HEC MONTRÉAL
École affiliée à l'Université de Montréal

Lean and Physicians: a Multi-Method Investigation of Complexity, Antecedents and Reactions

par
Pierre-Luc Fournier

Thèse présentée en vue de l'obtention du grade de Ph. D. en administration
(option Gestion des opérations et de la logistique)

HEC MONTRÉAL

École affiliée à l'Université de Montréal

Cette thèse intitulée :

Lean and Physicians: a Multi-Method Investigation of Complexity, Antecedents and Reactions

Présentée par :

Pierre-Luc Fournier

a été évaluée par un jury composé des personnes suivantes :

Kevin Johnson
HEC Montréal
Président(e)-rapporteur(se)

Marie-Hélène Jobin
HEC Montréal
Directrice de recherche

Liette Lapointe
McGill University
Membre du jury

Georges Abdul-Nour
Université du Québec à Trois-Rivières
Examinateur externe

Résumé

L'amélioration des services de santé demeure une priorité sociale, économique et politique. À cet égard, plusieurs solutions ont été mises de l'avant dans le but d'améliorer l'efficacité des services. Notamment, le Lean Management, une approche managériale développée par la Toyota Motor Corporation, continu de faire son chemin au sein des organisations de la santé. Cependant, plusieurs chercheurs ont mis de l'avant le besoin d'en savoir plus sur ce phénomène, notamment dû aux difficultés rencontrées lors des tentatives d'implantation du Lean. Cette thèse a pour but de contribuer à cette discussion.

Le premier essai étudie la complexité de l'environnement des organisations de la santé et pourquoi celui-ci rend l'implantation du Lean particulièrement difficile. À l'aide d'une revue de la littérature intégrée, nous utilisons un grand éventail de la littérature pour développer une perspective holistique du contexte des organisations publiques de santé. Nous superposons ensuite celui-ci aux particularités du Lean Management, détaillant les raisons pourquoi l'implantation du Lean en santé apparaît si compliquée. Notamment, nous soulignons la barrière que peut représenter l'adhésion des médecins. Ceci nous mène à examiner les réactions des médecins face au changement Lean dans les deux essais suivants.

Dans le deuxième article, nous réalisons une analyse secondaire de données qualitatives pour étudier les antécédents aux réactions des médecins face au Lean. À l'aide d'une double analyse basée sur l'induction analytique, nous révélons l'émergence d'antécédents liés au contenu, au processus et aux bénéfices perçus du changement. Notamment, nos résultats mettent l'accent sur l'impact du leadership, des menaces perçues à l'endroit du professionnalisme médical et de la perception d'un discours organisationnel de réduction des coûts sur le soutien des médecins, alors que les caractéristiques individuelles et le contexte organisationnel semblent avoir peu d'influence.

Le troisième article utilise une méthodologie quantitative, à l'aide d'un questionnaire distribué à des médecins aux États-Unis. Les données récoltées sont ensuite utilisées pour tester un modèle conceptuel du soutien comportemental des médecins face au Lean. Grâce

à la modélisation par équations structurelles, nous testons l'effet de médiation de l'engagement envers le changement sur la relation entre les antécédents de changement et le soutien comportemental des médecins. Cette analyse nous permet de conclure concernant des effets indirects, via l'engagement affectif, d'antécédents liés au contenu, au processus et aux bénéfices perçus du changement, sur le soutien comportemental envers le Lean. Nous postulons également que les antécédents préalables au changement n'influencent pas, ou peu, l'engagement médical.

En étudiant les médecins, cette thèse offre une contribution aux discussions concernant le Lean dans les organisations de santé. Ce faisant, nous offrons une vision originale sur un phénomène inhérent à la gestion des opérations à l'aide d'une perspective comportementale. Cette recherche propose aussi deux contributions méthodologiques intéressantes. Premièrement, notre approche multi-méthodes combine la richesse des données qualitatives avec la puissance des études quantitatives, contribuant à définir un nouveau standard de recherche concernant le Lean. Deuxièmement, notre troisième essai propose une des rares études ciblant les médecins à l'aide de données quantitatives comportementales. Finalement, cette thèse offre des pistes intéressantes aux responsables politiques et aux gestionnaires concernant les médecins et leurs réactions face au Lean et le changement en général.

Mots clés : Lean, santé, médecins, changement, antécédents

Méthodes de recherche : recherche quantitative, enquête, recherche qualitative, recherche longitudinale, études de cas

Abstract

Improving healthcare services continues to be a social, economic and political priority. To that extent, policy-makers and managers have put forth various innovations aimed at providing more effective services. Amongst these is Lean Management, a managerial approach initially developed by the Toyota Motor Corporation. As it continues to make its way into more healthcare organizations, scholars have highlighted its disputed benefits and the difficulties related to its implementation. They have also called upon the scientific community to investigate the complexity of Lean implementation in healthcare. This thesis contributes to this ongoing discussion.

The first essay investigates the environmental complexity of healthcare organizations and why that context makes Lean implementation challenging. Through an integrative literature review, we draw on a large body of literature to develop a holistic perspective of the public healthcare organizational context. We then overlap this context with the particularities of Lean Management, offering a detailed explanation of why Lean implementation in healthcare is notoriously difficult. Notably, we highlight how physicians often represent a barrier to Lean implementation. This leads us to investigate the reactions of physicians with regards to Lean change in the following essays.

In the second paper, we perform a secondary analysis of qualitative data to study the antecedents of physicians' reactions to Lean transformations. Using a two-stage analysis based on analytic induction, we reveal the emergence of antecedents linked to the content, the process and the perceived benefits of the change. Notably, our findings highlight how leadership, perceived threats to medical professionalism, and perceived efficiency-driven managerial discourse appear to impact medical support of Lean, while pre-existing individual characteristics and the internal organizational context seem to be of little influence.

The third paper uses a quantitative methodology based on a survey distributed to physicians across the USA. With the collected data, we test a conceptual model of physicians' behavioral support for Lean change anchored in the organizational behavior

literature. Using structural equation modeling, we test for the mediation effect of commitment to change on the relationship between change antecedents and behavioral support for Lean. We conclude on the indirect effects, through affective commitment, of change antecedents related to the content, the process and the perceived benefits of the change. We also conclude on how pre-change antecedents such as individual characteristics and the internal organizational context have little to no effect on behavioral support for Lean change.

This thesis contributes to the ongoing developments on Lean in healthcare, by focusing on how physicians react to this type of change. It extends a fresh perspective on an operations management concept through a behavioral lens. It also offers two interesting methodological contributions. First, our multi-method framework combines the richness of qualitative inquiry and the power of quantitative analysis, defining a new standard for research on Lean implementation. Second, our third paper's sampling provides one of the few behavioral, quantitative studies on physicians and change. This research also provides managers and policy-makers with guidance regarding physicians and their reactions towards Lean and change in general.

Keywords : Lean, healthcare, physicians, change, antecedents

Research methods : quantitative research, survey, qualitative research, longitudinal research, case studies

Table of contents

List of tables and figures

List of acronyms

ACC :	Affective Commitment to Change
AVE :	Average Variance Extracted
BPR :	Business Process Reengineering
BSUP :	Behavioral Support for Change
CCC :	Continuance Commitment to Change
CFA :	Confirmatory Factor Analysis
CQI :	Continuous Quality Improvement
COMP :	Compensation
EC :	Extent of Change
LE :	Lean Experience
MSSS :	Ministère de la Santé et des Services Sociaux
NCC :	Normative Commitment to Change
NHS :	National Health Service
OC :	History of Organizational Change
OM :	Operations Management
OS :	History of Organizational Support
PART :	Participation
PHO :	Public Healthcare Organization
PQ :	Perception of Quality
PRC :	Perception of Reduction of Costs
PST :	Perception of Patient Satisfaction
PWL :	Perception of Work Life
SEM :	Structural Equation Modelling
TLB :	Transformational Leadership Behavior
TPS :	Toyota Production System
TQM :	Total Quality Management

The Man Who Thinks He Can

If you think you are beaten, you are
If you think you dare not, you don't,
If you like to win, but you think you can't
It is almost certain you won't.

If you think you'll lose, you're lost
For out of the world we find,
Success begins with a fellow's will
It's all in the state of mind.

If you think you are outclassed, you are
You've got to think high to rise,
You've got to be sure of yourself before
You can ever win a prize.

Life's battles don't always go
To the stronger or faster man,
But soon or late the man who wins
Is the man who thinks he can!

Walter D. Wintle (1871-1953)

To my mom and dad, my brother, my family and friends, who supported me through the good and the bad, the fun and the painful, this would not have been possible without you.

Thank you, from the bottom of my heart!

Acknowledgements

I would like to acknowledge the support of HEC Montréal's staff and faculty throughout my doctoral journey. Professor Marie-Hélène Jobin, my research director, was a great motivator and helped me bring my ideas to fruition. I feel blessed and fortunate to have had her ear and advice over the last five years. She consistently went the extra mile for me and allowed me to become a better teacher, researcher, and human being. Professor Liette Lapointe helped me navigate the intricacies of qualitative research, a universe that was alien to me. Her feedback and advice were instrumental in the completion of this work. Professor François Bellavance was continuously of great help, and his guidance through the quantitative part of my work was crucial. Professor Sylvain Landry's contribution cannot be understated. His expertise on Lean and the networking opportunities he provided allowed this research to develop and go through. Professor Kevin Johnson enlightened me to the power of structural equation modeling. His advice and guidance were truly influential. I would also like to acknowledge Professor Denis Lagacé for his continued support over the years. Finally, I wish to thank the entire team of HEC Montréal's Healthcare Management Hub. Notably, Denis Chênevert, Caroline Parent, Nadia Benomar, Ariane-Hélène Fortin and Rafaël Provost; thank you so much for your support and above all, your friendship.

This work was supported by a doctoral grant from the Fonds de Recherche du Québec – Société et Culture (FRQSC). Part of this research was also supported by the Healthcare Management Hub of HEC Montréal. The data collection for the third essay of this doctoral thesis was supported by the Catalysis Healthcare Value Network. Their help in coordinating the data collection across the USA allowed this research to be completed.

Introduction

Healthcare has been at the forefront of our economic, social and political preoccupations. Governments and organizations have continuously put forth new policies and approaches to cope with the modern realities of managing healthcare (Longenecker and Longenecker, 2014). Yet, improvement has proven challenging. Most of us have, at some point in our lives, experienced the dreadful deficiencies of healthcare systems, whether it be hours long, and sometimes days long, wait times in emergency rooms, or the inability to book an appointment with our family doctor. While healthcare workers and managers work hard, round the clock, to provide high-quality care to patients and their families, services too often underperform (Porter, 2010). To help face this, policy-makers and managers have attempted various innovations over the years, such as Lean Thinking. Many hospitals and other care providers around the world have used Lean to different extents (Costa and Godinho Filho, 2016), but with disputed results (Moraros *et al.*, 2016). The question is: why?

The objective of this thesis is to contribute answers to this question. But before we delve into the content of this research, a little bit of historical perspective would prove useful, especially for the readers who are unfamiliar with Lean thinking.

A Brief History of Lean

In 1988, John Krafcik coined "Lean" in reference to the Toyota Production System. At the time, Mr. Krafcik was studying at MIT's Sloan School of Business and was part of the research team tasked with studying the auto industry. His objective was to find a name that would illustrate what this system could do in counterpart to traditional manufacturing, which was: "*less effort, less space, fewer defects, less throughput time, lower volume requirements, less capital for a given level of output, etc.*" (Womack, 2002; p.4) . Little did he know that ''Lean'' would go on to become one of the most important and influential concepts in Operations Management (Womack, 2002).

