cross-functional liaisons and integrate work of other people in healthcare have some similarities to the description of change agents (Esain et al., 2008; Damschroder et al., 2009; McCormack et al., 2013) as well as the link described by Larsson & Eid (2012). According to Gittel (2002) boundary spanners would strengthen relational coordination and further increase systems performance (Gittel et al., 2000) and presumably healthcare professionals' perception of systems performance. The use of the change agent function is considered in this thesis to be a conscious change strategy likely to enhance vertical alignment of change strategies. At the same time the change agent function has the potential of being a job resource for operative managers, which in the thesis is considered promising in enhancing horizontal alignment, and constituting a change approach.

Visual management tools – change strategy and change approach

A single individual's mental model of a production or system represents that individual's experience and prior knowledge of the system, which may not always be correctly matched with reality (Berlin & Adams, 2017). Having differing mental models of the work system within a team of employees thus may lead to severe problems. The theory of distributed cognition has similarities to Gittel's (2002) theory of relational coordination. Distributed cognition concerns the work system, i.e., the individuals, information tools, roles, and relationships within the system (Hutchins, 1995). It emphasizes the importance of shared understanding and cognition among individuals for increased systems safety and efficiency and is highly applicable to healthcare (Hazlehurst, Gorman, & McMullen, 2008; Hutchins, 1995). Cognitive artifacts such as visual management tools used in healthcare is often in the form of whiteboards, in different styles and sizes showing patient flows and efficiency at a specific unit or ward, and often placed in a public area (Holden, 2011; Mazzocato, 2010).

Visual management tools are said to be self-evident to be used in lean healthcare as it is an important method displaying continuous improvements, production flows and to detect problems in lean production (Liker, 2004; Womack & Jones, 2003). Previous research on visual management tools manifests these tools as contributing

to beneficial organizational outcomes. There is lesser research arguing the negative outcomes of visual management tools, perhaps since tools that are not adapted to the needs in the organization simply would not be used.

A study of the use of visual management tools in 52 industrial companies demonstrated that visual management tools were generally underestimated and that industry lacked knowledge of their potential benefits (Jaca, Viles, Jurburg, & Tanco, 2014). Visual management tools are said to serve as coordination devices and boundary spanners and play an important part in supporting distributed cognition and cooperation (Andersson & Liff, 2012; Hazlehurst et al., 2008; Nemeth, Cook, Connor, & Klock, 2004). Further the association between visual management tool use and employee engagement in improvement work (e.g. continuous improvements) is seen in both industry and healthcare (Holden & Hackbart, 2012; Jaca et al., 2014). N. Eriksson and co-authors (2016) mean that nurses' engagement in improvement work can be supported by external drivers such as tools and techniques. Research on the use of visual management tools in healthcare shows their support in communication, task management, resource planning and tracking, multidisciplinary problem solving and negotiation, socialization and team building (Eppler, 2004; Xiao, Schenkel, Faraj, Mackenzie, & Moss, 2007).

The first priority in designing visual management tools should be to create a sense of order and to design a tool, such as visual documentation and visual production control that give employees a sense of control over their workplace (Jaca et al., 2014). Visual management tools can then be used to display results and foster company culture (Jaca et al., 2014). Management that supplies support systems (e.g. visual management tools) that increases information flow and knowledge sharing within the organization is suggested to encourage bottom-up initiatives for change since information and knowledge of problems in the organization gives opportunities for members to contribute with creative solutions (Karlton et al., 2018; Yukl, 2009).

The conceptual framework for visual strategizing divides the strategic planning process into four stages: analyzing, development, planning, and implementation (Eppler & Platts, 2009). Depending on the stage of the planning process, different content is visualized and visual management tools provide different benefits. The framework identifies three dimensions of benefits during strategic planning, i.e. cognitive, social, and emotional benefits (Eppler & Platts, 2009). For instance cognitive analytical challenges, such as an overload of information during rounds, can be supported when providing healthcare professionals with a visual management tool that is facilitating the elicitation and synthesis of the complex logistics at the care unit. Further social challenges in e.g. planning and collaboration that is dependent on well-functioning communication can be supported by a visual management tool providing healthcare professionals with a common language and mutual understanding during shift change. And emotional challenges in implementing care process redesign e.g. lack of understanding or identification with a

strategy can be supported by visual management tools including all healthcare professional groups and departments in shared goals for certain patient groups as well as for the whole hospital. The use of visual management tools when developing care processes is also suggested to induce anchoring in the alignment process, which in turn supports social capital and the common understanding between healthcare professionals at a care unit (Gunnarsdóttir et al., 2018).

Again, by using the JD-R model as a theoretical basis in the thesis, visual management tools can theoretically serve as a physical job resource balancing cognitive demands in work (Bakker & Demerouti, 2007). There is a risk though that a visual management tool is seen as yet another source of information on top of other information sources at a care unit, which may lead to low confidence in the information that is being visualized (Conn et al., 2009). This may not lead to any sort of impact at all since that tool probably will not be used by healthcare professionals. But there could be a risk in visual management tools instead increasing the cognitive overload among healthcare professionals and thus these tools may constitute a cognitive job demand (Bakker & Demerouti, 2007). Depending on visual management tools as additional cognitive job resources or job demands the working conditions for healthcare professionals and managers as well as organizational outcomes would differ (Bakker & Demerouti, 2007). Research on visual management tools show they are used as means of supporting communication of strategies in the implementation of change, and can thus be considered a change strategy in its own. Research also show visual management tools being used as an operative level change approach when working practically with smaller changes at a care unit, or just supporting communication and collaboration between healthcare professionals and operative managers in the daily work. Visual management tool use in this thesis is therefore both considered a broad change strategy decided by strategic management, and an operative change approach supporting the combination of everyday patient work and improvement work at the operative levels.

2.3 Alignment connected to organizational outcomes of change

In this thesis sustainable care process redesign in Swedish hospitals is seen in the light of systems theory as described in the SEIPS model and the HTO concept. Alignment theory is also central for analyzing the impact of strategies and practical operative approaches for the sustainability of care process redesign.

The operative change approaches elaborated on in the thesis is not exclusively actions taken as means of implementing certain change strategies to redesign care processes, but also actions taken on own initiative on the operative levels as means of dealing with the struggles of everyday patient work. Nevertheless, these actions are important for the sustainable work of employees, and thus are considered to contribute to alignment within the hospital organizations.

Concepts such as social capital and relational coordination are closely related to alignment theory working both horizontally between different healthcare professional groups within the organization and vertically between different management levels in the organization. Social capital and relational coordination can be considered psychological or social job resources within the healthcare system that would theoretically balance job demands, enhance work engagement and inhibit burnout. Although in this thesis both concepts are theoretically classified as organizational outcomes affected by other job resources and job demands.

This thesis elaborates on the emotional and cognitive job demands, and the organizational (and partly social) and physical job resources as well as work engagement and burnout among healthcare professionals and operative managers during care process redesign. The elaboration of organizational outcomes associated with these job demands and job resources are operationalized by examining social capital, clinical engagement, collaboration, satisfaction with hospital governance, systems performance, follow-up and evaluation and fulfillment of managerial duties. Measuring the sustainability of a work system is in this thesis operationalized by the informants' perceptions of their working conditions and systems performance within the work system.

The interactions of different working conditions and preconditions to contribute to alignment within the hospitals would affect the outcomes in terms of healthcare efficiency and sustainable work. What goes on inside the hospitals thus reflects not only the conditions and the willingness for healthcare professionals and operative managers to stay within public care, but also the patient safety and the care given to the Swedish citizens as consumers of Swedish welfare.

3 Method

3.1 Research approach and design

The theory and methodology of science can be seen as “(...) each discovery is simply added to old discoveries, with the results being a gradual accumulation of knowledge” (Ray, 2000 p. 47). Kuhn (1970) suggested that this was not the case and that science develops through a series of revolutions or paradigms. From a paradigm of believing that the world is flat, to another paradigm believing that the world is round, science goes through a paradigm shift (Ray, 2000). This thesis is written within a paradigm where social science is accepted as valid and real science, and in which a mixed methods research design paradigm is overlapping the qualitative paradigm that revolutionized research between the 1900s and 1950s (Leech & Onwuegbuzie, 2009). Combined quantitative and qualitative research design in mixed methods research was first seen around 1960 and is used in disciplines such as management and organization, psychology and nursing research (Leech & Onwuegbuzie, 2009). The naturalistic non-participative observation is used when background information is sparse and the aim is to explore certain phenomenon without much pre-understanding of that phenomenon (Ray, 2000). Further the thesis has a correlational approach where the aim is to understand the association between phenomena without trying to establish, but discuss the possibility of how one variable affects the other (Ray, 2000).

Using the typology of mixed methods research design developed by Leech and Onwuegbuzie (2009), a partially mixed sequential/concurrent equal status design was used. The design was classified as partially mixed since the quantitative and qualitative portions of the thesis were not mixed until both data types had been collected and analyzed. The design was considered concurrent and sequential since both quantitative and qualitative data was collected concurrently and also sequentially 2012, 2013 and 2014 and both kinds of data were treated with equal status in the meta-analysis in the thesis.

Each year of data collection is referred to as T₀, T₁ and T₂. Referring to T₀ means the first year of data collection. T₀ is not considered as baseline, since using the word baseline would impose it being the measurement before any kind of intervention has taken place.

3.2 Sample

Sampling was done both on hospital level (choice of hospitals to participate) and on department level (choice of type of departments within hospitals to participate).

Representativeness of the sample of hospitals and transferability of results was discussed in the selection of hospitals. Therefore university hospitals and hospitals geographically situation in a city was excluded and hospitals of medium to small sizes were included. The main criterion for inclusion was that the hospitals had to work actively with care process redesign at the time of data collection. Five hospitals were invited and accepted to participate in the studies. Three of the hospitals were going to introduce lean as the major inspiration in care process redesign in 2012 (To). Two hospitals stated they were not going to implement lean. The hospital sizes and thus the department sizes differed slightly between the hospitals, but the contextual settings of acute care units and units downstream from acute care were considered to be similar enough in order to make certain conceptual generalizations of the results.

From each hospital a purposive selection of units was made including units sharing a high flow of patients from the emergency department, i.e. one medical, one surgical, one medical intake and one surgical intake unit (Table 2). However, one unit denied participation due to other on-going research and development projects.

Table 2. Characteristics of participating hospitals, and unit sample

| Hospital | Number of hospital beds | Number of employees | Participating units | Participation in Studies |
|-----------------|--------------------------------|----------------------------|--|---------------------------------|
| A | 100 | 700 | <ul style="list-style-type: none"> • Emergency department • Intensive care unit • Medical unit • Surgical unit | I, II, III, IV |
| B | 500 | 4000 | <ul style="list-style-type: none"> • Emergency department • Medical unit • Surgical unit • Acute medical unit • Acute surgical unit | I, II, III, IV |
| C | 450 | 3000 | <ul style="list-style-type: none"> • Emergency department • Acute medical unit • Acute neurological unit | I, II, III, IV |
| D | 350 | 2000 | <ul style="list-style-type: none"> • Emergency department • Intensive care unit • Medical unit • Surgical unit | I, II, IV |
| E | 157 | 1100 | <ul style="list-style-type: none"> • Emergency department • Intensive care unit • Medical unit • Surgical unit | I, II, IV |

3.2.1 Sample of strategic managers and other key functions

The decision to participate in the studies was mainly taken by strategic managements on hospital level. The exception was hospital C where the strategic management on county council level decided on the hospital participation.

The strategic managers i.e. hospital manager, human resources (HR) manager and development managers pointed out additional key functions to interview, i.e. change agents at strategic or operative level, logisticians, care developers or process leaders. At hospital C, also strategic management at the county council pointed out key function to interview at strategic county council level, and at hospital level.

3.2.2 Sample of operative managers

The sampling of operative managers was done in two steps. In the first step all operative managers connected to each participating unit were selected to participate in in-depth interviews (To) (reported in Andreasson, 2018) and semi-structured and structured interviews at T1 and T2. For the purpose of this thesis, these interviews were used to a) validate parts of the results from healthcare professional focus group interviews and healthcare professional questionnaires from respective unit, and b) assess characteristics of the care process redesign implementations. All operative managers at all hospitals were also included to participate in the manager questionnaires.

3.2.3 Sample of healthcare professionals

All healthcare professionals from the participating units were invited to answer the questionnaires at To, T1 and T2 (Table 6). At To the sample consisted of 75% female and 25% male staff. Of these 40% were registered nurses, 25% were assistant nurses, 34% were physicians and remaining healthcare professionals were missing profession. A majority had worked more than 14 years in their occupation, while 24% had worked 8-14 years, 19% 2-7 years and 6 % had worked less than two years in their occupation.

3.3 Data collection

Data was collected during three years and was used according to the research questions or study aims of the four studies. Observations conducted at all five hospitals during the three years were documented in photos. The collection of data is shown in table 3 below, and is further described in the following subsections.

Table 3 Summary of data collection

Data collected for the thesis.

| Year | Data | Hospital |
|----------------|--|-----------------|
| To T1 | semi-structured interviews, structured interviews, staff questionnaires | A, B, C, D, E |
| To T1 T2 | staff questionnaires to registered and assistant nurses | A, B, C, D, E |
| To | semi-structured interviews, focus group interviews held separately with assistant nurses, registered nurses and physicians | A, B, C |
| T1 T2 | semi-structured interviews, manager questionnaire | A, B, C, D, E |
| To T1 T2 | Observations | A, B, C, D, E |

3.3.1 Interviews

Interviews were conducted all three years and covered managers at strategic level, i.e. hospital manager, county council manager, HR manager and development manager and managers at operative level, i.e. department manager, also known as second line manager, and unit manager, also known as first line manager. Interviews were also conducted with supporting functions in care process redesign placed at either strategic (i.e. hospital or county council) level or operative (i.e. department or unit) level.

Semi-structured interviews

Semi-structured interviews at To were aiming at covering motives and strategies for care process redesign (at strategic level) and implementation, progress and healthcare professionals' response (at operative level). At T1 and T2 follow-up interviews were held with strategic level management and supportive functions in order to view status, progress and evolvement of the change strategies. The interviews were located to closed rooms and the length of interviews varied from 20 to 60 minutes depending on the interviewees' perception of degree of change progress at the hospital. The interviews were recorded and/or notes were taken in order to show procedural rigor (Kitto, Chesters, & Grbich, 2008). Out of 146 interviews Williamsson conducted 31 interviews alone or together with a colleague at To, and 12 interviews at T2 (Table 4).

Structured interviews

Structured interviews at T1 and T2 were held with first line managers at the selected units to map different kinds of approaches used at the unit level when pursuing care process redesign. These interviews used a modified version of a lean index questionnaire (Fagerlind Ståhl, Gustavsson, Karlsson, Johansson, & Ekberg, 2015), where the first line managers rated the use of different lean-inspired approaches at

their unit. The following approaches were included in the structured interviews and started with the question, “To what degree is daily work at your unit influenced by...”:

- Working with values (internal discussions regarding values at the unit)
- Patient orientation (focus on the patient perspective)
- Continuous improvements
- Eliminating waste
- Value flow analysis (mapping of flows to identify patient values)
- Standardized work practice
- 5S (sort, set in order, shine, standardize, sustain)
- Visual management with focus on visualizing (a) results, (b) different kinds of flow, (c) improvement work (e.g. PDCA)

The rating had a Likert scale from 1 to 5 (“Not at all” to “To a very high degree”) and the ratings were noted in an interview protocol. These interviews were conducted over telephone or held at a quiet place or closed office. If being held over telephone the interviewees had set aside time to take the call in a closed office. 47 structured interviews were held which 29 were held by Williamsson (Table 4).