In the 1930s and 40s, the Toyota Motor Corporation began working on a series of innovations that would allow the production process to combine flow with product variety

(Womack and Jones, 1996). Over time, key contributors included Edwards Deming with his work on sampling and quality control (Deming, 1966), Shigeo Shingo with the SMED (Shingo, 1985), the Poka-Yoke (Shingo, 1986), and the Kanban systems, the latter inspired from American supermarkets (Shingo, 1988), and Taiichi Ohno with his concepts of Just-in-Time and the ‘’7 wastes’’ (Ohno, 1988). Together, these contributions helped create what is known today as the Toyota Production System (TPS).

The ideas and principles implemented at Toyota remained largely unknown to the Western world until the first oil crisis of 1973. In 1979, the Motor Vehicle Program was launched at MIT and signaled a new interest regarding research on the automotive sector. This program would later be known as the International Motor Vehicle Program (IMVP) and would lay the groundwork for academic research on Lean for the decades to come. To understand why and how Japanese manufacturers had developed a competitive advantage, the IMVP first focused on the New United Motor Manufacturing (NUMMI) joint venture between Toyota and GM in the mid-80s (Krafcik, 1986). Research showed that the implementation of Toyota’s production methods had achieved 50% higher productivity levels than at similar GM plants as well as reaching the best levels of quality in all of GM’s production facilities (Krafcik, 1986). The research work accomplished by that same team from MIT also produced the landmark book *The Machine that Changed the World* (Womack *et al.*, 1990), detailing the concept of Lean manufacturing and its principles.

Initially, Lean was mostly described as a combination of tools, techniques, and principles, for which various authors provided structures. The most cited, for which we provide an overview in table 1, include Womack and Jones (1996) who distilled the principles of Lean down to five; Spear and Bowen (1999) who wrote on the four underlying rules of what they called the DNA of the TPS; and Shah and Ward (2003) who, in a landmark paper published in the *Journal of Operations Management*, introduced four categories of practices within the TPS. Other authors such as Liker (2004) and Hines *et al.* (2004) also offered contributions to this subject. Over the years, however, our vision of Lean evolved into that of a *holistic management system.* Notions such as “Leanness” (Papadopoulou and Özbayrak, 2005) and “Maturity” (Nightingale and Mize, 2002) came to define Lean

as a managerial philosophy (Bhasin and Burcher, 2006). Lean began to encompass the internal and external environments of the organization (Shah and Ward, 2007), all across the value chain (Moyano-Fuentes and Sacristán-Díaz, 2012). From there on end, the practices of Lean were seen as deeply rooted in social sciences, where leadership, committed management, training, problem-solving, and customer involvement became primary practices within the management system (Bortolotti *et al.*, 2015).

Table 1. Early structures of Lean practices and principles

Womack and Jones (1996)	Spear and Bowen (1999)	Shah and Ward (2003)
Five Lean principles: 1. Specify the *value* desired by the customer. 2. Identify the *value stream* for each product providing that value and challenge all of the wasted steps currently necessary to provide it. 3. Make the product *flow* continuous through the remaining, value-creating steps. 4. Introduce *pull* between all steps where continuous flow is impossible. 5. Manage toward *perfection* so that the number of steps and the amount of time and information needed to serve the customer continually falls.	Four rules underlying the DNA of the TPS: 1. All work shall be highly specified as to content, sequence, time, and outcome. 2. Every customer-supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses. 3. The pathway for every product and service must be simple and direct. 4. Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.	Four bundles of Lean practices: 1. Just-in-Time 2. Total Quality Management 3. Total Preventative Maintenance 4. Human Resource Management

While Lean evolved from technical driven implementation methods into cultural change programs, it also started to make its way into other industries. Predicated on the benefits shown in manufacturing, such as reduced lead times, increased quality and improved productivity, Lean began to be implemented by businesses and organizations in retail, financial services, transportation, construction, and education, just to name a few (Samuel *et al.*, 2015). Notably, the use of Lean saw an ever-increasing popularity in healthcare

services. While according to de Souza (2009), no one really knows when the first Lean experimentation in healthcare took place, the first publications on the subject date back to 2002. Lean was first used in support services sharing characteristics with their manufacturing counterparts, such as information technology, accounting, laundries and food services. Then, it progressed into ancillary services such as radiology, pharmacies, and laboratories. Ultimately, it spread into clinical and therapeutic operations (Costa and Godinho Filho, 2016). While evidence of its increasing use in healthcare has been repeatedly shown, scholars have many times concluded that Lean has failed to deliver conclusive gains for healthcare organizations (Costa and Godinho Filho, 2016; Mazzocato *et al.*, 2010; Moraros *et al.*, 2016). Recently, however, Shortell *et al.* (2018) uncovered significant and conclusive evidence of the positive effects of Lean on American hospitals. These new findings have finally given meaningful arguments to practitioners and scholars advocating for Lean in healthcare. However, as the authors and others have concluded (Bateman *et al.*, 2018), Lean implementation in healthcare remains difficult for most organizations. Further research is needed to provide better understanding and guidance regarding the advent of Lean in healthcare (Toussaint *et al.*, 2017).

The Genesis of This Research

The origins of this research can be traced back to before I even started my doctoral degree. As an industrial engineer, I was fortunate to undertake many endeavors related to Lean thinking in healthcare, such as executive coaching and continuous improvement management. Throughout the various initiatives I was involved in, I was struck by the difficulty healthcare organizations faced during their Lean implementation journeys. They had considerable difficulties sustaining whatever gains they could achieve through Lean initiatives. Even more striking to me was how much more difficult Lean implementation appeared to be in hospitals than what I had witnessed in other manufacturing-like environments. This realization would lead me down the path of scientific investigation.

Starting in 2013, I was involved in a large, governmentally funded project, studying Lean implementation in three hospitals in the province of Québec. Funded to the extent of 400 000$, this research studied the project-driven implementation of Lean over three years in those three hospitals. The findings of this study led to the development of the

Lean Healthcare Maturity Model (Jobin and Lagacé, 2015). This model proposes that a Lean culture in a healthcare organization is made up of 10 distinct dimensions, covering aspects such as governance, strategy, communication, technical expertise, and engagement, only to name a few. In the three papers presented in this thesis, we summarily discuss the findings of that research project. In the end, this large investigation concluded that even after three years of intensive Lean improvement projects, those three hospitals plateaued in their Lean maturity, unable to generate organization-wide adoption and true cultural change. The considerable data collected throughout that project was notably used to perform the analysis presented in the second paper of this thesis, which we will discuss shortly.

As part of that ambitious research endeavor, I was heavily involved in an underlying study focusing on the impacts of Lean on the performance of those organizations. Using financial and operational data, we evaluated how Lean had influenced performance at the organizational level. Our conclusion was that none of the three organizations had generated conclusive and substantial performance gains at the system level. Whatever improvements could be found were limited to non-recurrent financial gains, in areas where improvement projects had taken place. We presented those findings at the *2016 Conference on Healthcare Systems Engineering and Management* in Casablanca, Morocco (Fournier *et al.*, 2016). Combined with our findings on organizational Lean maturity, these conclusions further enhanced my desire for a deeper understanding of why Lean appeared to be the oil to healthcare's water. At that point, the question became: how should we go about it?

Structure and Summary

Through a pragmatic approach, this thesis is structured using three essays developed in sequence, starting from the following question: why do healthcare organizations face such challenges when implementing Lean? The first essay provides a conceptual answer to that question and leads to the subject of the following two papers: physicians and their reactions towards Lean change. The second essay uses a qualitative method of inquiry to study that subject and is followed by a quantitative essay where hypotheses were developed based on the second essay's findings.

In the first article, we used an integrative literature review methodology (Torraco, 2005) to develop an understanding of the context healthcare organizations, especially public ones, face with regards to Lean thinking from an operations management perspective. To do so, we used the seminal conceptualization of Schmenner (1986) to structure a large body of literature. Subsequently, we detailed the unique characteristics of healthcare organizations with regards to Lean and proposed a model centered around three distinct albeit not mutually exclusive, categories of service operations: *professional*, *public* and *healthcare* services. Each category brings specific characteristics that interact with the implementation of Lean, creating unique challenges and barriers making change more difficult. This paper contributes to current knowledge by providing a deep perspective on the reasons why healthcare is so particular with regards to Lean. This paper also highlighted an important factor contributing to that reality: the role of physicians in the complex reality of healthcare management and, by extent, the implementation of Lean in healthcare organizations. Following this conclusion, we decided to take a small step back and look at what our data collected during our three-year research of Lean implementation in healthcare was telling us. When analyzing that data, respondents appeared to be discussing physicians extensively, regarding a plethora of issues related to their implementation journeys. At the time, even though we were conscious of physicians' role during Lean change, we thought it was quite interesting that respondents would highlight physicians as one of their main preoccupations without being systematically asked about it. They seemed truly preoccupied with how physicians were reacting to Lean change and how much of a barrier their resistance could represent. The consensus appeared to be that physicians' support of Lean was a crucial element of successful implementation. This led us to ask the following question: what is it that influences physicians' reactions and support towards Lean change?

The large data set collected from 2013 to 2015 in the aforementioned research on *Lean maturity* provided a unique opportunity to offer answers to that question, which is the objective of the second paper of this thesis. Through a secondary analysis of qualitative data based on analytic induction, we identified the antecedents that, according to respondents, influenced physicians' reactions towards Lean change. By using a coding scheme based on Oreg *et al.'s* (2011) framework of organizational change, we were able

to perform intra-case analyses for all three hospitals where we highlighted the evolution of respondents' preoccupations regarding which antecedents tended to influence physicians the most. Ultimately, we cross-validated our findings by revealing the emerging trends between each case. This led to the conclusion that physicians' reactions towards Lean tended to be influenced by elements related to the change itself, the way it was managed, and the consequences perceived by physicians. We found that pre-existing conditions, such as the organizational context and individual characteristics were judged by the actors of Lean implementation as having little influence over how physicians responded to such change. While this study contributed meaningful evidence on physicians' reactions towards Lean change, two limitations led us towards pursuing our investigation in a complementary manner. First, as is the case with most qualitative work, the generalizability of our findings would prove difficult. Second, our conclusions were largely based on the managerial perceptions of physicians' reactions to Lean. Hence, we aimed to verify if those findings could be corroborated by asking physicians directly how they reacted to Lean change.

The third paper of this thesis pursues that objective. We developed a quantitative research methodology using a survey sent directly to 632 physicians in the USA, of which we received 176 responses. We developed that survey in collaboration with a panel of experts from across North America, then tested and validated it using a Confirmatory Factor Analysis. Our initial conceptual model based on Herscovitch and Meyer's (2002) landmark model of organizational change commitment and Oreg *et al.*'s (2011) framework of change recipients' reaction to change, hypothesized that physicians support of Lean change was influenced by two categories of antecedents, *pre-change* and *change* antecedents, and that this influence was mediated by the change commitment construct. We analyzed the data using structural equation modeling in AMOS 25, through a model-trimming approach (Ullman and Bentler, 2012) that allowed us to progressively refine our proposed model. This resulted in some of our mediation hypotheses being supported, while others were rejected. Our results showed that *pre-change* antecedents, linked to physicians' individual characteristics and perceptions of the organizational context, had little to no influence on their support of Lean change initiatives. Conversely, we found that *change* antecedents, which relate to the content of the change, the way it was managed

and its perceived benefits, significantly influenced physicians' support of Lean. *Communication, participation,* and *leadership* were amongst the elements positively influencing medical involvement. These findings corroborated those of our second paper and enhanced our conclusions by providing a second perspective of the subject under study, this time from physicians directly.