Table 4. Summary of semi-structured and structured interviews

Number of interviews T0, T1 and T2 used in Study I, II and/or IV. *Structured interviews. All else semi-structured interviews.

| Year | Hospital | Strategic level | Operative level | | |
|-----------------|----------|--|---|----------------------|----------------------|
| | | Managers and supportive functions (e.g. change agents) | Supportive functions (e.g. change agents) | Operative managers | |
| | | | | 2 nd line | 1 st line |
| T0 | A | 4 | 5 | 3 | 5 |
| | B | 5 | 4 | 4 | 4 |
| | C | 15 | 2 | 5 | 4 |
| | D | 8 | - | 2 | 4 |
| | E | 5 | - | 3 | 3 |
| Total T0 | | 37 | 11 | 17 | 20 |
| T1 | A | 1 | 1 | 3 | 4* |
| | B | 6 | 3 | 2 | 5* |
| | C | 9 | 2 | - | 4* |
| | D | - | - | - | 4* |
| | E | - | - | - | 4* |
| Total T1 | | 16 | 6 | 5 | 22 |
| T2 | A | 3 | 2 | 2 | 4* |
| | B | 5 | 4 | 2 | 5* |
| | C | 7 | 2 | - | 4* |
| | D | 4 | - | - | 7* |
| | E | 2 | - | 1 | 4* |
| Total T2 | | 21 | 8 | 5 | 25 |
| Total | | 74 | 25 | 27 | 68 |

3.3.2 Focus group interviews

Focus group interviews were held at T0 with healthcare professionals from emergency departments at the hospitals with strategic decision to introduce lean as major inspiration in care process redesign (hospitals A, B and C) (Table 5). The participants were invited via their operative managers (Table 5). Questions concerned work content, engagement and participation in care process redesign, attitudes towards the hospital's chosen strategies for care process redesign. Each interview was held in a closed conference room exclusively with each professional group at a time, since that was considered to provide the best prerequisites for each profession to be heard. Williamson conducted 7 of the 9 focus group interviews alone or together with a researcher from the research project. The interviews took about 45-60 minutes, were recorded and notes were taken.

Table 5. Summary focus group interviews

Interviewees per hospital, department and healthcare profession.

| Year | Hospital | Department | Assistant nurses | Registered nurses | Physicians |
|------|--------------|------------|------------------|-------------------|------------|
| 2012 | A | Emergency | 3 | 4 | - |
| | | Medical | - | - | 3 |
| | | Surgical | - | - | 4 |
| | B | Emergency | 5 | 5 | 3 |
| | C | Emergency | 4 | 7 | - |
| | Total | | | 12 | 16 |

3.3.3 Observations

All studied units were visited and observed three to five times a year from T₀ to T₂. Since visual management tools were commonly mentioned in interviews already at T₀, and observations of visual lean tools at units showed an increasing amount of visual management tools at the hospitals between T₀ and T₁, visual management tools was decided to be focused on in further studies.

During the unit visits observations were conducted and photos were taken. A registered nurse, assistant nurse, or operative manager was present to answer any questions concerning the location or the use of visual management tools at the units. The unit managers had given oral consent in advance to take photos and notes during the observations. In total 180 photos were taken by Williamsson at the five hospitals.

3.3.4 Questionnaires

Questionnaires were distributed to both healthcare professionals and operative managers from all hospitals. Details regarding questionnaire distributions and response rates for both staff questionnaires and manager questionnaires are seen in Table 6.

Staff questionnaire

The staff questionnaire had assistant nurses, registered nurses and physicians as main target groups. Healthcare professionals that had held a position at one of the included units (or departments in the case of physicians) for at least 6 months were included at T₀ and T₁. Since physicians were working more or less across departments as consultants the main intent was to include all physicians at the hospitals (that is physicians outside of the selected included units). Although at one hospital top management only consent to include physicians working at the included units. At T₂ staff questionnaires were distributed only to staff that had answered the questionnaires either at T₀ or T₁. The staff questionnaires were distributed as paper questionnaires at hospital A and B at T₀. At hospitals C, D and E web-questionnaires were used, with the exception of two units asking for paper versions

due to staff not using their e-mail frequently. When needed the web-questionnaires were complemented by paper versions as reminders. Detailed descriptions of and references to variables and index are seen in Appendix A.

Manager questionnaire

The manager questionnaires used in the research project were distributed to all managers at the hospitals at T0, T1 and T2. All manager questionnaires were distributed as web questionnaires, and two reminders were sent. Due to the thesis' aim the responses from operative managers were selected for analysis. Detailed descriptions of and references to variables and index are seen in Appendix B.

Table 6. Summary of questionnaires
 Distributed (N), responded (n) and response rates (%). SQ = staff questionnaire, MQ = manager questionnaire, HCP = healthcare professionals

| Hospital | 2012 | | 2013 | | 2014 | |
|-------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Study I (All HCP) | Study II (Nurses) | Study I (All HCP) | Study II (Nurses) | Study I (All HCP) | Study II (Nurses) |
| A | N=204 | N=146 | N=204 | N=142 | N=29 | N=108 |
| | n=155 (76%) | n=115 (79%) | n=155 (76%) | n=111 (78%) | n=23 (79%) | n=77 (71%) |
| B | N=220 | N=195 | N=236 | N=188 | N=132 | N=127 |
| | n=180 (82%) | n=163 (84%) | n=173 (73%) | n=143 (76%) | n=87 (66%) | n=87 (69%) |
| C | N=550 | N=157 | N=562 | N=185 | N=111 | N=114 |
| | n=212 (39%) | n=106 (68%) | n=226 (40%) | n=116 (63%) | n=66 (59%) | n=69 (61%) |
| D | N=341 | N=252 | N=315 | N=233 | N=89 | N=154 |
| | n=168 (49%) | n=138 (55%) | n=189 (60%) | n=145 (62%) | n=60 (67%) | n=121 (79%) |
| E | N=294 | N=198 | N=231 | N=152 | N=55 | N=118 |
| | n=135 (46%) | n=107 (54%) | n=169 (73%) | n=118 (78%) | n=32 (58%) | n=91 (77%) |
| Without hospital identification (n) | n=1 | | n=1 | | | n=1 |
| In total | N=1609 | N=948 | N=1548 | N=900 | N=416 | N=621 |
| n (%) | n=850 (53%) | n=629 (66%) | n=912 (59%) | n=633 (70%) | n=268 (64%) | n=445 (72%) |
| | | | | | | N=401 |
| | | | | | | n=219 (55%) |

3.4 Analysis

Analyses of qualitative and quantitative data were pursued parallel to the data collection as the studies proceeded. Data triangulation was obtained by using multiple data sources.

3.4.1 Qualitative analyses

The inductive approach justifies the choice of qualitative data collection (Kitto et al., 2008) since it gives opportunities to go further deeper and broader when examining a certain phenomenon. Analyses of the semi-structured and focus group interviews in Study I, III and IV were done by content analyses (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004). The content analysis was a thematic iterative process where the manifest codes, i.e. the spoken words by the interviewees contributed to the contextual understanding of the care process redesign at the hospitals. In further analysis with condensation and interpretation of the meaning of the manifest codes latent codes emerged highlighting certain preconditions or benefits in the care process redesign setting.

Content analysis of the photos was done stepwise and thematic. First, about 120 clear and non-duplicate photos from T1 and T2 were selected and manually sorted into piles based on their content (i.e., manifest data). During this sorting, three VM categories (i.e., latent data) as well as subcategories emerged (Graneheim & Lundman, 2004). The main VM categories were consistent with the notes from the observations at T0. The photos were mainly sorted by Williamsson; the sorting was later discussed among co-researchers and in research seminars. The notes taken during the unit visits were discussed among co-researchers and in relation to the photo sorting and the content analysis of the interviews. The unit of analysis was the hospital or unit level.

Interpretation problems in the content analyses, i.e. the researcher's expectations affects the data analysis, was handled by having an open coding process and analyzing data in a team of researchers with different areas of knowledge. Also this was a way of increasing inter-rater reliability. Respondent validation was part of the interpretation and analysis process when giving some of the results back to strategic management and healthcare professionals at the hospitals, while also giving time to receive feedback from the same (study I, III and IV)(Kitto et al., 2008).

3.4.2 Quantitative analyses

Each questionnaire respondent was de-identified by using an individual identification code that connected them to the right hospital and unit. Staff still employed at the same unit year after year had the same code each year. Answers from all three

years were kept in the same data set. Data from the structured interviews were quantified and integrated with the same dataset as data from the staff questionnaire. Thus structured interview data from a first line manager was matched with data from the respective first line managers' staff. All quantitative analyses were conducted in a way not to be able to point out certain individuals, and the identification codes and staff lists were treated with confidentiality.

To keep transparency in analysis of questionnaires each step from coding of staff lists and quantifying the data in a dataset in a statistical software; to creating index, checking for item reliability and so on, was noted in a research journal (Kitto et al., 2008).

Study I

Quantitative data in Study I were analyzed stepwise by first comparing results from the quantified structured interviews based on the lean index questionnaire. The measured lean approaches in the lean index questionnaire were indexed into different lean focus: *tool focus* (five items measuring value stream mapping, visual management tools of value stream mapping or flows, visual management tools of results, visual management tools of improvements, and standardized work practice), *value focus* (two items measuring patient orientation and working with values), *work process focus* (two items measuring team work and continuous improvements), and *cost reduction focus* (single item).

The use of lean focus at a unit ranged from 1-5 ("Not at all" to "To a very high degree"). Comparison of lean focus mean values were done between hospitals with lean as major inspiration in care process redesign (hospitals A, B and C referred to as 'lean hospitals') and hospitals not using lean as inspiration in care process redesign (hospitals D and E referred to as 'other hospitals'). Physicians were excluded in this analysis since they were not allocated to one particular unit and thus could not be related to different lean focus.

The importance of strategic lean decision for changes in working conditions over time (T₀ to T₁) within professional groups was analyzed. This analysis included all healthcare professionals at all five hospitals.

Secondly, investigating the importance of use of and kind of lean approaches at operative levels for healthcare professionals' working conditions was done by ANOVA. The test investigated mean differences within pairs and between pairs of healthcare professionals (physicians excluded) and also tested the interaction between operative lean approaches and strategic lean decision. Thirdly the stress-related symptoms among healthcare professionals (physicians excluded) were tested by linear regression models to investigate the contribution of job demands and job resources, operative level lean approaches and strategic lean decision, on stress.

Study II

Analyses in Study II were also done stepwise by dichotomizing nurses into three groups of visual management tools users: a) nurses not using visual management tools daily either year, b) nurses using visual management tools daily both T1 and T2, and c) nurses starting to use visual management tools daily between T1 and T2. This grouping was used when comparing between groups and within groups over time regarding the cognitive, social and socio-emotional benefits associated with daily visual management tool use. The grouping was also used when further investigating differences and changes between and within the groups with mixed models of repeated measurements regarding working conditions and systems performance from year to year T0-T2.

Study IV

Operative managers' change agent support and visual management tool use was examined by the distribution of managers at each hospital rating higher change agents support (rating 4 or 5 on a scale from 1-5), and weekly and daily use of visual management tools use (rating 1-2, and rating 1-4 on a scale from 1-6).

Analysis of quantitative data in Study IV were conducted by first dichotomizing operative managers into: a) a group of managers perceiving having a higher support from a change agent function (rating 4 or 5 on a scale from 1-5) both T1 and T2, and b) a group of managers perceiving having a lower support from a change agent function (rating 1-3 or not at all on a scale from 1-5) both T1 and T2. This first dichotomization was the basis for comparison between groups and within groups T1-T2. The analysis investigated change agents as supporting job resources for operative managers and further job demands, work engagement and burnout as well as organizational outcomes associated with change agent support.

A second dichotomizing of operative managers was conducted to create groups of: a) operative managers starting to use visual management tools daily between T1 and T2 (rating 1-4 or not at all on a scale from 1-6 at T1 and rating 5-6 on the same scale at T2), and b) operative managers not using visual management tools daily either year (rating 1-4 or not at all on a scale from 1-6 at T1 and T2). This dichotomization was used for comparing between and within groups T1-T2 and (similar to the previous analysis) investigated visual management tools as supporting job resources for operative managers and further the managers' job demands, work engagement and burnout, as well as organizational outcomes associated with visual management tool use.

A third dichotomization was done to group operative managers into; a) operative managers having higher support from change agent function and using visual management tools weekly at T2, and b) operative managers having lower support from change agent function and not using visual management tools weekly at T2. These groups' results at T2 were compared.

For tests of differences, Wilcoxon signed rank test and rank sum test and also Student's t-test were conducted. Wilcoxon signed rank test was used when there

were tests of paired dependent units and groups. However, there are many definitions of paired and independent. When there were uncertainties conclusions made in this thesis were made with caution and regard to these issues. All analyses were considered statistically significant when $p \leq 0.05$.

3.5 Methodological considerations

Scales in the staff and manager questionnaires were ordinal and nominal scales and not continuous data. Thus they were discrete variables that according to statistics textbooks should be treated accordingly with frequency tables (Körner & Wahlgren, 2015). As stated by Ray (2000, p 91) "(...) as a researcher you should care greatly about your inferences and logic". When quantifying ordinal scale data as done in this thesis, one needs to be aware of the risks in interpretation of the data. The scale steps in an ordinal scale are not as definitely even as in a ratio scale and thus the difference between 1- "do not agree" and 2- "partly agree" and cannot be equated with the difference between 4- "quite fully agree" and 5- "fully agree". This calls for careful interpretation of the results, and conclusions points to tendencies rather than set correlations between variables. However, the instructions of the widely used questionnaire instruments, e.g. Copenhagen Psychosocial Questionnaire (COPSOQII) (Pejtersen, Kristensen, Borg, & Bjorner, 2010) and Swedish Scale for Work Engagement and Burnout (SWEBO) (Hultell & Gustavsson, 2010) to consider the response scale and construction of index as continuous data was followed.

The conservative notion of parametric tests (i.e. ANOVA and linear regression) is that they cannot be used if; a) the size of the sample is small, b) the data is not normally distributed, and/or c) the data used are ordinal data from a Likert scale (Jamieson, 2004). Other researchers oppose this conservative view on statistical testing by questioning the ideas of excluding ordinal data for parametric tests, and meaning assumptions a), b) and c) above have been righteously "violated" in empirical research dating 80 years back (Norman, 2010; Ray, 2000). Different research traditions take stand in different corners of the ring in this matter. And the social science tradition in education, health and psychological research has used these ways of analyzing data for decades (Norman, 2010). Prior to writing the quote above, Ray (2000) clarifies that a statistical program does not care about what the numbers in the dataset represent. It is the inferences from the statistical analysis that truly matters (Ray, 2000).

Since the abovementioned assumption of continuous data was not fully met in the dataset used in the thesis, non-parametrical tests was used out of precaution to test the mean differences between two groups (Wilcoxon rank sum test) and within matched samples (Wilcoxon signed rank test) (Howell, 2012; Noether, 1991). Thanks to the large sample size and considering the central limit theorem, the social science convention of "violating" the three assumptions of parametric testing

was considered as partly dealt with. So by support from several researchers (i.e. Norman, 2010; Ray, 2000) decision was taken to perform ANOVA and linear regression tests as well.

Due to low staff rates and high work load at the emergency units the sampling of healthcare professionals to participate in focus groups was very difficult. Despite the risk of bias the operative managers at the units therefore had to assist in finding staff that was willing to participate outside of their working hours.

3.6 Ethical considerations

All four studies were included in the research program approved by the ethics committee at Karolinska Institute in Stockholm, Sweden (ref: 2012/94-31/5).

The decision to participate in the studies was taken by strategic management at strategic level at the hospitals, and the operative level that was to participate in interviews and questionnaires was not always as keen on participating as the strategic management. All interviewees wrote an informed consent before the interviews started, and each interviewee was thus informed about the possibility to end the interview or withdraw their contribution at any time. Each questionnaire was introduced by written information about the study and the participation in the study being voluntary. Thus staff filling in and submitting a questionnaire was considered a signed informed consent to participate. The distribution of staff questionnaires was handled and communicated with the operative managers at the participating units at the hospitals. A filled-in questionnaire was put in an envelope which was put in a locked box at the care units. The voluntary participation was also emphasized in communication with operative managers and at staff meetings during the time the questionnaires were distributed and when the reminders were sent. Some of the operative managers encouraged their staff and set time aside during meetings for their staff to fill in the questionnaires. There could be a risk of staff feeling pressured to fill in the questionnaires since their manager was part of the distribution. Nevertheless the encouragement from managers to participate by filling in a questionnaire was considered important in order to get sufficient response rates.

4 Results

The results section presents the findings by answering the thesis' research questions under respective sub-section (Table 7).

Table 7. Summary of the four studies included in the thesis.
 HCP = healthcare professionals, VM = visual management tools

| Study | Focus | Hospital | Data material | Key results | RQ |
|--------------|--|-----------------|---|---|----------------------------------|
| I | change strategies' and change approaches' association with working conditions and stress-related health for HCP | A, B, C, D, E | semi-structured interviews, structured interviews, staff questionnaires | Lean hospitals focus either small-scale improvements or large-scale care processes, educate managers. Other hospitals focus general support and direct method support to operative teams. Positive association between tool focus lean approaches and working conditions. Positive interaction between strategic lean decision and operative lean approaches on working conditions. | A B |
| II | daily visual management tool use's association with working conditions and systems performance among nurses | A, B, C, D, E | staff questionnaires to registered and assistant nurses | Nurses using VM tools daily or started to use VM tools daily associated with perceived cognitive, social and emotional benefits as compared to not using VM tools daily. Positive association between daily VM tool use and slightly higher perception of systems performance. | B |
| III | role assignments of formally appointed change agents contributing to care process redesign | A, B, C | semi-structured interviews, focus group interviews with HCP | Variation regarding; placement of change agents within hospital hierarchy, degree of detail in job description, clarity in roles and responsibilities in change, collaboration with operative levels, as well as opportunity to contribute to alignment within the hospitals. | A C |
| IV | operative managers' change agent and visual management tool use, and its association with working conditions and organizational outcomes | A, B, C, D, E | semi-structured interviews, questionnaires to operative managers | Variation regarding; perceived support from change agents, VM tool strategy and initiative at unit level. Positive associations between working conditions and change agent support and VM tool use separately. Positive association between working conditions and change agent support combined with VM use. Positive association between change agent support and/or VM use and organizational outcomes showing signs of alignment within the hospitals. | A C D |

4.1 Research question A

What are the change strategies chosen by strategic managements at hospitals, and further what are the change approaches pursued at the operative levels, during care process redesign?

4.1.1 Change strategies at hospitals A, B and C

(Based on semi-structured interviews and focus group interviews from Study I, III, IV, as well as observations)

Hospitals A, B and C (lean hospitals) had lean as major inspiration in their care process redesign. The strategic managements of these hospitals expressed a goal of operative management having the responsibility for change. One of their main change strategies was to assign change agents driving change. While hospitals A and B educated managers in operative lean approaches to varying extent, hospital C had a strategy of working in smaller cross-professional process groups learning about operative lean approaches within the group while working with a certain care process. Hospital A had change agents working close to the operative managers and healthcare professionals with little communication with or follow-up by strategic management (*Study III*). Strategic management at hospital B intervened at operative level with certain improvement projects, and change agents at department level had detailed job descriptions, and a change agent network within the hospital that supported them in their work. The operative lean approaches used at the operative levels of hospital A and B were mainly introduced by the change agents. At hospital B, unlike the case of hospital A, the operative lean approaches were more clearly encouraged by strategic management and thus also a part of the change strategy of hospital B (*Study III, IV*). At hospital C change agents were educated by an external consultant. The change agents were given no particular job description but worked as method supporters in the process groups and reported results from the process groups to strategic management. Hospital C had a history of local lean initiatives driven by certain lean champions at operative level before the introduction of the overarching change strategy and assigning strategic level (county council level) change agents (*Study III*). The units at hospital C that were influenced by and keen to use operative lean approaches were the units that had been introduced to lean as management concept before the county council change strategy. But the change agents assigned to work with the county council change strategy were to a limited extent used at operative levels, and the coherence of change strategy and operative change approaches was low (*Study III, IV*).

Hospital B also had an outspoken change strategy in using a visual management tool in the form of a visualized hospital matrix (the X-matrix) showing the goals and visions for different levels at the hospital (Figure 2). The X-matrix was used in planning and execution of change strategies during care process redesign.

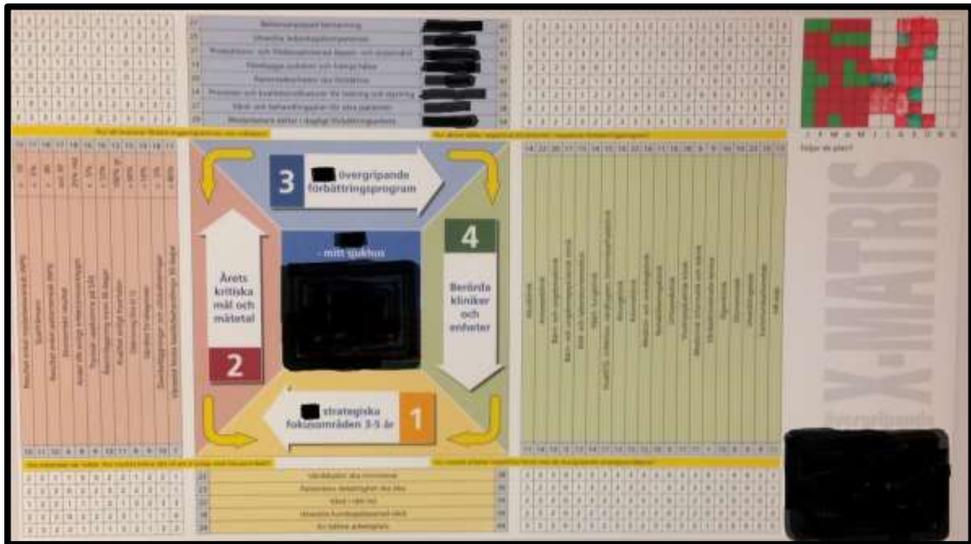


Figure 2. X-matrix as visual management tool. Included in the change strategy of Hospital B.

The yellow arrow (1) showed the strategic focus areas for the coming 3-5 years, the red arrow (2) showed this year's critical goals and key performance indicators, the blue arrow (3) showed overarching improvement programs, and the green arrow (4) showed affected or included clinics/departments at the hospital. The X-matrix was placed at a public place in a corridor at the hospital. Hospital top management held monthly and weekly open steer meetings at the X-matrix, and every department was expected to hold daily steer meetings at a modified X-matrix focused on that certain department's focus area and goals.

4.1.2 Change strategies at hospitals D and E

(Based on semi-structured interviews from Study I, IV)

When the studies included in this thesis were initiated both hospitals D and E (other hospitals) had a clear message of not using lean as inspiration in their care process redesign. These two hospitals worked with care process redesign teams that themselves initiated change projects at their own departments and/or units. A team presented their idea to hospital management at respective hospital and was (or was not) given consent to start a project which was financially supported in order for the team to set time aside for the project. The idea for a project needed to be well thought through and to include a patient or diagnose group that was prioritized at the moment. The team was supported by change agents that supported in methods and tools from various change management concepts or models (*Study I*). Hospital E that was the smaller of these two hospitals had shorter time from project to implementation of a change intervention developed in a project. Also

strategic management at hospital E had a closer dialogue with operative managers regarding e.g. needs and interests at operative level but left the operative work with care process redesign to the operative level (*Study I, IV*).

4.1.3 Change approaches pursued at the operative levels

(Based on semi-structured interviews, focus group interviews and structured interviews from Study I, III, IV, as well as observations)

Measuring the use of lean approaches categorized in different lean focus, the results showed that value focus, cost reduction focus, tool focus as well as summed lean focus was significantly higher among units at lean hospitals than units at other hospitals (*Study I*). This showed coherence between operative approaches and the main lean change strategy at the lean hospitals. The variation of use of lean approaches between the lean hospitals was shown in the semi-structured interviews and the focus group interviews (*Study I, III, IV*) and could be partly confirmed by the analyses of the structured interviews (*Study I*). The analysis showed significant variation within each lean focus between units at lean hospitals (A, B and C), while the same difference was not significant between units at the other hospitals (D and E). But the results showed signs of all different lean approach focus (value focus, cost reduction focus, work process focus, tool focus) at all five hospitals.

Observations at the five hospitals showed several units used some sort of visual management tools (visualizations) already at T₀. While visualizations were introduced at most units at some time between T₀ and T₁, in the units that had already implemented visualizations at T₀, the use had intensified and become more advanced. 16 of 20 units had some sort of visual management tool. The photos were sorted by manifest content analysis into the following main categories: results, flow, and improvements. The main categories had further subcategories divided into themes of content and ways to visualize content (Table 6).

Table 6. Categorization of observed visual management tools at the hospital units

1st = first line manager, 2nd = second line manager, RN = registered nurse, KPI = key performance indicators

| VISUAL MANAGEMENT TOOLS | | | |
|-------------------------|---------------------------|--------------------------------------|--|
| Main | Content - What | Method - How | Responsible for updates |
| 1 Results | 1.1 Incidents | 1.1.1 Green-cross incident reporting | 1 st or head RN together with staff |
| | 1.2 Medical | 1.2.1 KPI – medical | Change agent, 1 st , or 2 nd |
| | 1.3 Staff | 1.3.1 KPI – Overtime | Change agent, 1 st , or 2 nd |
| 1.3.2 KPI – Sick leave | | | |
| 2 Flow | 2.1 Patient related | 2.1.1 Flow chart | 1 st or head RN together with staff |
| | 2.2 Staff related | 2.2.1 Flow chart | 1 st or head RN |
| | 2.3 Work related | 2.3.1 Value stream mapping | Staff project group or external project group |
| 3 Improvements | 3.1 Current improvements | 3.1.1 Plan-Do-Check-Act | Staff, change agent, and 1 st |
| | 3.2 Previous improvements | 3.2.1 Improvement results | Change agent, 1 st or 2 nd , and staff project group |

An example of Results visualization was the “green-cross” reporting system in which squares in the cross represent all days of the month (Table 6, lower photo A in Figure 3). After each day, a square was filled using a green marker if no adverse event had occurred, or using a yellow, orange, or red marker depending on the severity of the potential or realized adverse event. The completed green crosses from all months were summarized into a yearly result to give an overview of the care hazards in a unit over a year (upper photo A in Figure 3). An example of Flow visualization was the frequent use of a whiteboard visualizing the flow of patients during the day or working shift, i.e. a team or unit master schedule. Visualization content comprises information such as: what patients occupy what beds, what treatments or care to deliver to what patients, what nurses to attend to what patients, and in what order to prioritize patients during rounds (Table 6, photo B and C in Figure 3). Different codes were used to keep the information on the master schedule succinct and to maintain patient confidentiality. Explanations of how to interpret the codes were often posted beside the master schedule for closer, more detailed reading. Graphic instructions (sometimes accompanied by detailed instructions to be read close up) on how to structure improvement meetings, or the care routine for different patient groups were also posted on the whiteboard or on the wall beside the master schedule (photo D in Figure 3). An example of Improvements visualization was the use of a PDCA (i.e., plan, do, check, act) wheel showing the process of continuous improvement work at the unit. The PDCA wheel consisted mostly of Post-it notes with staff suggestions, which were discussed during an improvement round, or “lean round” (Table 6, photo E in Figure 3). These visualizations often addressed a mixture of ongoing improvement suggestions in the PDCA process, but could also address previous improvement work and

its associated results. The observations showed a spread of visual management tools used at all five hospitals. The visualization of Flow was the most commonly used and especially at emergency or acute medical or acute surgical units (Table 7).

Table 7. Visual management tool use at the hospitals at T2

Kind of visualization at respective hospital.

| Hospital | Results | Flow | Improvements |
|-----------------|----------------|-------------|---------------------|
| A | 2 out of 4 | 2 out of 4 | 4 out of 4 |
| B | 5 out of 5 | 4 out of 5 | 3 out of 5 |
| C | - | 3 out of 3 | - |
| D | 1 out of 4 | 2 out of 4 | - |
| E | 3 out of 4 | 2 out of 4 | - |

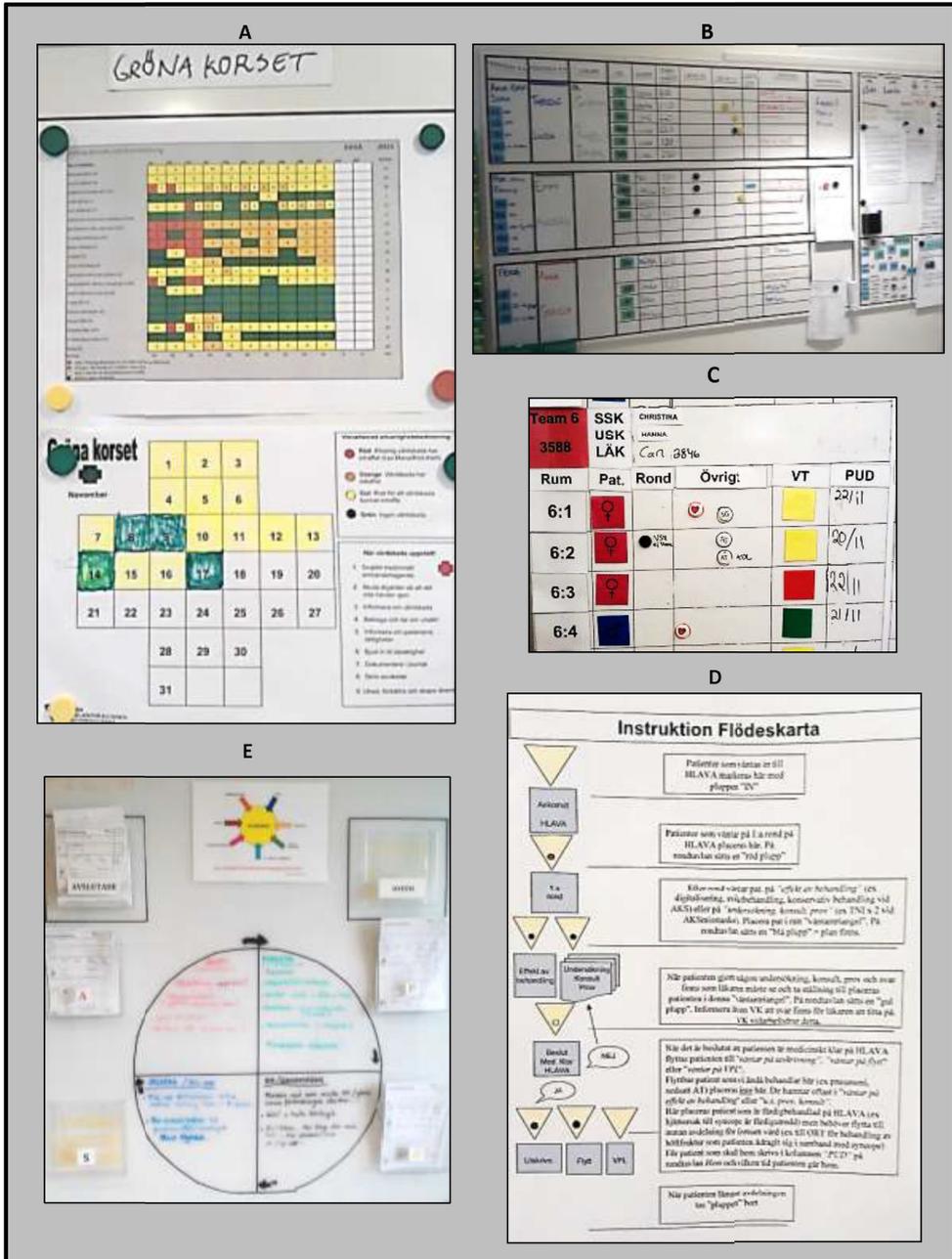


Figure 3. Examples of visual management tools of Results, Flow and Improvements
 A: Green-cross incident reporting system, daily per month (lower) and results over time (upper). B-D: Master schedule, patient flow, staff flow, and workflow. E: Plan – Do – Check – Act wheel with surrounding folders containing suggested and implemented improvements.