Scientific and Methodological Contributions

This thesis contributes to the ongoing developments on Lean in healthcare. As mentioned previously, scholars have repeatedly highlighted how little evidence there is of healthcare organizations having successfully triggered culture change towards Lean (Costa and Godinho Filho, 2016; Mazzocato *et al.*, 2010; Moraros *et al.*, 2016). Only recently have researchers concluded on the opposite (Shortell *et al.*, 2018). Authors have suggested various barriers explaining the challenges faced with Lean transformations in healthcare (Al-Balushi *et al.*, 2014), where physicians have been singled out as a pocket of resistance and under-involvement (Fournier and Jobin, 2018). Yet, little research has been done on that subject. While physicians and their singularities have been studied extensively in the past (Denis *et al.*, 2002; Kellogg, 2009), no such thing can be said regarding their interactions with Lean thinking. This thesis provides a dual perspective on physicians' relationship with Lean change. The findings of our qualitative essay, based on the managerial perspective, are corroborated by a quantitative study based on the medical view of the subject. Our second paper's conclusions allowed us to propose hypotheses anchored in an influential literature, which we then tested using meaningful data. Our findings are also in line with the emerging discourse on change, which now focuses more on the dynamic process of change itself (Rafferty *et al.*, 2013). These findings regarding physicians also contribute to knowledge on healthcare organizations in general and how they undergo change. Considering the current economic realities of healthcare around the world (Callahan, 2018), improvement is becoming more and more critical. Understanding what barriers exist, how they manifest and how they can be influenced could prove crucial in our understanding of how healthcare organizations can improve and ultimately, provide better healthcare.

Additionally, our first paper contributes to current organizational theory by developing a holistic perspective of public healthcare organization's environmental context, both internal and external, with regards to Lean implementation. By scouring a significant body of literature well outside the boundaries of Operations Management (OM), we proposed a model that synthesizes why healthcare and Lean have trouble mixing. Such a summarization was not available in the literature. We believe it will help both scholars and practitioners who are either familiar or not with Lean and healthcare, to understand how the different singularities the healthcare context relate to the particularities of Lean thinking.

We also contribute to the OM literature by using management and organizational behavior theories and concepts to study a phenomenon which inherently lies within the OM field. Historically, OM scholars have studied organizational phenomena through a highly rational lens. However, as Bolman and Deal (2017) have demonstrated, that perspective, which they call structural, is only one of four frames of organizational theory (Bolman and Deal, 1984). The other frames are *human resources*, *political*, and *symbolic*. This research contributes to the OM literature by departing from the structural perspective. We look at Lean, an important OM concept, through a behavioral lens that encompasses those other frames. We contribute using the *human resource* and *political* frames, which can help understand resistance to Lean change. The *human resource* frame focuses on the alignment of organizational and human needs, whereas the *political* frame views the organization through individuals' agenda and power dynamics. These frames diverge from the structural lens that views the organization as a rational mix of structure, tasks, and technology.

Furthermore, our research combines two significant concepts of organizational change: Herscovitch and Meyer's (2002) model of change commitment and Oreg *et al.'s* (2011) framework of change antecedents. We did not find any academic work that had studied the chain of causality of behavioral support for Lean change using such an approach. This could be viewed as a significant contribution, as it could be argued OM scholars have so far been unable to explain why many OM improvements in healthcare are difficult to sustain. Our goal was to contribute to ongoing knowledge in OM by using knowledge

from other disciplines with the intent of providing answers to questions OM researchers have had difficulties with.

Methodologically, our main contribution lies in our sampling. More specifically, our third essay used quantitative data collected directly from physicians. Historically, obtaining quantitative behavioral data from physicians has always represented a considerable challenge (Kellerman and Herold, 2001). A rigorous approach was used to collect this data, which allowed for solid statistical analysis. Providing a scientific perspective on an organizational phenomenon faced by healthcare organizations by relying on first-hand data from physicians has seldom been accomplished. This thesis, we believe, provides a significant contribution on that front. Furthermore, our multi-method research framework contributes to setting a new standard for research on Lean. We could not find any academic work using this dual approach to research on the implementation of Lean in organizations. Taken separately, each contribution could certainly stand on its own but would show the traditional limitations associated with each methodology. However, by linking our two studies, we combine the depth and richness of qualitative inquiry with the power and generalizability of quantitative methods.

Managerial Contributions

Our research could also prove helpful for healthcare managers and Lean practitioners. Since we know how physicians can influence organizational life, a deeper understanding of how they interact with Lean is certainly interesting. Our findings can help guide managers in identifying what they should prioritize during Lean change, and which traps they should make sure to avoid, notably regarding physicians. The evidence from this thesis reinforces the need for healthcare organizations to improve their change management competencies, to develop a clear vision of Lean and to adopt an appropriate discourse regarding it. Notably, we echo other researchers in suggesting that *communication* and *leadership* are central components of Lean change (Bortolotti *et al.*, 2015) and that Lean should not be viewed as a means towards increased efficiency (Radnor *et al.*, 2012). By contrasting findings made from both managers' and physicians' perspectives, we believe we have provided practitioners with solid evidence and conclusions that they should first and foremost focus on the dynamic reality of Lean

change and no so much on what happened before or on things they have no control over. Arguably, organizational change in healthcare is influenced by physicians more than any other stakeholders. Knowing which levers can be activated to favor support from physicians during change endeavors can be critical for managers and policy-makers.

How to Read This Thesis

While this thesis is structured in the by-article-style, I recommend readers keep in mind both the continuity of the research and the singularities of each essay separately. Of course, ultimately, the goal is to publish this work in scientific journals. To that extent, the first paper has already been published in a good journal, *Public Money and Management*. A beta version of the second paper was also published in *Leadership in Health Services* (both are available in the appendix). Hence, the reader might identify some repetitions from one essay to the next, as they somewhat build on the same body of literature. However, it is important to remember that this entire research emanates from the original questioning of why Lean implementation in healthcare has been so difficult. It is also important to consider that this essay focuses on an operations management phenomenon: Lean implementation in healthcare. To study it, we use a large body of literature from organizational behavior. Therefore, many of the notions and concepts employed in this research could appear foreign to OM scholars. Nevertheless, we believe that this cross-fertilization is ultimately essential and positive for OM as a discipline.

Lastly, it is important to remind that this research finds many of its origins with HEC Montréal's Healthcare Management Hub's large, three-year research project on Lean maturity in healthcare, which lasted from 2013 to 2015. While we do reference this project and summarize its findings at different points, we urge readers to remember that this investigation of physicians did not "come out of the blue" but rather, that it is rooted in an extensive examination of Lean transformations in healthcare organizations.

References

Al-Balushi, S., A. S. Sohal, P. J. Singh, A. Al Hajri, Y. M. Al Farsi and R. Al Abri (2014). 'Readiness factors for lean implementation in healthcare settings - a literature review', *Journal of Health Organization and Management*, vol. 28, no 2, pp. 135-153.

Bateman, Nicola, Zoe Radnor and Russ Glennon (2018). 'Editorial: The landscape of Lean across public services', *Public Money & Management*, vol. 38, no 1, pp. 1-4.

Bhasin, Sanjay and Peter Burcher (2006). 'Lean viewed as a philosophy', *Journal of Manufacturing Technology Management*, vol. 17, no 1, pp. 56-72.

Bolman, Lee G and Terrence E Deal (1984). *Modern approaches to understanding and managing organizations*, JSTOR.

Bolman, Lee G and Terrence E Deal (2017). *Reframing organizations: Artistry, choice, and leadership*, John Wiley & Sons.

Bortolotti, Thomas, Stefania Boscari and Pamela Danese (2015). 'Successful lean implementation: Organizational culture and soft lean practices', *International Journal of Production Economics*, vol. 160, pp. 182.

Callahan, D (2018). 'Is Rationing Inevitable?', *Rationing and Resource Allocation in Healthcare: Essential Readings*, vol. 311, no 24, pp. 26.

Costa, Luana Bonome Message and Moacir Godinho Filho (2016). 'Lean healthcare: review, classification and analysis of literature', *Production Planning & Control*, vol. 27, no 10, pp. 823-836.

de Souza, Luciano B (2009). 'Trends and approaches in lean healthcare', *Leadership in Health Services*, vol. 22, no 2, pp. 121-139.

Deming, William Edwards (1966). *Some theory of sampling*, Courier Corporation.

Denis, Jean-Louis, Yann Hébert, Ann Langley, Daniel Lozeau and Louise-Hélène Trottier (2002). 'Explaining diffusion patterns for complex health care innovations', *Healthcare Management Review*, vol. 27, no 3, pp. 60-73.

Fournier, Pierre-Luc, Nadia Benormar and Marie-Hélène Jobin (2016). 'Mesurer l'impact du Lean sur la performance : leçons apprises auprès de trois établissements de santé du Québec', communication présentée au *GISEH 2016*, Casablanca, Morocco.

Fournier, Pierre-Luc and Marie-Hélène Jobin (2018). 'Medical commitment to Lean: an inductive model development', *Leadership in Health Services*, vol. 31, no 3, pp. 326-342.

Herscovitch, Lynne and John P Meyer (2002). 'Commitment to organizational change: extension of a three-component model', *Journal of Applied Psychology*, vol. 87, no 3, pp. 474.

Hines, Peter, Matthias Holweg and Nick Rich (2004). 'Learning to evolve: a review of contemporary lean thinking', *International Journal of Operations & Production Management*, vol. 24, no 10, pp. 994-1011.

Jobin, Marie-Hélène and Denis Lagacé (2015). *Evaluating Lean Maturity in Three Healthcare Orgnization in Québec*, Montréal, Canada, Ministère de la Santé et des Services Sociaux du Québec.