4.2 Research question B

How do operative change approaches associate with perceived working conditions and systems performance for healthcare professionals during care process redesign?

4.2.1 Operative lean approaches and healthcare professionals' working conditions (Based on structured interviews and staff questionnaires from Study I)

The use of lean varied among the units with values ranging from 1 to 5 of the different lean focus; value focus, cost reduction focus, work process focus, tool focus. When comparing working conditions among healthcare professionals in relation to the use of operative lean approaches (different lean focus) at their units the findings show advantages for healthcare professionals working at units with higher use of lean approaches (Figure 4).

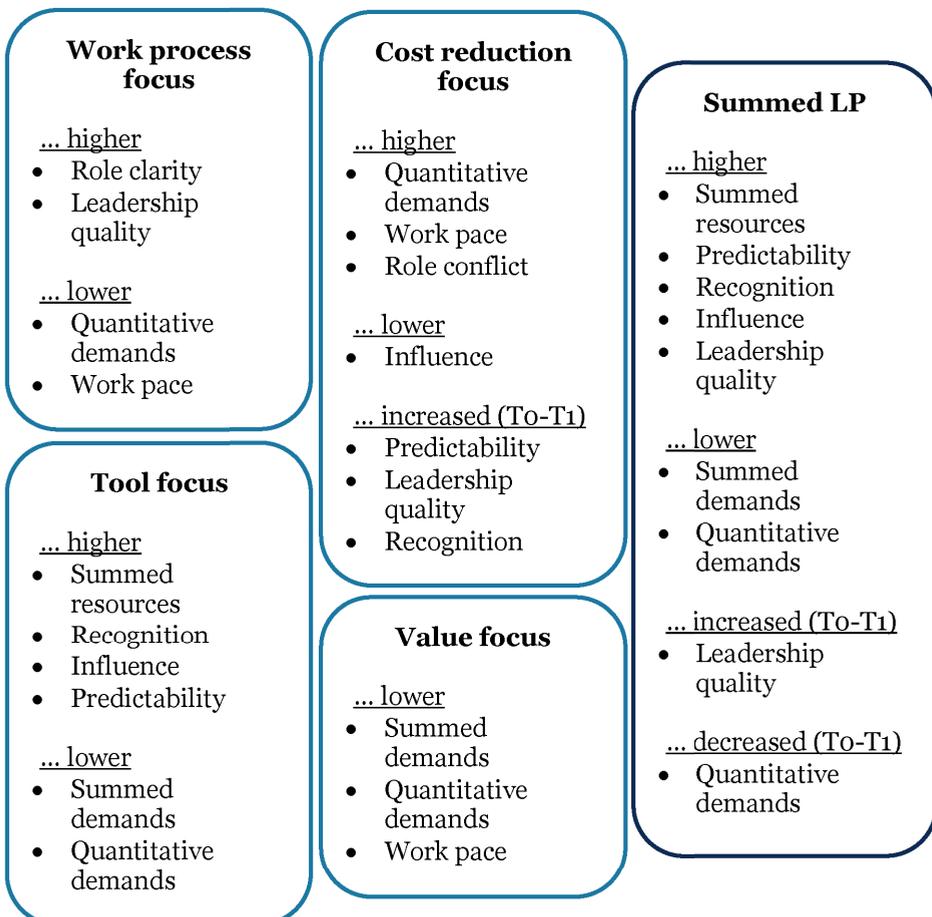


Figure 4. Respective LP focus' association with HCP working conditions

All HCP included in Study I working at units with higher use of summed and different focus in LP approaches, and their associations with working conditions

Higher use of (summed) lean was associated with lower summed demands and quantitative demands (which slightly decreased T₀-T₁) as well as higher summed resources, predictability, recognition, influence and leadership quality (which slightly increased T₀-T₁) among healthcare professionals. Working condition outcomes for healthcare professionals were also associated with certain focus in lean approaches. Work process focus was associated with lower quantitative demands and work pace, and higher role clarity and leadership quality. Value focus was associated with lower summed demands, quantitative demands and work pace. Cost reduction focus was associated with higher quantitative demands, work pace, role conflicts, and lower influence. But cost reduction focus was also associated with increased predictability, recognition and leadership quality. Tool focus was associated with lower summed demands and quantitative demands, and higher summed resources, recognition, influence and predictability. When comparing different healthcare professionals at lean hospitals (A, B and C) to healthcare professionals at the other hospitals (D and E) findings showed working condition benefits over time for registered nurses in both lean hospitals and other hospitals. While physicians had more working condition benefits over time if working at lean hospitals rather than other hospitals, there were a more negative development of working conditions over time for assistant nurses working at other hospitals.

4.2.2 Visual management tool use and healthcare professionals' working conditions and systems performance

(Based on staff questionnaires from Study II)

The use of visual management tools (visualizations) was studied further in Study II as observations at T₀ and T₁ showed an increased presence of visualizations at care units as well as the results from Study I indicated positive associations between lean tool focus (where visual management tools were included) and healthcare professionals working conditions. The findings in Study II showed that daily use of visualizations among nurses (registered and assistant nurses) was associated with cognitive and socio-emotional benefits (Table 8).

Table 8. Daily visual management tool use and the association with working conditions

Nurses included in Study II grouped into visual management tool user groups, and their associations to working conditions. VM = visual management tools

| | |
|---|--|
| Daily users (nurses using VM daily T1 and T2) | <p><u>Rated higher than non-daily VM users regarding:</u></p> <ul style="list-style-type: none"> • social capital (T1) <p><u>Rated higher than non-daily VM users regarding:</u></p> <ul style="list-style-type: none"> • clinical engagement in patient safety (T1, T2) • clinical engagement in care quality (T1, T2) <p><u>Rated higher than start users regarding:</u></p> <ul style="list-style-type: none"> • clinical engagement in patient safety (T1) <p><u>Increased regarding:</u></p> <ul style="list-style-type: none"> • Summed resources (T1-T2) <p><u>Decreased regarding:</u></p> <ul style="list-style-type: none"> • Leadership quality (T0-T2) |
| Start users (nurses starting to use VM daily between T1 and T2) | <p><u>Increased regarding:</u></p> <ul style="list-style-type: none"> • Gaining a work overview (T1-T2) • Focus important information (T1-T2) • Perception of goal monitoring and evaluation (T1-T2) • Clinical engagement in patient safety (T1-T2) • Influence (T1-T2) |
| Non-daily users (nurses not using VM daily at T1 and/or T2) | <p><u>Increased regarding:</u></p> <ul style="list-style-type: none"> • Mental stress (T1-T2) <p><u>Decreased regarding:</u></p> <ul style="list-style-type: none"> • Development opportunities (T0-T2) • Leadership quality (T0-T2) |

Results from comparisons within groups of visualization users showed cognitive benefits in gaining a work overview, focus important information and perception of goal monitoring and evaluation increasing among nurses starting to use visualizations daily (T1-T2). Clinical engagement in patient safety also increased over time (T1-T2) when starting to use visualizations daily. Nurses using visualizations daily both T1 and T2 was associated with ratings of socio-emotional benefits of a higher social capital (T1) and higher clinical engagement in patient safety (T1, T2) as compared to nurses not using visualizations daily. Comparing nurses using visualizations daily both T1 and T2 to nurses starting to use visualizations daily at T2 the daily users rated higher than the start users regarding clinical engagement in patient safety at T1, which was before the start users had started using visualizations daily. Results from mixed models of repeated measurements of the three groups of nurses T0-T2 showed nurses with daily visualization use and nurses that started using visualizations daily between T1 and T2 had more positive results

regarding working conditions and slightly more positive results regarding perceived systems performance. Start user nurses showed increased influence between T1 and T2 but no other differences over time regarding job demands and job resources. This was while the group of nurses that used visualizations daily T1 and T2 decreased in summed resources T1-T2 and the nurses not using visualizations daily either year decreased in, development opportunities and leadership quality (T0-T2). Also the nurses not using visualizations either year increased their mental stress over time (T1-T2). There were no differences seen within groups over time regarding perceived systems performance.

4.2.3 Importance of strategic lean decision and operative lean approaches

(Based on semi-structured interviews, structured interviews and staff questionnaires from Study I)

The results of the 2 x 2 ANOVA analysis showed that the combination of working at a hospital with a strategic decision to work with lean, and working at a unit with a high use of operative lean approaches, showed positive associations with increased influence over time (T0-T1) as well as decreased work pace over time (T0-T1) for healthcare professionals.

The results of the linear regression modelling showed about 15-17% of the variation in stress-related symptoms was explained by job demands and resources while an additional 1-2% was explained by hospital strategic decision to work with lean, and another 2% was explained by working at a unit with high use of operative level lean approaches.

4.3 Research question C

What are the preconditions for change agents to contribute to the alignment of top management change strategies and operative change approaches within hospitals during care process redesign?

4.3.1 Operative managers' use of change agents and change agents' organizational preconditions

(Based on semi-structured interviews, focus group interviews and manager questionnaires from Study III, IV)

Comparing findings from the manager questionnaires there were no great differences between the five hospitals regarding their operative managers experiencing having support from a change agent (or change agent-like function) in their work (either T1 or T2). There were small differences though, and the hospitals with the highest percentage of managers rating high support from change agents were hospital A at T1 and hospital E at T2.

The organization of change agents at lean hospitals (A, B and C) was intended so support the change drive of operative management that had a major responsibility in care process redesign. The unclear division of responsibilities between the different roles in change was expressed by change agents from all three lean hospitals.

While an organization of change agents close to the hospital floor gave direct support to first line managers in e.g. holding improvement meetings (hospital A), this also meant lifting some of the practical responsibility from the first line manager's shoulder. These change agents were responsible for facilitating the healthcare professional groups in suggesting improvements to put up on lean-boards at the units. The change agents had partly the same training in methods and tools to use but had little consensus between hierarchical levels or care units of what change strategy to operationalize on the operative levels.

A change agent supporting the second line managers in follow-up and preparing statistics for strategic management while simultaneously having legitimacy as former operative manager (hospital B) also meant being able to not only support the second line manager in driving change, but also being able to step in as assistant manager when needed. The change agent working close to operative management needed a sense of timing to give the right support at the right time. Change agents at hospital B had explicit and visualized goals to work according to at their respective home departments and were in close contact with strategic management as well as had support from each-other regarding methods and tools. The use of visual management tools was extensive among the change agents, and healthcare professionals working across different hospital units or departments found a similar visualization structure at all units.

The hospital with lowest percentage of managers rating high support from change agents among operative managers both T1 and T2 was hospital C. The change agents being organized to work in process groups including operative managers and healthcare professionals from certain departments meant the change agents were not widely known at the operative level, neither among healthcare professionals nor operative managers outside of the process group. The work pursued in a process group was thus being driven parallel to local change initiatives at operative level and operative managers generally knew little of the county council change agent resource available to support in care process redesign. These change agents were arranged in a joint office and supported each-other in developing lean approaches to be used in the process groups. But they were given loose instructions on how to drive change and what the change strategy meant for them and their work.

Operative managers at the other two hospitals (D and E) had support from a change agent function when needed, e.g. when participating in a project team and change agents at these hospitals was called for when needed. The change agents, as well as strategic management, at the smaller hospital E (with the highest percentage of operative managers rating higher change agent support in T2) were active in

walking around the hospital area and being responsive to needs on the operative levels.

4.4 Research question D

How are operative managers' use of change agents and use of visual management tools associated with perceived working conditions for operative managers in care process redesign?

4.4.1 Operative managers' change agent support and working conditions

(Based on manager questionnaires from Study IV)

Operative managers (from all five hospitals) with higher perceived support from change agents at the earlier stage of care process redesign (T1) rated lower on burnout indexes exhaustion, disengagement and inattentiveness, as well as summed burnout index. Also at the earlier stage of care process redesign, these managers rated significantly higher regarding collaboration, possibilities to fulfill managerial duties and satisfaction with hospital governance. The differences regarding lower inattentiveness among managers with higher change agent support were still present at follow up (T2), but otherwise there were no differences between or within the groups of managers with higher or lower support from change agents (between T1 and T2).

4.4.2 Operative managers' visual management tool use and working conditions

(Based on manager questionnaires from Study IV)

When examining the use of visual management tools among operative managers at the hospitals, hospital C had the highest percentage of managers using visualizations weekly at T1. At T2 hospital B had the highest percentage of managers using visualizations weekly. Hospital B also had the highest percentage of operative managers starting to use visualizations weekly between T1 and T2.

There were differences between the groups of managers (from all five hospitals) starting to use visualizations daily and other managers regarding lower ratings of the burnout index exhaustion, disengagement and also the summed burnout index at follow up (T2). The managers starting to use visualizations daily rated continuity in follow-up and evaluation higher at follow up (T2).

4.4.3 Operative managers' combined use of change agents and visual management tools

(Based on manager questionnaires from Study IV)

The findings further show that combined use of change agent support and weekly visualization use at follow up (T2) was associated with lower ratings on the burnout index exhaustion and the summed burnout index, as well as higher ratings on the outcomes continuity in follow-up and evaluation, collaboration between managers in care process redesign and possibilities to fulfill managerial duties.

5 Discussion

Aims of this thesis included the examining of top management change strategies and operative change approaches during care process redesign at hospitals. The thesis further aimed to explore the strategies' and approaches' associations with operative managers' and healthcare professionals' perceptions on working conditions and systems performance, and the preconditions for alignment of strategies and approaches within the hospitals.

The findings in the thesis show the organization of change leadership and the operative change approaches that were used had importance for sustainable work both for operative managers and healthcare professionals in the hospital work system.

5.1 Alignment of change strategies and operative change approaches

The varying alignment between the strategic and operative levels seen at the hospitals seemed to depend partly on the clarity of the change strategy itself and partly on the communication of roles and responsibilities of the change leadership at the hospitals (*Study III*). The hospitals with strategic managements that had chosen to use lean as major inspiration in care process redesign had pointed to change agent functions as crucial for succeeding with change. While some hospitals had clear outspoken change strategies and approaches, others had fuzzier visions and lacked explicit goals in their care process redesign. A change agent as a link between organizational levels (Larsson & Eid, 2012) could be considered to increase alignment and increase the level of change success (i.e. success according to the strategic management). The chances for a change agent to support vertical alignment as a common understanding between levels of the organization, regarding change goals and visions (von Thiele Schwarz & Hasson, 2013) is limited if the top management change strategy itself is unclear. Horizontal alignment is the common understanding or 'line of sight' among operative managers and healthcare professionals at parallel departments or units, regarding the meaning of the strategy and how to practically contribute to the strategy (Boswell, 2006; von Thiele Schwarz & Hasson, 2013). Not having an explicit division of the practical responsibilities in change kept operative managers, change agents and healthcare professionals from having a clear picture of each and everyone's contribution to care process redesign. The findings in this thesis showed examples of hospitals where the change agent as link in care process redesign was a support for operative managers in their complex work (hospital A) when initiating change, but also showed how a change agent could work as supporter for operative managers but not necessarily simultaneously supporting alignment within the hospital (*Study III*). If the roles and responsibilities in change leadership, and even the change vision (Kotter, 1995) was unclear, and the change agent was a formal change leader but lacking legitimacy among healthcare professionals this contributed to inhibiting alignment (both vertical and

horizontal). A strategic management intervening at the operative levels (hospitals B and E) with an intention of working as a role model link and also using change agent links (Larsson & Eid, 2012) supporting the operative managers (hospital E with highest change agent support rating T2), seemed to increase their chances of aligning their change strategies and approaches between the hierarchical levels (*Study I, III, IV*). The strategic managements as role models facilitated change through diagonal alignment, a mix of vertical and horizontal alignment (von Thiele Schwarz & Hasson, 2013).

Operative managers being stuck in between the strategic management and healthcare professionals and serving as shock-absorbers (Skagert et al., 2008) can be considered facing an increased pressure when care process redesign is launched (Andreasson et al., 2016; A. Eriksson et al., 2016). Findings showed that operative managers with higher support from change agents in the earlier phase of care process redesign rated higher regarding collaboration, possibilities to fulfill managerial duties, and satisfaction with hospital governance as compared with other operative managers (*Study IV*). These managers rating higher satisfaction with hospital governance can be interpreted as change agents serving well as links and fulfilling Kotter's (1995) fifth step of empowering operative managers to act on strategic managements' vision, and thus increasing vertical alignment. Managers rating higher satisfaction with hospital governance can also be interpreted as the managers being satisfied with the fact that strategic management had given them the long-awaited operative support (Wikström & Dellve, 2009) in the form of change agents. The change agents especially seemed to play an important role as supporters for operative managers in the pressured initial phase as the findings were not seen at a later phase (*Study IV*).

Considering the conceptual confusion and difficulties in defining lean (Brännmark et al., 2012; Pettersen, 2009) perhaps focus when researching care process redesign should instead be on matters concerning how and why care process redesign is pursued. The importance of alignment of goals and visions in change has been highlighted by several change management researchers (Gill, 2002; Kotter, 1995; Boswell, 2006; Karlton et al., 2018; von Thiele Schwarz & Hasson, 2013). The findings in this thesis showed a higher use of lean approaches at lean hospital units (*Study I*), which could be seen as a sign of vertical alignment. Alignment can be argued to be low within hospitals D and E and that the change strategies and approaches were characterized by tool-box lean (Brännmark et al., 2012; Pettersen, 2009). This due to the fact that their strategic managements claimed not to use lean as main change strategy in their care process redesign, while their operative levels showed signs of using lean approaches (*Study I, IV*). But it is also a good example of how management concepts from the industry have continued to find its way into the public sector following the NPM reforms in the 1990's. You pick what you consider to be the best parts of a concept and try it out in your own organization. As noted earlier there is a possibility that parts of the lean management concept can have impact on employees working conditions even without the buying in

on the whole lean concept (von Thiele Schwarz et al., 2013). The findings show that there was an association between tool focus lean and positive working conditions for healthcare professionals which can be seen as an example of operative change approaches working well at the operative levels, even without being subsidized by strategic management (*Study I, IV*).

The use of visual management tools worked both as part of hospital B's change strategy and as operative change approach within the hospital and the vertical alignment seemed to have worked well. Findings showed that hospital B was the hospital with highest percentage of operative managers using visualization weekly at follow-up (T2) and starting to use visualization weekly between T1 and T2 (*Study IV*). The practical use of visual management tools at departments and units in both handling daily work and care process redesign was also confirmed by several change agents at the hospital (*Study III*) and further by the observations.

5.2 Change strategies' and change approaches' implications on working conditions

The cognitive, social and emotional benefits of using visual management tools in a planning process (Eppler & Platts, 2009) was partly confirmed by the observations of visualizations at the hospital units. The units with a definite need to increase patient flows were the higher-acuity units (Holden et al., 2015). These units were either dealing with incoming flows (such as emergency unit) or being pressured to ease the patient pressure at the emergency by removing bottlenecks in the flow of patients from the emergency units (i.e. acute care units working "down-stream" from the emergency unit). These higher-acuity units showed to have a more extensive use of flow visualizations than the other units. Holden and co-authors' (2015) research demonstrated how staff at higher-acuity units had more positive attitudes towards lean than lower-acuity units. The higher-acuity units probably had seen the benefits of introducing flow visualizations as a sort of coping strategy and thus followed the recommendations of Jaca and co-authors (2014) to introduce visual management tools as means of increasing control and a sense of order at the work place.

In accordance with the JD-R model (Bakker & Demerouti, 2007) the findings showed lean tools and in specific visual management tools could be considered as physical job resources for healthcare professionals (*Study I, II*). This as it was positively associated with other organizational job resources (recognition, influence, predictability) (*Study I*), as well as they seemed to balance job demands (quantitative demands) for healthcare professionals (*Study I*) and nurses mental stress (when specifically examining visual management tool use among nurses) (*Study II*). Social capital has been shown to be positively related to healthcare professionals' ratings on leadership quality as well as clinical engagement in improvement of patient safety and care quality (Strömngren, 2017). Besides the positive cognitive

benefits for the nurses, daily visual management tool use among nurses was associated with positive organizational outcomes such as social capital, as well as positive ratings regarding leadership quality and an increase in clinical engagement in work with patient safety (*Study II*). Thus the thesis confirms visual management tools as coordination devices or boundary spanners (Andersson & Liff, 2012; Hazlehurst et al., 2008; Nemeth et al., 2004). Though not operationalized in the thesis, these findings could also implicate increased relational coordination (Gittel, 2002), as it relates to especially functioning communication and relationships of shared goals seen among nurses using visual management tools daily.

Furthermore the findings suggests visual management tools as potential means of increasing 'line of sight' for individual nurses (Boswell, 2006), as well as anchoring horizontal alignment (Dellve, 2018; Gunnarsdóttir et al., 2018; von Thiele Schwarz & Hasson, 2013) of change strategies and operative change approaches within and between healthcare professional groups and between hospital units. As nurses' daily visual management tool use was associated with more goal monitoring and evaluation (*Study II*), operative managers' daily visual management tool use was associated with more continuity in follow-up and evaluation (*Study IV*). Continuity in follow-up and evaluation could be interpreted as a higher level of executive control following NPM (SOU, 2016) but the continuity in follow-up and evaluation was not accompanied by greater demands of uniformity or higher burnout among operative managers. Instead it can be seen as a sign of a functioning communication with a strategic management that was eager to understand the needs at the operative levels and keeping track of the change progress. The associations between daily visual management tool use and higher leadership quality (*Study II*) does not answer the question whether better leadership in a certain group of nurses leads to better implementation of visual management tools, or if the use of visual management tools alone makes the nurses think more highly of their managers. The higher ratings on leadership quality among nurses that either used visualizations daily or started using visualizations between T1 and T2 were seen already at T0, when the presence of or level of visualization use were unknown. A leadership that is servant and sensitive to the needs of the employees (Gunnarsdóttir et al., 2018) is likely an underlying factor when succeeding to implement visual management tools that reflects the needs of an organization.

Hospital B both had the highest percentage of operative managers starting to use visual management tools weekly between T1 and T2, and had the highest percentage of operative managers using visual management tools weekly at T2 (*Study IV*). The strategic management at hospital B served as a supporting role model (Larsson & Eid, 2012) working with visual management tools as means to reach diagonal alignment of the change strategies between and within the hierarchical levels of the hospital (von Thiele Schwarz & Hasson, 2013) (*Study I, III, IV*). Exploring the findings in the thesis in relation to the JD-R model (Bakker & Demerouti, 2007; Bakker et al., 2014) visual management tools can be suggested to serve as job resource not only for healthcare professionals but also for operative managers. Daily

visual management tool use was associated with lower ratings regarding burnout as well as positive ratings regarding other organizational outcomes such as collaboration between managers and healthcare professionals and more regular follow-up and evaluation (*Study IV*). The use of tools and technique as drivers in improvement work has been highlighted as supporting nurses' raised status (N. Eriksson et al., 2016). A regular use of visual management tools among both operative managers and nurses may thus be beneficial not only for the collaboration between managers and nurses but also raise the nurses' status and increase their perception of leadership quality.

Operative managers' support from change agents can in the same way be explored related to the JD-R model (Bakker & Demerouti, 2007; Bakker et al., 2014) and the thesis' findings support change agents as organizational job resources in the (as mentioned before) earlier phase of care process redesign. Change agent support was associated with lower burnout (Bakker et al., 2014) among operative managers, as well as positive organizational outcomes (before mentioned collaboration, possibilities to fulfill managerial duties, and satisfaction with hospital governance) (*Study IV*). As also mentioned earlier there was an association between daily visual management tools use and social capital among nurses (*Study II*). The combined support from change agents and weekly visual management tool use being positively associated with collaboration between managers as well as between managers and healthcare professionals, can possibly be a foundation for building horizontal alignment (von Thiele Schwarz & Hasson, 2013) as well as horizontal trust and social reciprocity within the organization, and thus impact the organization's social capital (Strömngren, 2017).

5.3 Care process redesign and sustainable work

Legislating the participation in change efforts at hospitals (SOU, 2016) is not enough when the work system of acute healthcare is as strained as it is. Previous research show physicians need professional development as incentive to engage in improvement work (Lindgren et al., 2013). Applying management concepts that might implicate certain demands of uniformity may naturally be questioned by healthcare professional groups, e.g. physicians representing the cure logic (Glouberman & Mintzberg, 2001). The change agents working on supporting alignment (both vertical and horizontal) within the hospitals need to be aware of the hospitals' different stakeholders "common sense-making" (Cameron & Green, 2012; Damschroder et al., 2009; Gill, 2002) as well as their values in order to find the right incentives to commit to change (Klein & Sorra, 1996). Care process redesign related to change process theory (Van de Ven & Poole, 1995) is suggested in this thesis to be seen as following the dialectical theory. It is a multi-entity change with different stakeholder logics working in opposition to reach a synthesis of the different ideas and notions of how healthcare should be governed. Care process

redesign is iterative and moves forward with incremental changes to reach a higher set goal of sustainable healthcare. The hospitals studied in the thesis also show some resemblance to the middle-up-down approach to change (Karlton et al., 2018; Nonaka, 1994) where the change agents support the middle managers that is described by Nonaka as driving change. The middle-up-down approach is also described to be followed by less clarity regarding roles and responsibilities, which also was pointed to by change agents in this thesis (*Study III*).

To succeed in redesigning care processes at hospitals the same applies as stated earlier in change management research; the interaction between the sub-systems (HTO) needs to be in balance to optimize systems performance. This includes how care process redesign is organized, e.g. in terms of interactions between different healthcare professional groups and managers and how technical tools or infra-structural enablers support the human at work (Carayon & Smith, 2000; Kotter, 1995; Karlton et al., 2017). According to Gittell (2002) a cross-functional information system can support shared understanding and relational coordination, which in turn may lead to improved systems performance seen in increased care quality and shortened hospital stays (Gittell et al., 2000). The findings in this thesis show small but not strong associations between nurses' daily visual management tool use and improved systems performance (*Study II*). Presumably because measures were done in smaller groups of nurses and nurses alone and not combined with other healthcare professional groups. Lean implementation is said to depend on collaboration and communication between units in order to be successful (Greenfield et al., 2011; Lindgren et al., 2013; Mazzocato et al., 2010) and this would be the case with implementations over all, not exclusively lean. The operative managers' job resources such as visual management tools and change agents were positively associated with collaboration between managers (*Study IV*), and well-functioning collaboration between managers at a hospital may presumably also enhance collaboration and communication between healthcare professional groups at the operative level.

Participation and engagement among managers is said to affect the sustainability of change (Kotter, 1995; Larsson et al., 2005). A sustainable work system is by definition regenerative and striving to reach a higher level of complexity without being at the expense of exploiting another part of the system (Kira & van Eijnatten, 2008; Zink, 2014). This thesis found that visual management tools and change agents as job resources were associated with positive working conditions and different positive organizational outcomes (*Study II, IV*). The organizational outcomes (e.g. social capital, collaboration and clinical engagement) can be considered to contribute as job resource within the system and thus theoretically contribute to the system being regenerative and further increase sustainability of the healthcare system (Figure 5). The sustainability of the hospital work system undergoing care process redesign can thus be argued to be positively influenced by change agents and visual management tools contributing to vertical and horizontal alignment.

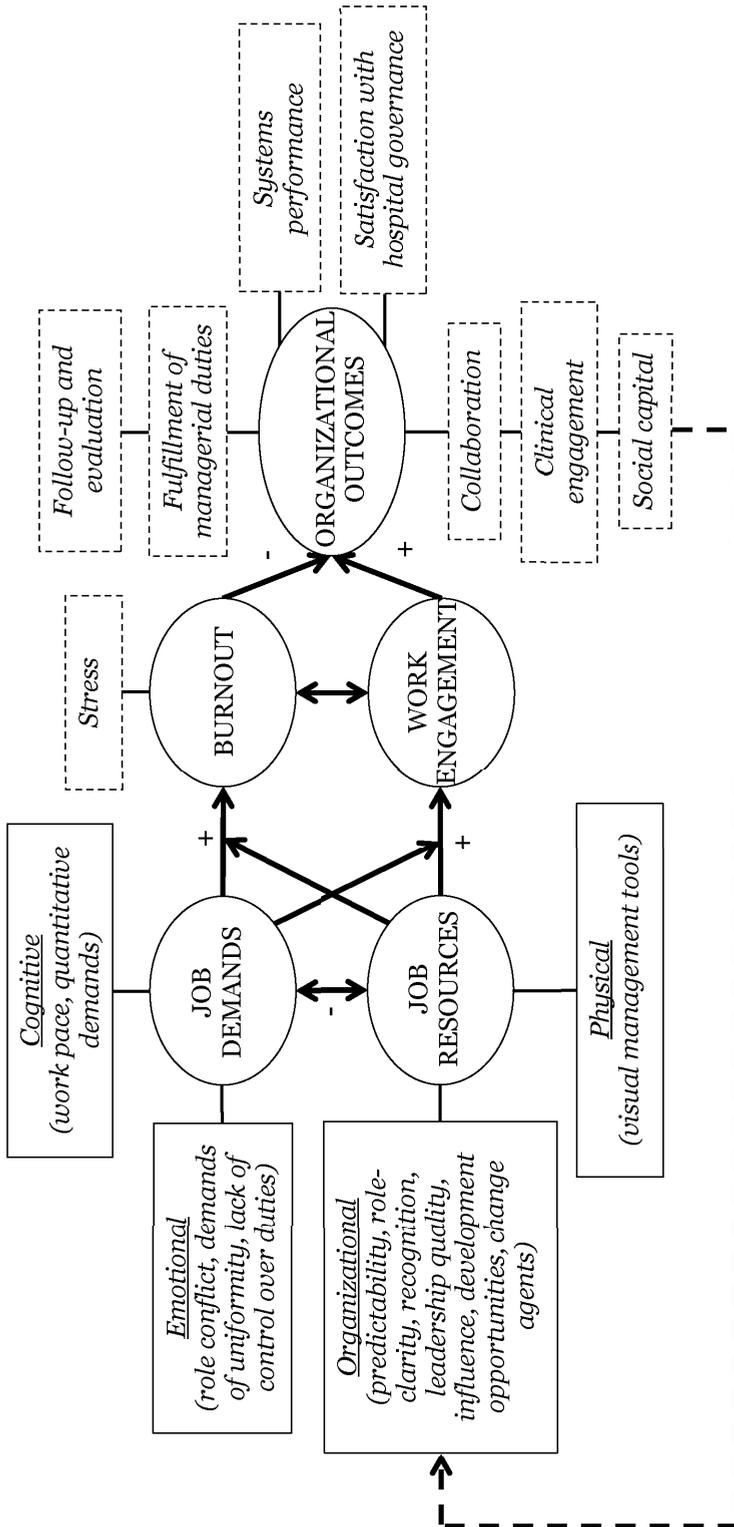


Figure 5. Modified version of the job demands and resources model (JD-R model) by Bakker & Demerouti, 2007
Working conditions affecting perceived organizational outcomes contributing to sustainable work.