Kellerman, Scott E. and Joan Herold (2001). 'Physician response to surveys: A review of the literature', *American Journal of Preventive Medicine*, vol. 20, no 1, pp. 61-67.
Kellogg, Katherine C (2009). 'Operating room: Relational spaces and microinstitutional change in surgery', *American Journal of Sociology*, vol. 115, no 3, pp. 657-711.
Krafcik, John F (1986). *Learning from NUMMI*, International Motor Vehicle Program, Massachusetts Institute of Technology.
Liker, Jeffrey (2004). *The Toyota Way*, Esensi.
Longenecker, Paul D and Clinton O Longenecker (2014). 'Why hospital improvement efforts fail: a view from the front line', *Journal of Healthcare Management*, vol. 59, no 2, pp. 147-168.
Mazzocato, Pamela, Carl Savage, Mats Brommels, Håkan Aronsson and Johan Thor (2010). 'Lean thinking in healthcare: a realist review of the literature', *Quality and Safety in Health Care*, vol. 19, no 5, pp. 376-382.
Moraros, John, Mark Lemstra and Chijioke Nwankwo (2016). 'Lean interventions in healthcare: do they actually work? A systematic literature review', *International Journal for Quality in Health Care*, vol. 28, no 2, pp. 150-165.
Moyano-Fuentes, José and Macarena Sacristán-Díaz (2012). 'Learning on lean: a review of thinking and research', *International Journal of Operations & Production Management*, vol. 32, no 5, pp. 551-582.
Nightingale, Deborah J and Joe H Mize (2002). 'Development of a lean enterprise transformation maturity model', *Information, Knowledge, Systems Management*, vol. 3, no 1, pp. 15-30.
Ohno, Taiichi (1988). *Toyota production system: beyond large-scale production*, Productivity Press.
Oreg, Shaul, Maria Vakola and Achilles Armenakis (2011). 'Change recipients' reactions to organizational change: A 60-year review of quantitative studies', *The Journal of Applied Behavioral Science*, vol. 47, no 4, pp. 461-524.
Papadopoulou, T.C. and M. Özbayrak (2005). 'Leanness: experiences from the journey to date', *Journal of Manufacturing Technology Management*, vol. 16, no 7, pp. 784-807.
Porter, Michael E. (2010). 'What is value in health care?', *The New England Journal Of Medicine*, vol. 363, no 26, pp. 2477-2481.
Radnor, Zoe J., Matthias Holweg and Justin Waring (2012). 'Lean in healthcare: The unfilled promise?', *Social Science & Medicine*, vol. 74, no 3, pp. 364-371.
Rafferty, Alannah E, Nerina L Jimmieson and Achilles A Armenakis (2013). 'Change Readiness', *Journal of Management*, vol. 39, no 1, pp. 110-135.
Samuel, Donna, Pauline Found and Sharon J. Williams (2015). 'How did the publication of the book The Machine That Changed The World change management thinking? Exploring 25 years of lean literature', *International Journal of Operations & Production Management*, vol. 35, no 10, pp. 1386-1407.
Schmenner, Roger W. (1986). 'How Can Service Businesses Survive and Prosper?', *Sloan Management Review*, vol. 27, no 3, pp. 21.
Shah, Rachna and Peter T Ward (2003). 'Lean manufacturing: context, practice bundles, and performance', *Journal of Operations Management*, vol. 21, no 2, pp. 129-149.

Shah, Rachna and Peter T. Ward (2007). 'Defining and developing measures of lean production', *Journal of Operations Management*, vol. 25, no 4, pp. 785-805.
Shingo, Shigeo (1985). *A revolution in manufacturing: the SMED system*, Productivity Press.
Shingo, Shigeo (1986). *Zero quality control: Source inspection and the poka-yoke system*, Productivity Press.
Shingo, Shigeo (1988). *Non-stock production: the Shingo system of continuous improvement*, Productivity Press.
Shortell, Stephen M, Janet C Blodgett, Thomas G Rundall and Peter Kralovec (2018). 'Use of Lean and Related Transformational Performance Improvement Systems in Hospitals in the United States: Results From a National Survey', *Joint Commission Journal on Quality and Patient Safety*.
Spear, Steven and H Kent Bowen (1999). 'Decoding the DNA of the Toyota production system', *Harvard Business Review*, vol. 77, pp. 96-108.
Torraco, Richard J (2005). 'Writing integrative literature reviews: Guidelines and examples', *Human Resource Development Review*, vol. 4, no 3, pp. 356-367.
Toussaint, John, John E Billi and Mark Graban (2017). *Lean for Doctors*, Catalysis.
Ullman, Jodie B and Peter M Bentler (2012). 'Structural equation modeling', *Handbook of Psychology, Second Edition*, vol. 2.
Womack, James P (2002). 'Lean thinking: where have we been and where are we going?', *Manufacturing Engineering*, vol. 129, no 3, pp. L2-L6.
Womack, James P and Daniel T Jones (1996). *Lean thinking: banish waste and create wealth in your corporation*, Simon and Schuster.
Womack, James P, Daniel T Jones and Daniel Roos (1990). *The Machine that Changed the World*, Simon and Schuster.

Chapter 1:
Understanding before implementing: the context of Lean in public healthcare organizations

Abstract

A three-year study of Lean implementation in public healthcare organizations in Québec identified poor understanding of the organizational context as a contributing factor to unsustainable Lean implementation. This paper presents a holistic perspective of the unique context of public healthcare organizations and discusses its implications with regards to Lean implementation.

Published, January 2018

FOURNIER, P.-L. & JOBIN, M.-H. 2018. Understanding before implementing: the context of Lean in public healthcare organizations. Public Money & Management, vol. 38, no. 1, pp. 37-44. DOI: 10.1080/09540962.2018.1389505

1.1. Introduction

Achieving efficiency gains in healthcare is becoming increasingly difficult (Longenecker and Longenecker, 2014). Lean has been promoted by policy-makers around the world as a solution to reducing budgets and increasing demand (Costa and Godinho Filho, 2016; Womack and Jones, 2015). A number of studies, however, have concluded that Lean in healthcare has failed to produce conclusive gains at the organizational level (Costa and Godinho Filho, 2016; Mazzocato *et al.*, 2010; Moraros *et al.*, 2016). In 2011, three organizations in Québec were chosen to begin a formal implementation of Lean. We studied that implementation, as well as its impact on organizational performance for three years (Fournier *et al.*, 2016; Jobin and Lagacé, 2014). Our findings echoed those of researchers in the UK (Schmenner, 1986), where implementation tended to be isolated, driven by efficiency targets, and unable to trigger cultural change. So why do public healthcare organizations (PHOs) have trouble implementing Lean?

We found that managers had great difficulty adapting Lean to their work, blindly applying tools and techniques developed in manufacturing industries. Lean implementation is contextual (Radnor and Osborne, 2012) and adaptation is required to achieve sustainable implementation. We believe better understanding of that context is critical for practitioners to properly adapt Lean and produce successful change. However, we could not find any studies in the academic literature that provided an integrated perspective of that context for PHOs. We fill that gap in this paper.

This paper first provides a short overview of the origins of Lean. Second, we present the findings from our study of Lean implementation in Québec's healthcare system. Third, we summarize the results of our literature review and develop an integrated view of the context of PHOs. To develop a complete contextual perspective, we used Schmenner's (1986) categorization of services. By combining professional, public and healthcare services, we performed an integrative literature review (Torraco, 2005) allowing us to develop a holistic view of that context. Finally, we discuss the implications of our findings on Lean implementation.

1.2. Origins of Lean

Lean has evolved from a simple combination of tools and techniques to reduce costs (Womack and Jones, 2015) with the focus now more on increasing value (Samuel *et al.*, 2015). Lean now encompasses many so-called 'soft-practices', such as committed management (Soriano-Meier and Forrester, 2002), respect for people and Kata (Rother, 2010). Leadership, training, problem-solving and customer involvement are also crucial. Today, Lean is viewed as a management system deeply rooted in the social sciences. Its implementation is usually predicated on the various performance improvements it has exhibited (Womack and Jones, 2015). However, Lean's capacity to improve performance has been disputed (Samuel *et al.*, 2015).

1.3. The implementation of Lean in Québec's healthcare system

The Canadian public healthcare system has been criticized it for its lack of efficiency and long waiting times (Fine *et al.*, 2009). Lean has been one of the approaches taken by policy-makers to help overcome these challenges. Organizations such as Five Hills Health Region in Saskatchewan, St-Joseph's Health Center in Ontario and St- Boniface Hospital in Manitoba were the first to experiment with Lean (Fine *et al.*, 2009; Graban, 2011). In Québec, formal discussions about using Lean started around 2008. In 2011, the Ministry of Health and Social Services began implementing Lean across the provincial healthcare network with three pilot organizations deploying Lean through various improvement projects over the course of three years. The initial investment of 12 million Canadian dollars (CAD) was followed, in 2013, by another targeting 16 more organizations. Through those two phases, roughly a third of the system's 275 000 employees have been touched, directly or indirectly, by various Lean initiatives.

In 2013, Québec's Ministry of Health and Social Services asked us to investigate Lean implementation in those three organizations. We started by developing a measurement tool to empirically assess Lean maturity in PHOs (Jobin and Lagacé, 2014). Using this tool, we evaluated the maturity level of those organizations over the course of three years (Jobin and Lagacé, 2015). Finally, we investigated the impact Lean had had on performance (Fournier and Jobin, 2018).

Performance was evaluated in terms of accessibility and quality of care, efficiency and user and employee satisfaction. While local gains had been made where Lean initiatives took place, such as the reduction of waiting lists in surgical departments, it was not possible to assess whether or not those had translated to the organizational level and beyond. The only evidence of organizational-level improvement was recurrent financial gains of roughly 650,000 CAD for the three organizations combined. However, it was impossible to evaluate how those gains were reinvested and if they had helped improve accessibility and quality of care.

Table 2. Generic Lean maturity levels

Lean maturity levels		Description
1	Initiation	Few attempts at Lean, principles are unknown and expertise is external.
2	Recognition	Lean attempts are present, based on visual elements and tools. Expertise is mostly external.
3	Integration	Lean practice is significantly present, principles are known and are starting to be integrated. Expertise is becoming more and more internal. Cultural change is starting to emerge.
4	Generalization	Lean maturity is manifested by general mobilization and adoption, and into daily continuous improvement. Expertise is held internally.
5	Excellence	The epitome of Lean organizations. Lean is observed in the behaviors and roles of the stakeholders. The organization is a reference and is known as an innovator.

We also studied how the organizations had implemented Lean and how they progressed along a maturity scale. Maturity was evaluated on a scale of one to five, as shown in table 2. The measurement tool assessed 78 components of a Lean culture, divided into 10 dimensions. For each of those components, a unique scale description was used to rate the maturity level. In the end, an average score was computed to determine the overall maturity level of the organization. To perform this study, 99 interviews were conducted with a variety of stakeholders. After three years of Lean implementation, the three organizations reached average maturity scores of 2.6, 2.2 and 2.4. After this period, progress had plateaued (Jobin and Lagacé, 2015). While differences existed between them, none had triggered the beginning of a real cultural change. Lean was still viewed by most stakeholders simply as a set of

principles and tools. Our findings also highlighted the efficiency-focused view of Lean, leading to unsustainable gains.

Our findings were very similar to studies in the UK. Indeed, Burgess and Radnor (2013) found that Lean implementation in the National Health Service (NHS) tended to be isolated, as opposed to system-wide, and mostly based on its visual elements. Lean implementation was typically driven towards internal efficiency, with short-term financial gains in mind (Radnor and Osborne, 2012). In short, healthcare organizations in Canada face many challenges also faced by those in the UK, being unable to transition from using tools and techniques into cultural change.

Our research concluded that policy-makers, managers, and practitioners had great difficulty in properly adapting Lean to the public healthcare context. We believe this partly explains why PHOs have been unable to leave their state of transition. This led us to investigate why the public healthcare context is so unique and how does that context impact on Lean implementation? The similarities between our findings and those of researchers in the UK convinced us that exploring this question will have potential for generalization to other public healthcare systems around the world.

To understand the public healthcare context, we used Schmenner's (1986) seminal service categorization as a starting point. In this work, mass services such as public services, professional services such as doctors, and healthcare services such as hospitals correspond to three distinct categories of service providers. Historically, Lean has been adapted to fit each of those types of service organizations separately. But in PHOs, the characteristics of each are integrated into one unique context. These add distinctive factors to the internal and external environments of PHOs, creating a much more complex setting than any of those three types of organizations alone. To comprehend this context, we undertook an integrative literature review (Torraco, 2005).