5.4 Methodological considerations

When collecting qualitative data such as conducting interviews, there is always a risk of the researcher influencing the data collection process (Hansson, 2007). The researcher conducting the interviews may reflect his or her own expectations on the interviewees in the way the questions are formulated, the way the interviewer phrase the question or follows up on a response that might lead to a further deeper question. This subjectivity always needs to be dealt with in different ways to prevent bias. One way is to have another researcher or professional interviewer conducting the interviews (Kitto et al., 2008). The multiple sources of data in the data collection, and the fact that there were four other researchers involved in interviewing can be considered as strengths. Thus there were opportunities to validate and discuss interpretations beyond examining of transcribed interviews. The downside of not being in the interview situation yourself as a researcher is the loss of possibilities to follow up on certain areas of interest for your research. In the studies included in the thesis the upside of being able to ask follow up questions was considered to overweight the downside of influencing in the interviews.

When discussing this thesis' results, it is done reflecting previous research in similar healthcare contexts, but also in industrial contexts. Part of the interpretation of the result is also a translation of results into practical implications for hospital settings. This is in order to highlight what can be learnt in order to contribute to further development of change practices in the hospital setting. Both the good and the not so good examples in the thesis need to be presented to get as full picture of the change approaches as possible (Kitto et al., 2008).

In social sciences and in qualitative research the application of the findings can sometimes be hard since the general generalizability is low (Kitto et al., 2008). The conceptual generalizability of Study I, III and IV i.e. the transferability of the findings of a study to other similar context was however considered as fairly good (Kitto et al., 2008). The fact that Study I, III and IV described the contextual backgrounds of the hospitals and that Study I described the lean-inspired change strategies and approaches and analyzed it in relation to operative level lean approaches gave possibilities to compare the results to similar contexts and implementations.

When exploring the use of change agent functions at the hospitals (Study III) the interviews with strategic management and operative management revealed signs of potential champions that could have had impact on the care process redesign at the hospitals. Focus was thus on the change agents that each strategic management had identified and pointed out as formally assigned and that was considered by strategic management as important in change leadership at their respective hospital. To avoid having operative managers responding to the change agent support questions (Study IV) with these potential champions in mind the questions regarding operative managers' change agent support specified the support function as a formal change supporting function and not an informal (i.e. a change champion)

(for details on change agent support measure see Appendix B). There could however be a risk that operative managers had other change agent like functions in mind rather than the formally assigned change agents, when answering the questions.

Results in Study I, II and IV show correlations but cannot state causal relationships. The majority of measures used in Study I, II and IV were previously used and validated in earlier studies but some were new single item measures and thus may threaten construct validity. Extensive qualitative studies (e.g. Study III and A. Eriksson et al., 2016) constituted the basis when developing these items. The measures were tested for construct validity by e.g. focus group interviews and by triangulation where results from single items were compared with structured interview data in Study I. Due to low Cronbach's alpha values when testing internal consistency on the four item indexes 'Influence' and 'Development opportunities' for the staff questionnaire in Study II, these analyses were conducted with the measurements as single item measurements. Exploring the benefits of visual management tool use for operative managers in Study IV would have benefited from a hospital wise analysis of change agent and visual management tool support in order to relate hospital change strategies and approaches to level of change agent and visual management tool support. But the dichotomization of change agent support and visual management tool use resulted in very small groups of managers from each hospital, which made the analysis impossible to conduct.

Longitudinal study designs that were used in Study I, II and IV gives strength to the found associations. Different methods of data collection and a variety of perspectives in the analyses also give credit to the thesis. Despite the thesis not being able to state causal relationships, it contributes with practical implications by highlighting change agents and visual management tools as important job resources for both healthcare professionals and operative managers in care process redesign.

6 Conclusion

Top management change strategies for care process redesign highly involve operative managers as change drivers, with support from formally assigned change agent functions. Hospital change agents' preconditions to contribute to change depend on organizational conditions, such as closeness to operative managers due to the change agents place in the healthcare hierarchy, but also due to clarity regarding roles and responsibilities of key actors involved in care process redesign. Change agents can be considered as providing support as organizational job resources for operative managers when introducing care process redesign. Change agents with a close collaboration with operative managers, while also being supported by strategic management and other change agents, seem to have better preconditions to contribute to vertical and horizontal alignment between change strategies and change approaches within a hospital.

Hospitals with lean-inspired change strategies tend to use lean-inspired operative change approaches to a greater extent than hospitals with a top management not using lean as inspiration in their change strategies. However findings show hospital care units in the 2010's tend to use lean-inspired operative change approaches (with value focus, cost reduction focus, work process focus and/or tool focus) also without working with care process redesign strategies based on lean. Operative lean approaches show association with positive working conditions for healthcare professionals, and especially for healthcare professionals working at a hospital with lean as major inspiration in care process redesign, and a unit using operative lean approaches in daily work.

Visual management tools can serve both as change strategy and change approach during care process redesign. As change strategy it has potential to support collaboration and communication of change within and between organizational levels in a hospital, and is thus considered to contribute to systems performance and vertical and horizontal alignment during care process redesign. Visual management tools often visualize contents related to different results, flow (patients or staff) and/or improvements, where flow visualizations are typically used at higher-acuity units. Further visual management tools as change approach can be seen as a cognitive job resource for operative managers as a daily use show associations with e.g. lower burnout and more functioning collaboration. Also nurses' daily use of visual management tools have associations with cognitive, social and emotional benefits, and show signs of enhancing perceived systems performance and buffering nurses' mental stress. The synthesis of the findings implies change agents and the use of visual management tools as contributing to sustainable work for operative managers and healthcare professionals during care process redesign.

6.1 Future research

Previous research on healthcare organizations' use of change agents highlights the importance of securing expertise over time to reach sustainable change, i.e. giving time for operative managers or champions to replace change agents as change drivers (Cameron & Green, 2012; Holden, 2011). Physicians as healthcare professional group are considered as potential champions (Damschroder et al., 2009; Greenfield et al., 2011) working across department borders and moving between the different silos that constitute certain medical specialties. Therefore research would benefit from further studies on the role of physicians as champions and their impact on horizontal alignment within hospitals (von Thiele Schwarz & Hasson, 2013).

Research on visual management tool use among different healthcare professional groups than solely nurses, and its implications on horizontal collaboration and communication would provide a deeper understanding of the connection between visual management tools and systems performance. Previous research has shown a connection between relational coordination and shortened hospital stays (Gittell et al., 2000) and social capitals' association to increased clinical engagement among healthcare professionals (Strömgren, 2017). These studies opens up for further research on relational coordination and social capital connected to visual management tool use. Further these kinds of studies would preferably be conducted as longitudinal follow-up studies, examining the continuous change drive, the sustainability of change, and sustainable work at hospitals.

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References

*in Appendix A and B

Andersson, T. (2015). The medical leadership challenge in healthcare is an identity challenge. *Leadership in Health Services*, 28(2), 83-99.

Andersson, T., & Liff, R. (2012). Multiprofessional cooperation and accountability pressures: Consequences of a post-new public management concept in a new public management context. *Public Management Review*, 14(6), 835-855.

Andreasson, J. (2018). *Organizational preconditions and supportive resources for Swedish healthcare managers: factors that contribute to or counteract changes*. (Doctoral dissertation no. 36, 2018, KTH Royal Institute of Technology)

Andreasson, J., Eriksson, A., & Dellve, L. (2016). Health care managers' views on and approaches to implementing models for improving care processes. *Journal of Nursing Management*, 24(2), 219-227.

Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309-328.

Bakker, A. B., Demerouti, E., & Sanz-Vergel, A. I. (2014). Burnout and work engagement: The JD-R approach. *Annual Review of Organizational Psychology and Organizational Behavior*, 1(1), 389-411.

Bamford, D. R., & Forrester, P. L. (2003). Managing planned and emergent change within an operations management environment. *International Journal of Operations & Production Management*, 23(5), 546-564.

Berlin, C., & Adams, C. (2017). *Production Ergonomics: Designing Work Systems to Support Optimal Human Performance*. London: Ubiquity Press.

Berntson, E., Wallin, L., and Härenstam, A. (2012). Typical situations for managers in the Swedish public sector: cluster analysis of working conditions using the Job Demands-Resources model. *International Public Management Journal*, 15(1), 100-130.

Boswell, W. (2006). Aligning employees with the organization's strategic objectives: Out of 'line of sight', out of mind. *The International Journal of Human Resource Management*, 17(9), 1489-1511.

Brownson, R.C, Colditz, G.A, Proctor, E.K. (2012). *Dissemination and implementation research in health; translating science into practice*. US: Oxford University Press.

- Burnes, B. (2004). Emergent change and planned change-competitors or allies? The case of XYZ construction. *International Journal of Operations & Production Management*, 24(9), 886-902.
- Burnett S., Mendel, P., Nunes, F., Wiig, S., van den Bovenkamp, H., Karlton, A., Robert, G., Anderson, J., Vincent, C., & Fulop, N. (2016). Using institutional theory to analyse hospital responses to external demands for finance and quality in five European countries. *Journal of Health Services Research & Policy*, 21(2), 109-117.
- Brännmark, M., & Eklund, J. (2013). *Lean-inspirerade förändringar och personals upplevelser*. In Sederblad, P., (Red.) (2013). *Lean i Arbetslivet*. Liber AB. Stockholm. pp. 103-121.
- Brännmark, M., & Håkansson, M. (2012). Lean production and work-related musculoskeletal disorders: overviews of international and Swedish studies. *Work*, 41(Supplement 1), 2321-2328.
- Brännmark, M., Langstrand, J., Johansson, S., Halvarsson, A., Abrahamsson, L., & Winkel, J. (2012). Researching Lean: Methodological implications of loose definitions. *Quality Innovation Prosperity= Kvalita Inovacia Prosperita*, 16(2), 35.
- By, R.T. (2005). Organisational change management: A critical review. *Journal of Change Management*, 5(4), 369-380.
- Cameron, E., & Green, M. (2012). *Making sense of change management: A complete guide to the models, tools and techniques of organizational change* (3rd edition). Kogan Page Limited.
- Carayon, P. (2006). Human factors of complex sociotechnical systems. *Applied Ergonomics*, 37(4), 525-535.
- Carayon, P., Hundt, A. S., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Brennan, P. F. (2006). Work system design for patient safety: the SEIPS model. *Quality and Safety in Health Care*, 15 (suppl 1), i50-i58.
- Carayon, P., & Smith, M. J. (2000). Work organization and ergonomics. *Applied Ergonomics*, 31(6), 649-662.
- Choi, S., Holmberg, I., Löwstedt, J., & Brommels, M. (2011). Executive management in radical change — The case of the Karolinska University Hospital merger. *Scandinavian Journal of Management*, 27(1), 11-23.
- Choi, S., Holmberg, I., Löwstedt, J., & Brommels, M. (2012). Managing clinical integration: a comparative case study in a merged university hospital. *Journal of Health Organization and Management*, 26(4), 486-507.

Conn, L. G., Lingard, L., Reeves, S., Miller, K. L., Russell, A., & Zwarenstein, M. (2009). Communication channels in general internal medicine: a description of baseline patterns for improved interprofessional collaboration. *Qualitative Health Research, 19*(7), 943-953.

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science, 4*(1), 50.

Dellve, L. (2018). Tillitsskapande styrningspraktiker? En analys av styrningspraktiker i sjukvården genom nyckeltal. *Socialmedicinsk tidskrift 95*(3), 298-310.

Dellve, L., Andreasson, J., Eriksson, A., Strömgen, M., & Williamsson, A. (2016). *Nyorientering av svensk sjukvård: Verksamhetstjänande implementeringslogiker bygger mer hållbart engagemang och utveckling – i praktiken.* [Re-orientation of Swedish healthcare: Servant and practice oriented management approaches builds sustainable engagement and development.] KTH – Royal Institute of Technology (TRITA-STH-PUB:1). Retrieved from: https://www.kth.se/polopoly_fs/1.796614!/Nyorientering%20av%20sjukv_slutrapport.pdf

Dellve, L., Eriksson, A., Fredman, M., & Kullen-Engstöm, A. (2013). *Lean i hälso- och sjukvården.* In Sederblad, P., (Red.) (2013). *Lean i Arbetslivet.* Liber AB. Stockholm. pp. 142-161.

*Dellve, L., Lindgren, Å., & Bååthe, F. (2012). *Health care professionals motivation and engagement in health care development. Proceedings of the 44th Annual Nordic Ergonomics and Human Factors Society Conference, Saltsjöbaden, Sweden.*

*Dellve, L., Skagert, K., & Eklöf, M. (2008). The impact of systematic occupational health and safety management for occupational disorders and long-term work attendance. *Social Science & Medicine, 67*(6), 965-970.

Dellve, L., & Wikström, E. (2009). Managing complex workplace stress in health care organizations: leaders' perceived legitimacy conflicts. *Journal of Nursing Management, 17*(8), 931-941.

Docherty, P., Kira, M., & Shani, A.B. (2009). *What the world needs now is sustainable work systems.* In: Docherty, P., Kira, M., Shani, A.B. (Eds.), *Creating Sustainable Work Systems*, second ed. Routledge, London and New York, pp. 1-21.

Eklund, J. (2003). *An extended framework for humans, technology and organization in interaction. Human Factors in Organizational Design and Management – VII.* IEA Press, Santa Monica, 47-60.

- *Eklöf, M., Pousette, A., Dellve, L., Skagert, K., & Ahlberg Jr, G. (2010). *Gothenburg Manager Stress Inventory (GMSI)*. Institute of Stress Medicine Region Västra Götaland, available at: https://alfresco.vgregion.se/alfresco/service/vgr/storage/node/content/work-space/SpacesStore/316e07c5-707c-48df-9cb2-c49449681352/2010_7_GMSI%20.pdf?a=false&guest=true (accessed 2018-08-16)
- Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology*, 5(1), 105-123.
- Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107-115.
- *Eriksson, A., Dellve, L., Williamsson, A., & Holden, R.J. (2014). *Three Swedish hospitals' lean strategies and their contribution to organizational development. Proceedings of the 11th ODAM Symposium/46th NES conference, 2014*, Copenhagen, Denmark.
- Eriksson, A., Holden, R. J., Williamsson, A., & Dellve, L. (2016). A Case Study of Three Swedish Hospitals' Strategies for Implementing Lean Production. *Nordic Journal of Working Life Studies*, 6(1), 105-131.
- Eriksson, N., Müllern, T., Andersson, T., Gadolin, C., Tengblad, S., & Ujvari, S. (2016). Involvement drivers: a study of nurses and physicians in improvement work. *Quality Management in Health care*, 25(2), 85-91.
- Esain, A., Williams, S., & Massey, L. (2008). Combining planned and emergent change in a healthcare lean transformation. *Public Money and Management*, 28(1), 21-26.
- Eppler, M. J. (2004). Facilitating knowledge communication through joint interactive visualization. *Journal of Universal Computer Science*, 10(6), 683-690.
- Eppler, M. J., & Platts, K. W. (2009). Visual strategizing: the systematic use of visualization in the strategic planning process. *Long Range Planning*, 42(1), 42-74.
- Fagerlind Ståhl, A. C. (2015). *Live long and prosper: Health-promoting conditions at work*. (Doctoral dissertation, Linköping University Electronic Press).
- Fagerlind Ståhl, A. C., Gustavsson, M., Karlsson, N., Johansson, G., & Ekberg, K. (2015). Lean production tools and decision latitude enable conditions for innovative learning in organizations: A multilevel analysis. *Applied Ergonomics*, 47, 285-291.
- Gill, R. (2002). Change management – or change leadership? *Journal of Change Management*, 3(4), 307-318.