1.4. Three Categories of Services

Our integrative literature review (Torraco, 2005) was performed using the EBSCO and ABI/ INFORM databases. Using a combination of keywords such as 'services', 'management', 'operations' and 'organization', along with the keywords 'professional', 'public' and 'healthcare', we identified a total of 215 academic papers. After reviewing the abstracts of these papers, 56 publications were selected for deeper analysis, which resulted in a total of 26 articles being selected (see figure 1).

Figure 1. Characteristics of three types of services from Schmenner's matrix
Read from left to right for each type of service, dotted lines indicate a relationship between concepts.

Type of service	***Main characteristics***	***Detailed context***			
Professional services	*Value co-creation*	Co-production phenomenon (Dobrzykowski *et al.*, 2016)	Unstable demand (Hines *et al.*, 2002)		
	Knowledge work	High work complexity and customization require expert knowledge (Goodale *et al.* 2008)	High task uncertainty (Staats *et al.*, 2011)		High process variation (Boone and Ganeshan, 2001)
			High workforce specialization (Nembhard *et al.*, 2009), subject to external pressures (Harvey, 1990)		
Public services	*Public governance*	Public governance is highly political (Osborne, 2006) and complex (Bovaird and Löffler, 2003)	New Public Management paradigm (Osborne, 2006)	Results-based frameworks driven towards efficiency (Martin *et al.*, 2004) and better "value to the users" (Bovaird, 2005)	
			Innovation constantly challenged (Hartley, 2005)		
	Rigidity	Complex labor relations (Scorsone, 2008)			
		Numerous laws, regulations and policies (Ferlie *et al.*, 2003)			
Healthcare services	*High organizational complexity*	Fuzzy boundaries (Champagne *et al.*, 2002)	Various missions of *cure, care, control and community* (Glouberman and Mintzberg, 2001)		
		Pluralistic governance and distributed leadership (Denis *et al.*, 2012)	Clinical governance (Buetow and Roland, 1999)		
		Professional logic of hierarchy (Bate, 2000), powerful core of doctors (Sheaff *et al.*, 2004)			
		Complex work organization	Patient is material input and output (Schneller and Smeltzer, 2006)		
			Complex and personalized interactions between clinicians themselves and with patients (Schneller and Smeltzer, 2006)		
			Highly specialized and varied workforce (Nembhard *et al.*, 2009)		
			Dual role of physicians (Schneller and Smeltzer, 2006)		
	High environmental uncertainty	High dynamism (Dess and Beard, 1984)	Increased pace of technological change (Zhang *et al.*, 2012)		
			Greater variety offering (Mitchell *et al.*, 2011)		
			Volatile demand (Wiengarten *et al.*, 2012)		
		High munificence (Dess and Beard, 1984)	High scarcity of critical resources needed (Castrogiovanni, 1991)		
		External stakeholders	Knowledge monopolies, regulatory or legal bodies and private companies (Harvey, 1990)		

Professional services are characterized by value co-creation and knowledge work (Goodale *et al.*, 2008). The co-production phenomenon, where client and provider work together to create value (Dobrzykowski *et al.*, 2016), creates an unstable demand (Hines *et al.*, 2002). Knowledge-work creates high task uncertainty (Staats *et al.*, 2011) and requires a highly specialized workforce (Nembhard *et al.*, 2009). In the end, combining those factors generates high process variation (Boone and Ganeshan, 2001).

Public services have two main characteristics:

- Public governance, which is complex and inherently political (Bovaird, 2005; Osborne, 2006). Public governance has been highly influenced by New Public Management (NPM), which has brought about major reforms implemented through results-based frameworks (Martin *et al.*, 2004). These target short-term efficiency, aiming to increase 'value to the users' (Bovaird, 2005). The public context also makes innovation more difficult, because it must be constantly validated by all stakeholders and, as opposed to the private sector (Hartley, 2005), is not viewed as a 'virtue in itself'.

- Public services are inherently rigid; labor relations are complex due to unionization and worker protection (Scorsone, 2008). Managers are also highly constrained by laws, regulations, and policies, making decision-making inflexible (Ferlie *et al.*, 2003).

Two main characteristics of healthcare services were distinguished. The first is high organizational complexity, created by the fuzzy boundaries of healthcare organizations, which often have multiple roles such as providing social services and research (Champagne *et al.*, 2002; Glouberman and Mintzberg, 2001). It is also generated by the pluralistic nature of governance (Denis *et al.*, 2012). While pluralism involves many stakeholders, healthcare organizations also have a professional hierarchy (Bate, 2000) dominated by a powerful core (doctors) (Sheaff *et al.*, 2004). This creates a leadership paradox, where distributed leadership is desired, but actors other than doctors have limited influence. To overcome this, healthcare providers have adopted clinical governance to improve quality through better coordination and co-operation between clinical and managerial actors (Buetow and Roland, 1999). High complexity is also caused by the complex organization of work resulting from the patient being the material input and output of the value chain (Schneller and Smeltzer, 2006). The work performed in healthcare requires very complex and personalized interactions between the clinicians themselves, and with patients (Schneller and Smeltzer, 2006). With a highly specialized and varied workforce (Nembhard *et al.*, 2009), important challenges arise with regards to the design of work. The centrality of physicians (Schneller and Smeltzer, 2006), who act both as suppliers by referring patients and as providers, further enhances complexity.

The second characteristic of healthcare services is high environmental uncertainty, generated by three factors. The first is high dynamism (Dess and Beard, 1984), defined as the combination of fast-paced technological change (Zhang *et al.*, 2012), increased variety of services offered (Mitchell *et al.*, 2011) and volatile demand (Wiengarten *et al.*, 2012). The second is high munificence (Dess and Beard, 1984), defined as the scarcity of critical resources needed to operate (Castrogiovanni, 1991), such as doctors, nurses and various equipment. The third is external pressures, such as knowledge monopolies, regulatory or legal bodies and private companies that can influence internal processes (Harvey, 1990). High environmental uncertainty greatly impacts decision-making. It limits information, reduces the predictability of external events and, in turn, impacts operational activities (Cannella *et al.*, 2008).

These characteristics come together to create a unique organizational context which has important implications for successful implementation of Lean.

1.5. Discussion – the Context of PHOs

Our study revealed that managers and practitioners had great trouble adapting Lean to the unique context of PHOs, often opting for a 'copy and paste' application of the principles and tools used in manufacturing. We believe this is due to a lack of understanding regarding the unique context of PHOs and the issues it creates with Lean implementation. As Ovretveit (2011) states, the importance of understanding the context of improvement is critical because it will affect its success.

The unique context of PHOs is shaped by three distinct, albeit not exclusive, organizational settings. A PHO combines professional, public and healthcare services— see figure 2. Those types of services, to different degrees, face an unstable demand generated, in part, by the co-production phenomenon. Our literature review allowed us to identify three important aspects of organizational life impacted by the unique context of PHOs, and that have important implications with regards to Lean implementation.

1.5.1. Customer and value

At the center of the PHO context is a unique relationship with its customer. In professional services, customer involvement is high, because it is based on the individual needs of each

client. In healthcare services, this involvement is heightened because the customer is also the material input and output of the value chain. Compounding, even more, the complexity of the client-provider relationship is the notion of value. In public services, value has a wider meaning than 'value to the users', because it has social implications. Co-creation of value is not limited to the client-provider relationship, it includes the user's wider social network (Bovaird, 2005), as well as society in general. The vision of Lean, focusing on the creation of value for the client, must be adapted to PHOs' context of a larger definition of value (Moore, 1995). Managers and professionals, as stated by Bovaird (2005), need to develop a 'mutual and interdependent relationship' with their users, meaning beliefs and behaviors have to change. Since value is at the heart of Lean management, any implementation must account for the contextual meaning of value as this will guide the organizational vision.

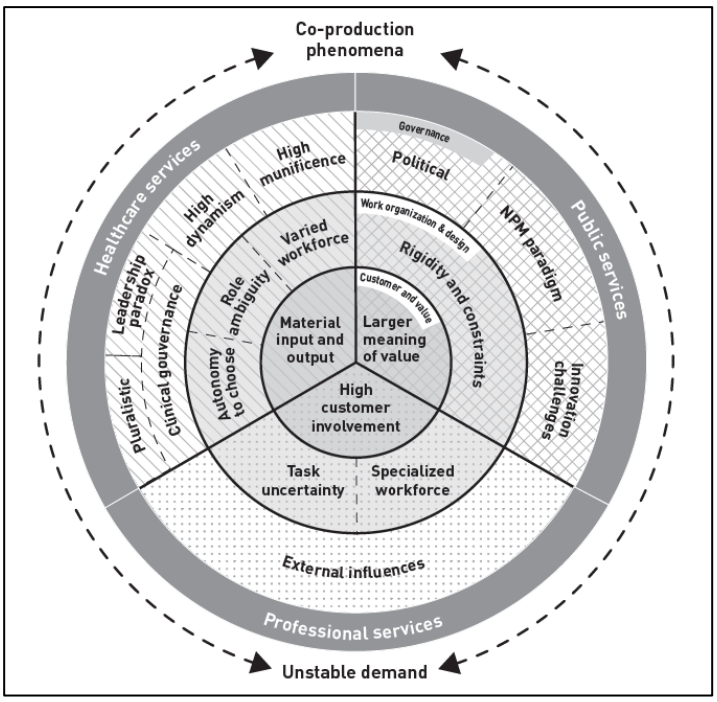


Figure 2. Holistic view of the PHO organizational context

1.5.2. Governance

At a higher level, governance in PHOs is complex for many reasons. First, external influences exerted on professional services by knowledge monopolies and regulatory bodies complicate decision-making. Then, governance in public organizations is inherently political, with priorities based on the government's agenda. In healthcare organizations, it is largely

pluralistic, with various stakeholders having a say in the decision-making process. Yet, for all that plurality, governance faces an important leadership paradox, because a core of actors (doctors) has more influence and power than any other stakeholders. This is particularly true in Canada, where doctors are independent workers. Their interests and priorities can differ from those of other actors. To overcome this issue, clinical governance has been adopted by some healthcare organizations as a means to bridge the gap between managerial and clinical approaches. However, rarely do Lean practitioners attempt to strengthen or improve clinical governance practices (Jobin and Lagacé, 2015). These are often viewed as a type of 'waste' to be eliminated, which creates resistance from staff. Instead of improving or developing practices in collaboration with clinicians, new processes are put in place to bypass clinical governance. This can result in disjointed communication and decision-making (Jobin and Lagacé, 2015). Therefore, politics, plurality, and unbalanced power make it difficult to develop a clear vision of Lean. This can have important consequences towards the success of implementation, as poor vision leads to poor leadership, a main driver of unsustained Lean change (Hines *et al.*, 2008). Poor vision can result in a lack of conviction and commitment from leaders across the organization. As stated by Soriano-Meier and Forrester (2002), since this is the most basic principle of Lean implementation, great care needs to be taken in developing a strong and clear vision of Lean.

When managerial vision is unclear, leadership issues arise at all levels of the organization, resulting in a lack of support and communication. Managers will adopt a 'command-and-control' type of leadership (Boyer and Sovilla, 2003) because they will be under scrutiny for efficiency (Waring and Bishop, 2010). With high munificence, managers are under pressure to secure critical resources while still being constrained by tight budgetary conditions. This is compounded by the NPM paradigm still followed in today's public governance. A "tyranny of efficiency" is encouraged by results-based frameworks, preventing managers from providing workers with the "license to experiment" that is essential to empower employees and create a Lean culture (Jones *et al.*, 2006). Managers become afraid to lose power and control and workers are scared of layoffs (Buesa, 2009), which creates resistance at many levels.