- Gittell, J.H. (2002). Coordinating mechanisms in care provider groups: Relational coordination as a mediator and input uncertainty as a moderator of performance effects. *Management Science*, 48(11), 1408-1426.
- Gittell, J. H., Fairfield, K. M., Bierbaum, B., Head, W., Jackson, R., Kelly, M., ... & Zuckerman, J. (2000). Impact of relational coordination on quality of care, postoperative pain and functioning, and length of stay: a nine-hospital study of surgical patients. *Medical Care*, 807-819.
- Glouberman, S., & Mintzberg, H. (2001). Managing the care of health and the cure of disease — Part I: Differentiation. *Health Care Management Review*, 26(1), 56-69.
- Graetz, F. (2000). Strategic change leadership. *Management Decision*, 38(8), 550-564.
- Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2), 105-112.
- Greenfield, D., Nugus, P., Travaglia, J., & Braithwaite, J. (2011). Factors that shape the development of interprofessional improvement initiatives in health organisations. *BMJ Quality & Safety*, 20(4), 332-337.
- Gunnarsdóttir, S., Edwards, K., & Dellve, L. (2018). *Improving health care organizations through servant leadership. In practicing servant leadership*. Palgrave Macmillan, Cham. pp. 249-273.
- Hansson, S. O. (2007). *The art of doing science*. Department of Philosophy and the History of Technology, KTH.
- Hasle, P., Nielsen, A. P., & Edwards, K. (2016). Application of lean manufacturing in hospitals — The need to consider maturity, complexity, and the value concept. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 26(4), 430-442.
- Hazlehurst, B., Gorman, P. N., & McMullen, C. K. (2008). Distributed cognition: an alternative model of cognition for medical informatics. *International Journal of Medical Informatics*, 77(4), 226-234.
- Hendy, J., & Barlow, J. (2012). The role of the organizational champion in achieving health system change. *Social Science & Medicine*, 74(3), 348-355.
- Holden, R. J. (2011). Lean thinking in emergency departments: a critical review. *Annals of Emergency Medicine*, 57(3), 265-278.

- Holden, R. J., Eriksson, A., Andreasson, J., Williamsson, A., & Dellve, L. (2015). Healthcare workers' perceptions of lean: A context-sensitive, mixed methods study in three Swedish hospitals. *Applied Ergonomics*, 47, 181-192.
- Holden, R. J. & Hackbart, G. (2012). From group work to teamwork: A case study of "Lean" rapid process improvement in the ThedaCare Information Technology Department. *IIE Transactions on Healthcare Systems Engineering*, 2(3), 190-201
- Howell, D. C. (2012). *Statistical methods for psychology*. Wadsworth: Cengage Learning.
- Hultell, D., & Gustavsson, J. P. (2010). A psychometric evaluation of the Scale of Work Engagement and Burnout (SWEBO). *Work*, 37(3), 261-274.
- Hutchins, E. (1995). *Cognition in the Wild*. MIT press.
- IEA, (2016). International Ergonomics Association. Webpage. <http://www.iea.cc/whats/index.html> (retrieved 2016-04-21)
- Jaca, C., Viles, E., Jurburg, D., & Tanco, M. (2014). Do companies with greater deployment of participation systems use Visual Management more extensively? An exploratory study. *International Journal of Production Research*, 52(6), 1755-1770.
- Jackson, B., & Parry, K. (2011). *A very short fairly interesting and reasonably cheap book about studying leadership*. Sage.
- Jamieson, S. (2004). Likert scales: how to (ab) use them. *Medical Education*, 38(12), 1217-1218.
- Karasek, R. (1990). Lower health risk with increased job control among white collar workers. *Journal of Organizational Behavior*, 11(3), 171-185.
- Karltun, A. (2014). *A novel approach to understand nested layers in quality improvement*. In *Human Factors in Organizational Design and Management – xi Nordic Ergonomics Society Annual Conference – 46*, Copenhagen, August 17-20. (pp. 343-348).
- Karltun, A., Karltun, J., Eklund, J., & Berglund, M. (2017). HTO – A Complementary Ergonomics Approach. *Applied Ergonomics*, 59, 182-190
- Karltun, A., Sanne, J.M.S., Aase, K., Andersson, J.E, Fernandes, A., Fulop, N.J., Höglund P., & Andersson-Gare, B. (2018). Knowledge management infrastructure to support quality improvement: A qualitative study of maternity services in four European hospitals. *Submitted to BMC Health Services Research*.

- Kira, M., & Eijnatten, F. M. V. (2008). Socially sustainable work organizations: A chaordic systems approach. *Systems Research and Behavioral Science*, 25(6), 743-756.
- Kitto, S. C., Chesters, J., & Grbich, C. (2008). Quality in qualitative research. *The Medical Journal of Australia*, 188(4), 243-246.
- Kjellström, S., Avby, G., Areskoug-Josefsson, K., Andersson Gäre, B., & Andersson Bäck, M. (2017). Work motivation among healthcare professionals: A study of well-functioning primary healthcare centers in Sweden. *Journal of Health Organization and Management*, 31(4), 487-502.
- Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review*, 21(4), 1055-1080.
- Kotter, J. P. (1995). Leading change: Why transformation efforts fail. *Harvard Business Review*, 73(2), 59-67.
- Kristensen, T. S., Hasle, P., Pejtersen, J. H., & Olesen, K. G. (2007). *Organisational social capital and the health and quality of work of the employees'—two empirical studies from Denmark. Proceedings from International Congress on Social Capital and Networks of Trust*. Jyväskylä, Finland.
- Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed). Chicago: University of Chicago Press.
- Körner, S., & Wahlgren, L. (2015). *Statistiska metoder* (Vol. 3). Lund: Studentlitteratur.
- Landsorganisationen i Sverige (LO). (2018). Medbestämmandelagen. Retrieved 180927 from: http://www.lo.se/start/politiska_sakfragor/arbetsratt/lagarna/medbestammande
- Larsson, G., & Eid, J. (2012). An idea paper on leadership theory integration. *Management Research Review*, 35(3/4), 177-191.
- Larsson, G., Sjöberg, M., Vrbanjac, A., & Björkman, T. (2005). Indirect leadership in a military context: A qualitative study on how to do it. *Leadership & Organization Development Journal*, 26(3), 215-227.
- Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & Quantity*, 43(2), 265-275.
- Lewin, K. (1947). Frontiers in group dynamics: Concept, method and reality in social science; social equilibria and social change. *Human Relations*, 1(1), 5-41.

- Liker, J. (2004). *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer: 14 Management Principles from the World's Greatest Manufacturer*. New York, NY: McGraw-Hill.
- Lin, N. (1999). Building a network theory of Social Capital. *Connections*, 22(1), 28-51.
- Lindgren, Å., Bååthe, F., & Dellve, L. (2013). Why risk professional fulfilment: a grounded theory of physician engagement in healthcare development. *The International Journal of Health Planning and Management*, 28(2), e138-e157.
- Lindskog, P. (2016). *Reaching at sustainable development: Lean in the public sector*. (Doctoral dissertation No.7, 2016, KTH Royal Institute of Technology).
- Lunenburg, F. C. (2010). Managing change: The role of the change agent. *International Journal of Management, Business & Administration*, 13(1), 1-6.
- Mazzocato, P., Savage, C., Brommels, M., Aronsson, H., & Thor, J. (2010). Lean thinking in healthcare: a realist review of the literature. *Quality and Safety in Health Care*, 19(5), 376-382.
- McCormack, B., Rycroft-Malone, J., DeCorby, K., Hutchinson, A. M., Bucknall, T., Kent, B., ... & Wallin, L. (2013). A realist review of interventions and strategies to promote evidence-informed healthcare: a focus on change agency. *Implementation Science*, 8(1), 107.
- Ministry of Finance, Government offices of Sweden. (2017). The Swedish model. Retrieved 180924 from: <https://www.government.se/4a5336/contentassets/8416c4ff1410419090181fe503920390/the-swedish-model.pdf>
- Modig, N., & Åhlström, P. (2011). *Vad är lean?: en guide till kundfokus och flödeseffektivitet*. SSE Institute for Research. Stockholm.
- Moon, M. Y. (2009). Making sense of common sense for change management buy-in. *Management Decision*, 47(3), 518-532.
- Nemeth, C. P., Cook, R. I., O'Connor, M., & Klock, P. A. (2004). Using cognitive artifacts to understand distributed cognition. *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, 34(6), 726-735.
- Noether G.E. (1991) *Nonparametric and Parametric Tests*. In: *Introduction to Statistics*. Springer Texts in Statistics. Springer, New York, NY
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14-37.

Norbäck, L. E., & Targama, A. (2009). *Det komplexa sjukhuset: att leda djupgående förändringar i en multiprofessionell verksamhet*. Studentlitteratur. Lund.

Norman, G. (2010). Likert scales, levels of measurement and the “laws” of statistics. *Advances in Health Sciences Education*, 15(5), 625-632.

*Parand, A., Burnett, S., Benn, J., Pinto, A., Iskander, S., & Vincent, C. (2011). The disparity of frontline clinical staff and managers’ perceptions of a quality and patient safety initiative. *Journal of Evaluation in Clinical Practice*, 17(6), 1184-1190.

Pejtersen, J. H., Kristensen, T. S., Borg, V., & Bjorner, J. B. (2010). The second version of the Copenhagen Psychosocial Questionnaire. *Scandinavian Journal of Public Health*, 38(3 suppl), 8-24.

Pettersen, J. (2009). Defining lean production: some conceptual and practical issues. *The Total Quality Management Journal*, 21(2), 127-142.

Pollitt, C. (2000). Is the emperor in his underwear? An analysis of the impacts of public management reform. *Public Management an International Journal of Research and Theory*, 2(2), 181-200.

Ray, W. (2000). *Methods toward a science of behavior and experience* (6th ed). Wadsworth Thomson Learning. RR Donnelley & Sons. Crawfordsville, USA.

Rollenhagen, C. (1997). *Sambanden människa, teknik och organisation: en introduktion*. Studentlitteratur. Lund.

Semler, S. W. (1997). Systematic agreement: A theory of organizational alignment. *Human Resource Development Quarterly*, 8(1), 23-40.

Skagert, K., Dellve, L., Eklöf, M., Pousette, A., & Ahlborg Jr, G. (2008). Leaders’ strategies for dealing with own and their subordinates’ stress in public human service organisations. *Applied Ergonomics*, 39(6), 803-811.

Statens offentliga utredningar. (2016). *Effektiv vård*. (SOU 2016:2). Retrieved from https://www.regeringen.se/contentassets/42b0aef4431c4ebf9410b8ee771830eb/effektiv-vard---slutbetankande-av-en-nationell-samordnare-for-effektiva-resursutnyttjande-inom-halso--och-sjukvarden_sou-2016-2.pdf

*Strömgren, M., Eriksson, A., Bergman, D., & Dellve, L. (2016). Social capital among healthcare professionals: A prospective study of its importance for job satisfaction, work engagement and engagement in clinical improvements. *International Journal of Nursing Studies*, 53, 116-125.

Strömgren, M. (2017). *Social capital in healthcare: A resource for sustainable engagement in organizational improvement work*. (Doctoral dissertation No.8, 2017, KTH Royal Institute of Technology).

- Tengblad, S. (2010). *Medarbetarskap på 60 minuter* [Co-leadership in 60 minutes.] (Technical report). Skövde: University of Skövde.
- Tengelin, E., Arman, R., Wikström, E., & Dellve, L. (2011). Regulating time commitments in healthcare organizations: Managers' boundary approaches at work and in life. *Journal of Health Organization and Management*, 25(5), 578-599.
- Van de Ven, A. H., & Poole, M. S. (1995). Explaining development and change in organizations. *Academy of Management Review*, 20(3), 510-540.
- von Thiele Schwarz, U., & Hasson, H. (2013). *Alignment for achieving a healthy organization*. In Bauer, G.F., & Jenny, G.J. (2013). *Salutogenic organizations and change*. Springer, Dordrecht. pp. 107-125.
- von Thiele Schwarz, U., Stenfors-Hayes, T., Augustsson, H., & Hasson, H. (2013). *Kan lean vara hälsofrämjande? Kaizen som utgångspunkt för hälsopromotion*. In Sederblad, P., (Red.) (2013) *Lean i Arbetslivet*. Liber AB. Stockholm. pp. 122-139.
- Weimarsson, H. (2011). Nio av tio sjukhus har gått över till "Lean" (Nine out of ten hospitals have implemented Lean) [in Swedish]. *Läkartidningen*, 108(39). PMID: 22111232. Available from: http://ww2.lakartidningen.se/store/articlepdf/1/17019/_1915.pdf (accessed 2018-08-16)
- Womack, J. P., & Jones, D. T. (2003). *Lean Thinking*, revised ed.
- Wiig, S., Aase, K., von Plessen, C., Burnett, S., Nunes, F., Weggelaar, A. M., ... & Fulop, N. (2014). Talking about quality: exploring how 'quality' is conceptualized in European hospitals and healthcare systems. *BMC Health Services Research*, 14(1), 1.
- Wikström, E., & Dellve, L. (2009). Contemporary leadership in healthcare organizations: fragmented or concurrent leadership. *Journal of Health Organization and Management*, 23(4), 411-428.
- *Williamsson, A. (2018). Operative managers' Job-Demands-Resources when redesigning care processes. (*submitted to journal*)
- *Williamsson, A., Dellve, L. and Karlton, A. (2018), Nurses' use of visual management in hospitals – a longitudinal, quantitative study on implications on systems performance and working conditions. *Journal of Advanced Nursing*, (*In Press*)
- WCED. (1987). *Our Common Future*. London: Oxford University Press
- Xiao, Y., Schenkel, S., Faraj, S., Mackenzie, C. F., & Moss, J. (2007). What whiteboards in a trauma center operating suite can teach us about emergency department communication. *Annals of Emergency Medicine*, 50(4), 387-395.

Yukl, G. (2009). Leading organizational learning: Reflections on theory and research. *The Leadership Quarterly*, 20(1), 49-53.

Zink, K. J. (2014). Designing sustainable work systems: The need for a systems approach. *Applied Ergonomics*, 45(1), 126-132.

Appendix A

All single items and index used in the staff questionnaire, showing the contribution in study I and II.