Lean relies heavily on worker commitment (Harrison and Storey, 1996), attitude (Groebner and Mike Merz, 1994) and motivation (De Treville *et al.*, 2005). Hence, workers cannot be

disassociated from the implementation process if true cultural change is to be achieved. In PHOs, work is often demanding and stressful, and while Lean has shown an ability to positively influence the quality of working life (Kuipers *et al.*, 2004), poor implementation has also caused negative effects. Indeed, poor management decisions during Lean adoption have been shown to create more intense and stressful work (Klein, 1989), monotonous and repetitive tasks (Schouteten and Benders, 2004), decreased job stability (Suzuki, 2004), and decreased autonomy (Parker, 2003). To avoid this, management needs to constantly co-operate with employees and their unions (Kochan *et al.*, 1997), while also adapting their training and hiring practices (LaScola *et al.*, 2002).

Furthermore, change in PHOs is dichotomous. While healthcare services are subject to high dynamism, created by constant, fast-paced change (Zhang *et al.*, 2012), innovation in public organizations is notoriously difficult, subject to high resistance and often contested. Since Lean is a radical innovation (Smeds, 1994), it will face challenges and has to be led in conjunction with other types of change.

1.5.3. Work organization and design

Wedged in between governance and the customer is work design and organization. Professional services require a highly-specialized workforce because they are based on knowledge work. By combining knowledge work with high customer involvement, task uncertainty increases. In a highly uncertain environment, many well-known Lean tools and techniques are difficult to apply. Work is much harder to standardize and the more visual elements of Lean and the elimination of so-called 'wastes' have limited potential in many situations (Radnor and Osborne, 2012).

Healthcare services require a varied workforce with the autonomy to choose and make decisions. Lean emphasizes worker autonomy, as opposed to the autonomy to choose (De Treville *et al.*, 2005). Therefore many traditional Lean tools, aimed at standardizing work in manufacturing environments, are difficult to use (Jobin and Lagacé, 2015). Hence, new tools need to be developed for use with autonomous healthcare professionals. The varied workforce and autonomy to choose in healthcare settings also make defining responsibilities difficult, resulting in ambiguity over the roles various actors play. Since successful Lean adoption relies

on proper delegation of responsibilities (Lowe, 1993), teamwork (Thompson and Wallace, 1996) and clearly identified roles (Delbridge *et al.*, 2000), this role ambiguity creates an unstable foundation for implementation.

The characteristics of work organization and design in professional and healthcare services, as presented in figure 2, create significant process variation. Yet, the rigidity and constraints created by laws, regulations and the complex labor relations in public services make managing that variation arduous. Combined with low flexibility, process variation makes the use of some Lean principles, such as the leveling of production or "heijunka", and continuous flow more difficult to implement. Ultimately, the unique context of PHOs calls for policy-makers, managers, and practitioners to be very involved in their implementation approach. They must account for the distinct natures of the customer and how value is created for society, while acknowledging the unique features of governance and work organization.

1.6. Conclusion

Lean implementation had difficulty taking hold and PHOs were plateauing in their journey to cultural change. Managers and practitioners had great difficulty adapting Lean to their particular context. This led us to investigate what was so specific about the context of PHOs and why it was important with regards to Lean implementation.

We conclude that a better understanding of the context of PHOs will allow researchers, policy-makers, managers, and practitioners to rethink their vision of Lean and have a better chance of successful implementation. It will also help PHOs leave the state of transition they are in, where they are unable to make the leap from using Lean tools and principles, and into true cultural change.

Further work needs to be done to understand how the singularities of PHOs impact the way Lean is implemented and how it affects organizations. This paper has limitations, mostly due to its conceptual nature. Hence, it should be enhanced by empirical research into the factors regulating the interactions between the various characteristics of PHOs and the implementation of Lean. Particularly, the role doctors play on a daily basis in creating a culture of continuous improvement appears of interest to us, knowing the central role they have in PHOs.

References

Bate, Paul (2000). 'Changing the culture of a hospital: from hierarchy to networked community', *Public Administration*, vol. 78, no 3, pp. 485-512.

Boone, Tonya and Ram Ganeshan (2001). 'The effect of information technology on learning in professional service organizations', *Journal of Operations Management*, vol. 19, no 4, pp. 485-495.

Bovaird, Tony (2005). 'Public governance: balancing stakeholder power in a network society', *International Review of Administrative Sciences*, vol. 71, no 2, pp. 217-228.

Bovaird, Tony and Elke Löffler (2003). 'Evaluating the quality of public governance: indicators, models and methodologies', *International Review of Administrative Sciences*, vol. 69, no 3, pp. 313-328.

Boyer, Michael and Lisa Sovilla (2003). 'How to Identify and Remove the Barriers for a Successful Lean Implementation', *Journal of Ship Production*, vol. 19, no 2, pp. 116-120.

Buesa, René J (2009). 'Adapting lean to histology laboratories', *Annals of Diagnostic Pathology*, vol. 13, no 5, pp. 322-333.

Buetow, Stephen A and Martin Roland (1999). 'Clinical governance: bridging the gap between managerial and clinical approaches to quality of care', *Quality in Health Care*, vol. 8, no 3, pp. 184-190.

Burgess, N. and Z. Radnor (2013). 'Evaluating Lean in healthcare', *International Journal Health Care Quality Assurance*, vol. 26, no 3, pp. 220-235.

Cannella, Albert A, Jong-Hun Park and Ho-Uk Lee (2008). 'Top management team functional background diversity and firm performance: Examining the roles of team member colocation and environmental uncertainty', *Academy of Management Journal*, vol. 51, no 4, pp. 768-784.

Castrogiovanni, Gary J (1991). 'Environmental Munificence; A Theoretical Assessment', *Academy of Management Review*, vol. 16, no 3, pp. 542-565.

Champagne, F, AP Contandriopoulos, JL Denis and L Lamothe (2002). *Developing a conceptual model for security analysis in health organizations*, Health Canada.

Costa, Luana Bonome Message and Moacir Godinho Filho (2016). 'Lean healthcare: review, classification and analysis of literature', *Production Planning & Control*, vol. 27, no 10, pp. 823-836.

De Treville, Suzanne, John Antonakis and Norman M. Edelson (2005). 'Can standard operating procedures be motivating? Reconciling process variability issues and behavioural outcomes', *Total Quality Management & Business Excellence*, vol. 16, no 2, pp. 231-241.

Delbridge, Rick, James Lowe and Nick Oliver (2000). 'Shopfloor responsibilities under lean teamworking', *Human Relations*, vol. 53, no 11, pp. 1459-1479.

Denis, Jean-Louis, Ann Langley and Viviane Sergi (2012). 'Leadership in the plural', *The Academy of Management Annals*, vol. 6, no 1, pp. 211-283.

Dess, Gregory G and Donald W Beard (1984). 'Dimensions of organizational task environments', *Administrative Science Quarterly*, pp. 52-73.

Dobrzykowski, David D., Kathleen L. McFadden and Mark A. Vonderembse (2016). 'Examining pathways to safety and financial performance in hospitals: A study

of lean in professional service operations', *Journal of Operations Management*, vol. 42–43, pp. 39-51.
Ferlie, Ewan, Jean Hartley and Steve Martin (2003). 'Changing public service organizations: current perspectives and future prospects', *British Journal of Management*, vol. 14, no S1, pp. S1-S14.
Fine, Benjamin A, Brian Golden, Rosemary Hannam and Dante Morra (2009). 'Leading lean: a Canadian healthcare leader's guide', *Healthcare Quarterly*, vol. 12, no 3, pp. 32-41.
Fournier, Pierre-Luc, Nadia Benormar and Marie-Hélène Jobin (2016). 'Mesurer l'impact du Lean sur la performance : leçons apprises auprès de trois établissements de santé du Québec', communication présentée au *GISEH 2016*, Casablanca, Morocco.
Fournier, Pierre-Luc and Marie-Hélène Jobin (2018). 'Understanding before implementing: the context of Lean in public healthcare organizations', *Public Money & Management*, vol. 38, no 1, pp. 37-44.
Glouberman, Sholom and Henry Mintzberg (2001). 'Managing the care of health and the cure of disease—Part I: Differentiation', *Healthcare Management Review*, vol. 26, no 1, pp. 56-69.
Goodale, John C, Donald F Kuratko and Jeffrey S Hornsby (2008). 'Influence factors for operational control and compensation in professional service firms', *Journal of Operations Management*, vol. 26, no 5, pp. 669-688.
Graban, Mark (2011). *Lean hospitals: improving quality, patient safety, and employee satisfaction*, CRC Press.
Groebner, David F and C Mike Merz (1994). 'The impact of implementing JIT on employees' job attitudes', *International Journal of Operations & Production Management*, vol. 14, no 1, pp. 26-37.
Harrison, Alan and John Storey (1996). 'New wave manufacturing strategies: operational, organizational and human dimensions', *International Journal of Operations & Production Management*, vol. 16, no 2, pp. 63-76.
Hartley, Jean (2005). 'Innovation in governance and public services: Past and present', *Public Money and Management*, vol. 25, no 1, pp. 27-34.
Harvey, Jean (1990). 'Operations management in professional service organisations: a typology', *International Journal of Operations & Production Management*, vol. 10, no 4, pp. 5-15.
Hines, Peter, Ana Lucia Martins and Jo Beale (2008). 'Testing the boundaries of lean thinking: observations from the legal public sector', *Public Money and Management*, vol. 28, no 1, pp. 35-40.
Hines, Peter, Riccardo Silvi and Monica Bartolini (2002). 'Demand chain management: an integrative approach in automotive retailing', *Journal of Operations Management*, vol. 20, no 6, pp. 707-728.
Jobin, M.-H. and Denis Lagacé (2014). 'La démarche Lean en santé et services sociaux au Québec: comment mesurer la maturité des établissements', *Gestion*, vol. 39, no 3, pp. 116-127.
Jobin, Marie-Hélène and Denis Lagacé (2015). *Evaluating Lean Maturity in Three Healthcare Orgnization in Québec*, Montréal, Canada, Ministère de la Santé et des Services Sociaux du Québec.

Jones, D, A Mitchell, D Ben, D Fillingham, C Makin, K Silvester*, et al.* (2006). 'Lean Thinking for the NHS: a Report Commissioned by the NHS Confederation', *Lean Enterprise Academy UK*.

Klein, Janice A. (1989). 'The Human Costs of Manufacturing Reform' [Article], *Harvard Business Review*, vol. 67, no 2, pp. 60-66.

Kochan, Thomas A, Russell D Lansbury and John Paul Macduffie (1997). *After lean production: evolving employment practices in the world auto industry*, Cornell University Press.

Kuipers, Ben S, Marco C De Witte and Ad H van der Zwaan (2004). 'Design or development? Beyond the LP-STS debate; inputs from a Volvo truck case', *International Journal of Operations & Production Management*, vol. 24, no 8, pp. 840-854.

LaScola, Kim, Bryan A Norman, Bopaya Bidanda, Poonsiri Ariyawongrat, Wipawee Tharmmaphornphilas and Rona Colosimo Warner (2002). 'Assessing human capital: a lean manufacturing example', *Engineering Management Journal*, vol. 14, no 3, pp. 35-39.