| (SQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|---|---|---|------------------|
| VM tool use measures (Williamsson et al., 2018) | | | |
| Single item | Do you have any aid or tool(s) illustrating important information concerning processes and/or workflow (e.g. lean boards, round boards and whiteboards) in your unit? | 1–3 (<i>Yes, No, I don't know</i>) | II |
| Single item | If Yes on the above question, to what extent do you use the tool? | 1–6 (<i>Never/Almost never, Monthly, Weekly, Several times a week, Daily, Several times a day</i>) | II |
| Cognitive measures (Williamsson et al., 2018) | | | |
| Single item | If YES on question concerning presence of VM at unit: To what extent does/do the tool(s) help you... a)...gain an overview of your work? b)...focus on important information concerning processes or workflow? c) ...detect potential improvements of processes or workflow? | 1–5 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | II |
| Single item | Our unit goals are being monitored and evaluated in a proper way. | | II |
| Single item | How often do you overlook important information due to information overload? | 1–5 (<i>Never/Almost never, Seldom, Sometimes, Often, Always</i>) | II |
| Social measures (Dellve et al., 2012; Lindgren et al., 2013) | | | |
| Collaboration in care process redesign | How do you perceive the collaboration concerning care process redesign... ... in your professional group? | 1–5 (<i>I don't know, Very bad, Fairly bad, Fairly good, Very good</i>) | II |
| | ... between different professional groups? | | |
| | ... between your unit and other units? | | |
| Single item | How many improvement suggestions have you come up with during the past year? | 1–5 (<i>None, 1–3, 4–6, 7–10, More than 10</i>) | II |
| Single item | How many of your suggestions have been listened to and discussed? | 1–5 (<i>None, 1–3, 4–6, 7–10, More than 10</i>) | II |
| Socio-emotional measures (Strömberg et al., 2016) | | | |
| Recognition | Are you fairly treated at your work place? | 0–100 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | (Social capital) |
| | Are you respected by management at your work place? | | |
| | Is your work respected and appreciated by management at your work place? | | |
| Reciprocity | At my workplace we care for each other. | | |
| | At my workplace we treat each other with respect. | | |
| | At my workplace I feel safe and accepted. | | |

| (SQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|---|--|---|------------------|
| Socio-emotional measures continuing... | | | |
| Trust regarding management | Can you trust the information that comes from the management? | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | (Social capital) |
| Mutual trust between employees | Do the employees in general trust each other? | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | (Social capital) |
| Social capital | Reciprocity Trust regarding management Mutual trust between employees Recognition | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | II |
| Clinical engagement in patient safety | At our clinic ... | 1–5 (<i>Is not at all correct, Is not correct, Is partly correct, Is very much correct</i>) | II |
| | ... we work actively to improve patient safety | | |
| | ... we discuss how to avoid errors | | |
| | ... we work actively to improve the reporting of errors | | |
| Clinical engagement in care quality | ... we report directly and without hesitation when we see something that can harm patients' safety | | |
| | ... we have active dialogue about how to provide good care for patients at our ward/ clinic | | |
| | ... we have good opportunities to meet patients' needs | | |
| | ... the values of providing good care at my clinic agree with my own | | |
| Systems performance measures | | | |
| Single item (<i>Eriksson et al., 2014</i>) | How pleased are you with... a) ... the care quality in your unit? b) ... the efficiency of your unit? c) ... the work environment of your unit? | 1–4 (<i>Very displeased, Displeased, Pleased, Very pleased</i>) | II |
| Timeliness of care (<i>Parand et al., 2011</i>) | How often do patients in your unit have to wait too long for treatment? (reversed item) | 1–5 (<i>Never/ Almost never, Seldom, Sometimes, Often, Always</i>) | II |
| | How often do patients in your unit get care/treatment at the correct time or even earlier? | | |
| Working condition measures (<i>Pejtersen et al., 2010</i>) | | | |
| Predictability | Are you being informed in time when it comes to important decisions, changes or future plans at your workplace? | 0–100 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | I, II |
| | Do you get to know all you need to know in order to manage your work well? | | |

| (SQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|---|---|--|-------|
| Working condition measures continuing... | | | |
| Influence | Do you have a large degree of influence over decisions affecting your work? | 0–100 (<i>Never/Almost never , Seldom, Sometimes, Often, Always</i>) | I |
| | Can you influence the amount of work assigned to you? | | |
| | Can you influence who to work with? | | |
| | Do you have any influence on what you do at work? | | |
| Influence (Single item) | Do you have any influence on what you do at work? | | II |
| Development opportunities | Does your work require you to take initiative? | 0–100 (<i>To a very low degree , To a low degree, Partly, To a high degree, To a very high degree</i>) | I |
| | Do you have the possibility of learning new things through your work? | | |
| | Can you use your skills or expertise in your work? | | |
| | Does your work give you the opportunity to develop your skills? | | |
| Development opportunities (Single item) | Do you have the possibility of learning new things through your work? | | II |
| Leadership quality | To what degree do you think your closest manager ... | 0–100 (<i>To a very low degree , To a low degree, Partly, To a high degree, To a very high degree</i>) | I, II |
| | ... appreciates staff and takes the individual into account? | | |
| | ... makes sure every individual has good development opportunities? | | |
| | ... prioritizes further education and development among staff? | | |
| | ... prioritizes well-being at work? | | |
| | ... is good at planning work? | | |
| | ... is good at allocating work? | | |
| | ... is good at solving conflicts? | | |
| | ... is good at communicating with staff? | | |
| Recognition | Are you fairly treated at your work place? | 0–100 (<i>To a very low degree , To a low degree, Partly, To a high degree, To a very high degree</i>) | I, II |
| | Are you respected by management at your work place? | | |
| | Is your work respected and appreciated by management at your workplace? | | |
| Role clarity | Do you know what is expected from you in your work? | 0–100 (<i>To a very low degree , To a low degree, Partly, To a high degree, To a very high degree</i>) | I, II |
| | Are you clear about your responsibilities in your work? | | |
| | Are there clear goals for your work? | | |

| (SQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|---|---|---|-------|
| Working condition measures continuing... | | | |
| Quantitative demands | Is the burden from your work unevenly distributed so that you fall behind in your work? | 0–100 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | I |
| | How often do you not have the time to finish your work tasks? | | |
| | Do you fall behind in your work? | | |
| | Do you have enough time to finish your work tasks? | | |
| Work pace | Is it necessary that you work very fast? | 0–100 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | I |
| | Is it important to keep a high work pace? | | |
| | Is the work pace high throughout the work day? | | |
| Stress symptoms (Pejtersen et al., 2010) | | | |
| Mental stress | During the past four weeks: | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | I, II |
| | How often have you found it hard to relax? | | |
| | How often have you been edgy/ irritable? | | |
| | How often have you been tense? | | |
| | How often have you felt stressed? | | |
| Cognitive stress | During the past four weeks: | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | I |
| | How often have you had trouble concentrating? | | |
| | How often have you had trouble thinking clearly? | | |
| | How often have you had trouble making decisions? | | |
| | How often have you had trouble remembering? | | |
| Physical stress | During the past four weeks: | 0–100 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | I |
| | How often have you had stomach ache? | | |
| | How often have had head ache? | | |
| | How often have you felt palpitations? | | |
| | How often have you felt muscle tensions? | | |

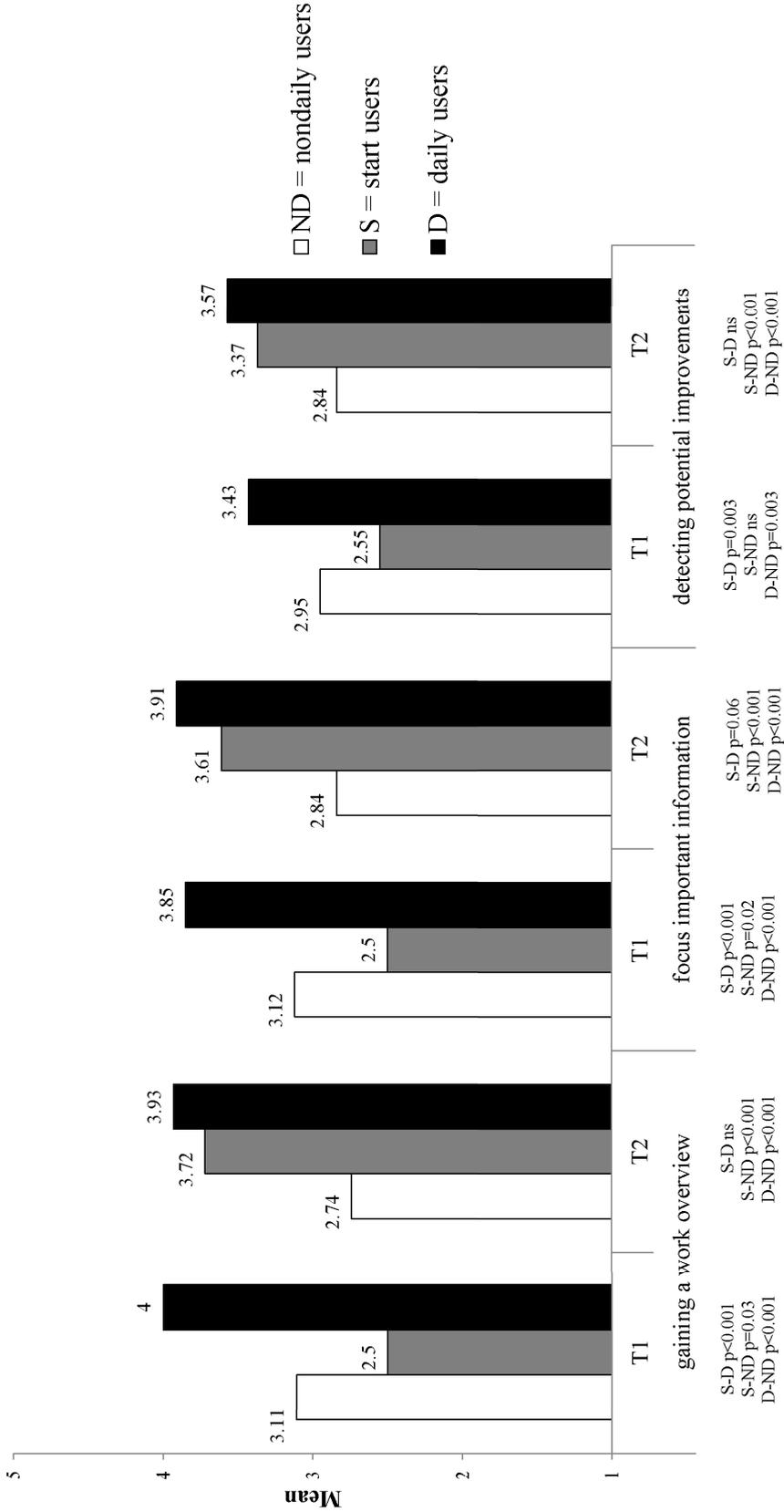
Appendix B

All single items and index used in the manager questionnaire, showing the contribution in study IV.

| (MQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|---|---|---|-------|
| Job resources | | | |
| Support from change agents (Williamsson, 2018) | I have good support from a resource function (such as care developer, lean-coach, or improvement leader) when working with improvements. | 1–5 (<i>Is not at all correct, Is not correct, Is partly correct, Is correct, Is very much correct</i>) | IV |
| VM use (Williamsson et al., 2018) | Do you have any aid or tool(s) illustrating important information concerning processes and/or workflow (e.g. lean boards, round boards and whiteboards) in your unit? | 1–3 (<i>Yes, No, I don't know</i>) | IV |
| | If Yes on the above question, to what extent do you use the tool? | 1–6 (<i>Never/Almost never, Monthly, Weekly, Several times a week, Daily, Several times a day</i>) | IV |
| VM support (Williamsson et al., 2018) | If YES on question concerning presence of VM at unit: To what extent does/do the tool(s) help you... a)...gain an overview of your work? b)...focus on important information concerning processes or workflow? c) ...detect potential improvements of processes or workflow? | 1–5 (<i>To a very low degree, To a low degree, Partly, To a high degree, To a very high degree</i>) | IV |
| Job demands | | | |
| Cognitive load (Williamsson et al., 2018) | How often do you overlook important information due to information overload? | 1–5 (<i>Never/Almost never, Seldom, Sometimes, Often, Always</i>) | IV |
| Uniformity demands (Eklöf et al., 2010) | How often have you experienced that you had to adjust to executive demands of uniformity? | 1–5 (<i>Never/Almost never, Seldom, Sometimes, Often, Always</i>) | IV |
| Lack of control (Eklöf et al., 2010) | How often have you had a difficulty getting a clear picture of your responsibilities as a manager? | 1–5 (<i>Never/Almost never, Seldom, Sometimes, Often, Always</i>) | IV |
| Work engagement (Hultell & Gustavsson, 2010) | | | |
| Vigour (index) | How often during the last two weeks at work have you felt... | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...energetic? | | |
| | ...persevering? | | |
| | ...active? | | |
| Dedication (index) | ...pride? | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...dedication? | | |
| | ...inspiration? | | |
| Attentiveness (index) | ...fully concentrated? | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...attentive? | | |
| | ...nimblely? | | |
| | ...clear-headed? | | |

| (MQ) MEASURE | QUESTION | RESPONSE RANGE (value) | STUDY |
|--|---|---|-------|
| Burnout (Hultell & Gustavsson, 2010) | | | |
| Exhaustion (index) | How often during the last two weeks at work have you felt... | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...decrepit? | | |
| | ...exhausted? | | |
| | ...run-down? | | |
| Disengagement (index) | ...indifference? | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...insignificance? | | |
| | ...dejection? | | |
| Inattentiveness (index) | ...unfocused? | 1-5 (<i>Not at all, Very seldom, Partly, Often, All the time</i>) | IV |
| | ...restless? | | |
| | ...easily distracted? | | |
| Organizational outcomes | | | |
| Collaboration in care process redesign (Dellve et al., 2012; Lindgren et al., 2013) | How do you perceive the collaboration concerning care process redesign... ... between managers and health-care professionals? ... between managers? | 1-5 (<i>I don't know, Very bad, Fairly bad, Fairly good, Very good</i>) | IV |
| Possibility to fulfill managerial duties (index) (Dellve et al., 2008) | How satisfied are you you're your possibilities to fulfill duties regarding; | 1-5 (<i>Not relevant, Not at all, To a quite low degree, To a pretty high degree, To a very high degree</i>) | IV |
| | daily operative work? | | |
| | psychosocial environment issues? | | |
| | physical environment issues? | | |
| | quality work? | | |
| care process redesign? | | | |
| continuous improvements? | | | |
| Continuity in follow up and evaluation (index) (Dellve et al., 2008) | How frequently is evaluation of work being done regarding; | 1-6 (<i>Not relevant, I don't know, Not at all, Yearly or more seldom, At least once every six months, At least once every third month</i>) | IV |
| | daily operative work? | | |
| | long-term planning and development? | | |
| | quality work? | | |
| | care process redesign? | | |
| continuous improvements? | | | |
| Satisfaction with hospital governance (Williamsson, 2018) | How satisfied are you with the way your hospital is managed? | 1-4 (<i>Very unsatisfied, Unsatisfied, Satisfied, Very satisfied</i>) | IV |

Appendix C



Errata Study II, Figure 1. Cognitive measures regarding support provided from VM tool use. Mean differences between non-daily users (ND), start users (S) and daily users (D), T1 and T2. Wilcoxon rank sum test was used to test differences.

Appendix D

ERRATA Study II, Table 2. Cognitive, social and socio-emotional measures. Mean differences between non-daily users (ND), start users (S) and daily users (D), T1 and T2. Wilcoxon rank sum test was used to test differences.

| Benefits and variables | T1 | | | | | | T2 | | | | | |
|------------------------|--|------------------|------------------|------------------|------|-------|---------------------------|------------------|------------------|----------|-------|------|
| | ND | S | D | S-ND | D-ND | S-D | ND | S | D | S-ND | D-ND | S-D |
| | Mean (standard deviation) | | | p-values | | | Mean (standard deviation) | | | p-values | | |
| Cognitive | Overlook info due to info overflow | 2.64 (0.74) | 2.76 (0.79) | 2.57 (0.71) | 0.48 | 0.38 | 2.58 (0.73) | 2.59 (0.72) | 2.56 (0.75) | 0.98 | 0.93 | 0.92 |
| | Goal monitoring and evaluation | 3.10 (0.85) | 3.14 (0.83) | 3.32 (0.74) | 0.57 | 0.06 | 3.06 (0.82) | 3.43 (0.94) | 3.35 (0.93) | <0.01 | 0.01 | 0.51 |
| Social | Collaboration in care process redesign | 3.74 (0.56) | 3.82 (0.49) | 3.82 (0.64) | 0.19 | 0.25 | 3.80 (0.62) | 3.94 (0.53) | 3.86 (0.55) | 0.07 | 0.33 | 0.50 |
| | Suggested improvements | 2.12 (0.88) | 2.09 (0.70) | 2.19 (0.84) | 0.84 | 0.44 | 2.15 (0.86) | 2.17 (0.82) | 2.12 (0.82) | 0.63 | 0.97 | 0.73 |
| | Discussed improvements | 1.86 (0.74) | 1.85 (0.58) | 2.00 (0.84) | 0.73 | 0.23 | 1.89 (0.76) | 1.98 (0.84) | 1.91 (0.74) | 0.45 | 0.75 | 0.76 |
| Socio-emotional | Social capital | 66.77 (14.38) | 68.93 (12.16) | 73.15 (14.92) | 0.38 | <0.01 | 66.04 (14.17) | 68.35 (15.00) | 70.31 (15.31) | 0.19 | 0.09 | 0.57 |
| | Clinical engagement in patient safety | 3.98 (0.68) | 4.01 (0.75) | 4.25 (0.58) | 0.66 | <0.01 | 4.01 (0.66) | 4.23 (0.67) | 4.31 (0.67) | <0.01 | <0.01 | 0.38 |
| | Clinical engagement in care quality | 3.74 (0.66) | 3.83 (0.81) | 3.97 (0.58) | 0.22 | <0.01 | 3.80 (0.66) | 3.92 (0.70) | 4.03 (0.73) | 0.09 | <0.01 | 0.28 |