Longenecker, Paul D and Clinton O Longenecker (2014). 'Why hospital improvement efforts fail: a view from the front line', *Journal of Healthcare Management*, vol. 59, no 2, pp. 147-168.

Lowe, James (1993). 'Manufacturing reform and the changing role of the production supervisor: the case of the automobile industry', *Journal of Management Studies*, vol. 30, no 5, pp. 739-758.

Martin, Valérie, Marie-Hélène Jobin and H. E. C. Montréal. Centre d'études en transformation des organisations (2004). *La gestion axée sur les résultats: comparaison des cadres de gestion de huit juridictions*, vol. 4-01.;4-01;, Montréal, HEC Montréal, Centre d'études en transformation des organisations.

Mazzocato, Pamela, Carl Savage, Mats Brommels, Håkan Aronsson and Johan Thor (2010). 'Lean thinking in healthcare: a realist review of the literature', *Quality and Safety in Health Care*, vol. 19, no 5, pp. 376-382.

Mitchell, J Robert, Dean A Shepherd and Mark P Sharfman (2011). 'Erratic strategic decisions: when and why managers are inconsistent in strategic decision making', *Strategic Management Journal*, vol. 32, no 7, pp. 683-704.

Moore, Mark Harrison (1995). *Creating public value: Strategic management in government*, Harvard University Press.

Moraros, John, Mark Lemstra and Chijioke Nwankwo (2016). 'Lean interventions in healthcare: do they actually work? A systematic literature review', *International Journal for Quality in Health Care*, vol. 28, no 2, pp. 150-165.

Nembhard, Ingrid M, Jeffrey A Alexander, Timothy J Hoff and Rangaraj Ramanujam (2009). 'Why does the quality of health care continue to lag? Insights from management research', *The Academy of Management Perspectives*, pp. 24-42.

Osborne, Stephen P (2006). 'The new public governance?', *Public Management Review*, vol. 8, no 3, pp. 377-387.

Ovretveit, John (2011). 'Understanding the conditions for improvement: research to discover which context influences affect improvement success', *BMJ Quality & Safety*, vol. 20, pp. 18-23.

Parker, Sharon K (2003). 'Longitudinal effects of lean production on employee outcomes and the mediating role of work characteristics', *Journal of Applied Psychology*, vol. 88, no 4, pp. 620.
Radnor, Zoe and Stephen P. Osborne (2012). 'Lean: A failed theory for public services?', *Public Management Review*, vol. 15, no 2, pp. 265-287.
Rother, Mike (2010). *Toyota Kata: Managing people for improvement, adaptiveness, and superior results*, McGraw Hill New York, NY.
Samuel, Donna, Pauline Found and Sharon J. Williams (2015). 'How did the publication of the book The Machine That Changed The World change management thinking? Exploring 25 years of lean literature', *International Journal of Operations & Production Management*, vol. 35, no 10, pp. 1386-1407.
Schmenner, Roger W. (1986). 'How Can Service Businesses Survive and Prosper?', *Sloan Management Review*, vol. 27, no 3, pp. 21.
Schneller, Eugene S and Larry R Smeltzer (2006). *Strategic management of the health care supply chain*, Jossey-Bass.
Schouteten, Roel and Jos Benders (2004). 'Lean production assessed by Karasek's job demand–job control model', *Economic and Industrial Democracy*, vol. 25, no 3, pp. 347-373.
Scorsone, Eric A (2008). 'New development: what are the challenges in transferring Lean thinking to government?', *Public Money and Management*, vol. 28, no 1, pp. 61-64.
Sheaff, Rod, Martin Marshall, Anne Rogers, Martin Roland, Bonnie Sibbald and Susan Pickard (2004). 'Governmentality by network in English primary healthcare', *Social Policy & Administration*, vol. 38, no 1, pp. 89-103.
Smeds, Riitta (1994). 'Managing change towards lean enterprises', *International Journal of Operations & Production Management*, vol. 14, no 3, pp. 66-82.
Soriano-Meier, Horacio and Paul L Forrester (2002). 'A model for evaluating the degree of leanness of manufacturing firms', *Integrated Manufacturing Systems*, vol. 13, no 2, pp. 104-109.
Staats, Bradley R., David James Brunner and David M. Upton (2011). 'Lean principles, learning, and knowledge work: Evidence from a software services provider', *Journal of Operations Management*, vol. 29, no 5, pp. 376-390.
Suzuki, Yoshiji (2004). 'Structure of the Japanese Production System: Elusiveness and Reality', *Asian Business & Management*, vol. 3, no 2, pp. 201-219.
Thompson, Paul and Terry Wallace (1996). 'Redesigning production through teamworking: Case studies from the Volvo Truck Corporation', *International Journal of Operations & Production Management*, vol. 16, no 2, pp. 103-118.
Torraco, Richard J (2005). 'Writing integrative literature reviews: Guidelines and examples', *Human Resource Development Review*, vol. 4, no 3, pp. 356-367.
Waring, Justin J and Simon Bishop (2010). 'Lean healthcare: rhetoric, ritual and resistance', *Social Science & Medicine*, vol. 71, no 7, pp. 1332-1340.
Wiengarten, Frank, Mark Pagell and Brian Fynes (2012). 'Supply chain environmental investments in dynamic industries: Comparing investment and performance differences with static industries', *International Journal of Production Economics*, vol. 135, no 2, pp. 541-551.

Womack, James P and Daniel T Jones (2015). *Lean solutions: how companies and customers can create value and wealth together*, Simon and Schuster.
Zhang, Dongli, Kevin Linderman and Roger G Schroeder (2012). 'The moderating role of contextual factors on quality management practices', *Journal of Operations Management*, vol. 30, no 1, pp. 12-23.

Chapter 2:
Physicians and Lean: a Qualitative Perspective

* An early version of this paper was accepted for publication in *Leadership in Health Services* on April 11, 2018. It is available in the appendix.

Fournier, Pierre-Luc et Marie-Hélène Jobin (2018). « Medical commitment to lean: An inductive model development », *Leadership in Health Services*, vol. 31, no 3, p. 326-342. https://doi.org/10.1108/LHS-02-2018-0015

Abstract

The implementation of Lean in healthcare faces many barriers, one of which is the resistance traditionally exhibited by physicians. The status and power of physicians make them very influential during organizational change. Scholars and practitioners alike have identified this as an important challenge for Lean implementation in healthcare (Toussaint *et al.*, 2017). They have notably called upon the scientific community to investigate what influences physicians' reaction to Lean. To do so, we performed a secondary analysis of qualitative data collected during a large research project that studied Lean implementation in three healthcare organizations for three years. Using analytic induction, we performed a two-stage analysis anchored in Oreg et al.'s (2011) framework of organizational change reactions. First, we identified various *pre-change* and *change* antecedents who were found to influence physicians' reactions to Lean change. *Pre-change* antecedents have to do with the change recipient's individual characteristics and the internal organizational context. C*hange* antecedents relate to the content of the change, the process of change and the perceived benefits of the change. Second, a cross-case analysis allowed us to identify patterns and trends by comparing similarities and differences between cases. Other than previous experience with Lean thinking, *pre-change* antecedents appeared to influence physicians' reaction to Lean change much less significantly than *change* antecedents. Changes to the organization of work and the core-technical practices of physicians tended to generate negative reactions to Lean. Communication, involvement, and leadership

proved important in inducing positive reactions. When Lean was viewed as a way to reduce costs, physicians showed distrust towards it, as opposed to quality improvement, which appeared to be positively viewed by physicians. This paper contributes to both research and practice, by providing evidence of how physicians as a group of organizational actors tend to react to Lean and how managers can better face this challenge.

2.1. Introduction

For the last decades, policy-makers worldwide have faced challenges regarding the ability of healthcare systems to provide cost-effective services (Kaplan and Porter, 2011). While various efforts have been put forth to do so, change has proven notoriously difficult (Longenecker and Longenecker, 2014). Amongst these is Lean Management, a holistic management system based on a culture of continuous improvement (Womack and Jones, 2015), implemented in various countries and settings (Costa and Godinho Filho, 2016). However, many authors have recently concluded that while it has produced gains at the local level, in units or departments where initiatives have taken place, Lean has failed to provide definite gains at the organizational level and beyond (Costa and Godinho Filho, 2016; Mazzocato *et al.*, 2010; Moraros *et al.*, 2016)

Our three-year study of Lean implementation in three Canadian healthcare organizations investigated how organizations matured during their Lean journeys. Notably, it highlighted the central role played by physicians during Lean change initiatives (Jobin and Lagacé, 2014). From 2013 to 2015, we conducted 99 individual interviews in three distinct organizations attempting major Lean transformations. Through this research, we identified the implication of physicians as a central issue for Lean implementation in healthcare organizations. Their status as independent workers was often highlighted as a concern for managers and Lean practitioners (Fournier and Jobin, 2018b). Physicians themselves emphasized how they and their colleagues played a central role during successful Lean implementation.

The results from our three-year study led us down a path to further investigate the role of physicians during Lean initiatives. In a recent paper (Fournier and Jobin, 2018b) we

developed a conceptual model of complexity in healthcare organizations regarding Lean implementation. In this model, clinical governance was highlighted as a critical aspect impacting Lean implementation. It was argued that physicians play a central role in the success or failure of Lean initiatives. Healthcare organizations, especially public ones, must deal with an important leadership paradox that results from the unique position of physicians as powerful stakeholders. Moreover, the current academic literature views the commitment of physicians to change as a necessary component of successful organizational change in healthcare (Battilana and Casciaro, 2012; Desbiens, 2016). Yet, no conclusive empirical evidence is available to determine if higher levels of commitment from physicians result in positive impacts for Lean initiatives in particular. Furthermore, an important question remains: what influences physicians' reactions towards Lean change?

This is the next step in our research. To investigate, we will build on the data collected during our three-year research of Lean implementation in healthcare. With these results, we use analytic induction to develop an understanding of physicians' reactions to Lean change and the factors influencing it. To do so, we anchor our analysis in Oreg *et al.*'s (2011) change reactions framework. According to these authors, recipients can have affective, cognitive and behavioral reactions to change. The authors propose two categories of antecedents that influence these reactions to organizational change: *pre-change* and *change antecedents*. Through their thorough review of academic literature, they identified 86 *pre-change* and 28 *change* antecedents influencing individuals' reaction to change. The objective of our research is, considering their unique status, to investigate which of these is potentially present regarding physicians and Lean change. To do so, we use qualitative data from three case studies in a two-stage secondary analysis based on analytic induction. After reviewing the transcripts, we use a combination of structural (Guest *et al.*, 2012) and descriptive (Miles *et al.*, 2014) coding to identify various change antecedents. In the with-in case analyses, we use the chain of evidence from each case to summarize which antecedents were found to influence physicians' reactions to Lean change, the nature of that influence and whether this influence appeared to grow or diminish over time. Then, in our cross-case analysis, we identify patterns and trends by comparing the similarities and differences between each case. Our findings demonstrate

how individual characteristics and the internal organizational context seem to have limited influence on physicians' reactions to Lean. Instead, they highlight how the content of the change, the process of change and the perceived benefits of the change impact physicians' reactions. Notably, we emphasize how changes to the organization of work and core-technical practices tend to generate resistance from physicians. Also, *communication*, *involvement,* and *leadership* are shown to be closely linked to physicians' reactions. Finally, we present how the perceived benefits related to *cost reduction* and *quality improvement* have opposite influences on physicians.

This paper is structured as follows. First, we will present a short overview of the origins of Lean. Second, we will discuss the implementation of Lean in healthcare organizations and summarize our findings from our three-year study in the Canadian healthcare system. Third, we will examine the complexity of Lean implementation in healthcare, focusing on issues related to physicians' role in the organization. Fourth, we will present our methodology and findings, as well as discuss these related to physicians' reactions to Lean change. We will end our paper by discussing the implications and limitations of our research, as well as future research avenues.

2.2. Origins of Lean

Originated in Japan, Lean has become one of the most important management paradigms of the last 30 years. ''Lean'' was coined in 1988 by John Krafcik, an MIT graduate student at the time (Krafcik, 1988). Over the years, it has evolved from a generic definition of the Toyota Production System (TPS), into a holistic value system adapted to different realities, from manufacturing to services, and beyond (Samuel *et al.*, 2015). Originally viewed as a combination of tools and techniques (Liker, 2004; Spear and Bowen, 1999; Womack and Jones, 1996) focusing on cost reduction, the understanding of Lean has shifted to a value appropriation vision encompassing many ''soft-practices'' such as respect for people (Liker and Convis, 2011), committed management (Soriano-Meier and Forrester, 2002) and meta-routines of work such as Toyota-Kata (Rother, 2010). As a management system deeply rooted in social sciences, leadership, training, and problem solving are now core elements of Lean.

While it is predicated on the benefits it has been shown to provide (Fullerton *et al.*, 2003; Womack and Jones, 2015), the causality between Lean implementation and improved performance has been disputed abundantly by scholars (Lin and Chun, 1999), who have argued that gains related to performance are found only when companies appropriate the value created by Lean and not simply through implementation. Hence, leadership, management, and culture are now prominent subjects in the Lean management literature, because of how they influence value appropriation.

2.3. Lean in Healthcare - Evidence from Canada

Evidence of Lean implementation in healthcare organizations can be found across the world. In the USA, places such as ThedaCare in Wisconsin (Barnas, 2011) and the Virginia Mason Institute (Kenney, 2012) have achieved, at one point, some form of success through their implementations. The United Kingdom's *National Health Service* (NHS) has also been experimenting with Lean for many years (Burgess and Radnor, 2013; Radnor *et al.*, 2009). In Canada, St-Joseph's Health Center in Ontario, Five Hills Health Region in Saskatchewan and St-Boniface Hospital in Manitoba were the first ones to experiment with Lean thinking (Fine *et al.*, 2009; Graban, 2011). In the province of Québec, discussions regarding Lean began around 2008 leading to a policy-driven implementation across three large organizations in 2011, accompanied by an investment of 12 million dollars over three years. This initial implementation was followed, in 2013, by a second phase that targeted a further 16 organizations. The impact Lean had on those organizations' performance was inconclusive (Fournier *et al.*, 2016). Over the course of three years, we studied how the first three hospitals had implemented Lean, the challenges they faced, the results they achieved and how they had matured with regards to Lean. The *Lean Healthcare Maturity Model* (Jobin and Lagacé, 2014) was developed through an inductive research spanning three years. Over this period, 99 individual interviews and 6 focus groups were conducted with various stakeholders, including general managers, senior managers, physicians, clinical and administrative staff, union representatives and patients. The data collected during this process allowed us to develop a comprehensive perspective of Lean in a healthcare setting, constituted by 10 dimensions subdivided into 78 components. A measurement tool was then developed to allow for the evaluation of

Lean maturity in a healthcare organization. This tool evaluates each component on a 5-level scale, as presented in table 2 of chapter 1. Using this tool, our research empirically concluded on the difficulty faced by healthcare organizations in attaining greater Lean maturity. The three organizations that we studied showed plateauing in their maturity progression at around 2.5, unable to leave a *state of transition* from local Lean initiatives based on visual elements and external expertise, into an organization-wide integration. This was notably echoed by researchers studying the manufacturing industry where the notion of plateauing was discussed, where progress becomes more and more difficult as organizations fail to leave their project-based mindset and transit into true cultural change (Netland *et al.*, 2015).

Our research concluded that policy-makers, managers, and practitioners had difficulty to properly adapt Lean to the public healthcare context. These findings echoed those made in the UK (Burgess and Radnor, 2013), where Lean implementation in English Hospitals had a tendency to be isolated, efficiency-driven, and unable to trigger cultural change. But why do healthcare organizations have such difficulty adapting Lean to their unique context? Our interviews with various actors of Lean implementation highlighted the complexities of the public healthcare setting. Particularly, our three-year study of Lean implementation in healthcare revealed that physicians contribute largely to the complexity of Lean implementation in those organizations, through the leadership paradox they create and their professional hegemony (Fournier and Jobin, 2018b)

2.4. About physicians

2.4.1. Physicians as organizational actors

The centrality of physicians in decision-making and work design makes them a focal point of Lean change as well as organizational life. The issues related to physicians' role within healthcare organizations are not new. The issues usually originate from two dimensions of physicians' unique characteristics: their status and power. The clinician hierarchical status defines the identity of physicians (Kellogg, 2009) and it has long been established that this status is viewed as superior to that of any other healthcare professional (Harrison *et al.*, 1992). In Giaimo's (2009) model of professional groups' role divisions, physicians

exert dominance over all other categories of healthcare professionals. The medical status also allows, in part, for a large professional autonomy over the organization of work and decision-making. This unique status of medical professionalism, therefore, confers large amounts of power to physicians. This power is compounded by the monopoly they exert on the expertise needed for hospitals to provide care (McNulty and Ferlie, 2002). In the end, as highlighted by Battilana and Casciaro (2012), physicians are the central "decision makers" of both the clinical and the administrative domains.

The centrality of physicians can be problematic for healthcare organizations, especially since physicians tend to comply more to their own professional judgment as they do to organizational rules (Dent, 2003). Also, Crawford-Mason (2002) brings to our attention that physicians' training does not inherently allow them to understand the interdependent nature of their work with other aspects of the medical system. Furthermore, according to Dent (2003), the medical profession has successfully defended their ability to resist managerial influence because of their status and power. Historically, healthcare executives have not been able to use traditional "rewards or punishments" in order to influence physicians' behaviors (Callister and Wall Jr, 2001). Often, physicians are not employed by the organizations, and they also may feel that their interests or that of the medical profession are at odds with those of the organization.

Why is this problematic? Well, as argued by Dukerich *et al.* (2002), the success of healthcare organizations is determined by the cooperative behaviors of all stakeholders, especially physicians. The authors explain that physicians have the most impact on the utilization of resources, because they effectively control demand by determining the flow of critical inputs and because they have essential administrative duties that cannot be performed by non-clinician managers. In effect, the protected status and power of physicians provide them with the ability to veto managerial decisions (Desbiens, 2016). Therefore, physicians create a *leadership paradox* in which one group of stakeholders possesses a disproportionate amount of power over the others within pluralistic governance mechanisms (Fournier and Jobin, 2018b).

2.4.2. Physicians and Change

The centrality of physicians also causes challenges with regards to organizational change. While not inherently different than other healthcare professionals with regards to change, scholars have studied the relationship between physicians and change due to their distinctiveness as organizational actors. Physicians have a notorious rapport with organizational change, usually showing inertia towards it (Cabana *et al.*, 1999). It has been highlighted that resistance to organizational change from physicians is notoriously particular (Lapointe and Rivard, 2005, 2007; Rivard *et al.*, 2011). Their power and status have often made them the gateway towards success, or failure, of change initiatives. During organizational change, members of the organization, particularly physicians, negotiate their participation in order to better control the change and its impact on their work, and the dispatching of resources (McNulty and Ferlie, 2002). Hence, when their perception is that change will threaten their professional dominance, their resistance will usually increase (Light, 2000). As confirmed by Ferlie *et al.* (2005), when a professional's desire to protect their professional boundaries is high, the diffusion of innovation is notoriously more difficult.

Over the years, scholars have identified various elements influencing physicians' resistance to change. At the heart of this issue is professional autonomy. If physicians believe a change will decrease their decision-making authority or challenge their professional judgment, they are unlikely to engage (Greco and Eisenberg, 1993). Indeed, as stated by Denis *et al.* (2002) and Desbiens (2016) many innovations that could improve quality are, too often, blocked by physicians because they wish to protect their professional autonomy.

Other issues can also bring about resistance to change from physicians. If they perceive the change is threatening their economic well-being, resistance will tend to be higher (Greco and Eisenberg, 1993; Light, 2000). When change impacts the organization of their work and the specific role divisions they enjoy, resistance will also be greater (Giaimo, 2009; Rogers *et al.*, 2004). Finally, if they believe the desired change will have a negative impact on the quality of care offered to patients, their engagement will be difficult to secure (Brass, 1971; Cabana *et al.*, 1999; Mathie, 1997).

Mathie (1997) provide a deep analysis of physicians and their relationship with change. The author concludes that certain factors can predispose physicians towards the acceptance of change. According to her work, general practitioners and specialist physicians react differently during change. Specialists are usually more influenced by enthusiastic individuals exhibiting strong leadership, while generalists are more influenced by individuals' listening skills and willingness to advise. She also concluded that propensity to change is also influenced by age, younger physicians being more positively inclined towards it. Furthermore, she identified time as a non-financial incentive to encourage physicians to adopt new behaviors. This notion was validated by Cabana *et al.* (1999) and Pynoo *et al.* (2012), who argued that physicians were more likely to engage in a change if they perceived it would allow them to use their time more effectively and if it would increase their individual performance.

While they are unique, physicians are not excluded from social influence. Indeed, as stated by (Farand *et al.*, 1999), they are particularly influenced by their own medical environment, meaning their colleagues. This is not inherently negative, because it means physicians can act as powerful change agents themselves. By using their power based on credibility as clinicians and control over certain strategic elements, they can positively influence change. To make physicians into change agents, Goldstein and Ward (2004) argue that they must be involved in strategic decision-making regarding improvement. This will favor success and also, ultimately, lead to better organizational performance.

2.4.3. Physicians and Lean

Physicians' difficult relationship with organizational change creates challenges with regards to Lean implementation. After all, Lean is a form of organizational change. As early as 2006, which coincides with the start of a wider Lean implementation in healthcare, Jones *et al.* (2006) identified the role of physicians as a central issue during Lean change. However, it wasn't until recently that both scholars and practitioners highlighted the need to investigate it further. Waring and Bishop (2010) and Toussaint *et al.* (2017) argue that physicians engagement is critical for successful Lean implementation, but they highlight that little is known about it with regards to Lean change. In their paper, Lorden *et al.* (2014) go further, arguing that physicians, more often

than not, become barriers to Lean implementation. While little is present in the academic literature about this subject, there is, albeit not substantial, a body of work concerning various improvement methodologies such as Total Quality Management (TQM) and Business Process Reengineering (BPR).

Shortell *et al.* (1995) highlight the under-involvement of physicians during Continuous Quality Improvement (CQI) efforts. At the same time, Weiner *et al.* (1997) stress the need for strong medical leadership during clinical continuous improvement. In their work on TQM, Huq and Martin (2000) conclude on the importance of strong, shared leadership with physicians for successful implementation. In another example, McNulty and Ferlie (2004) found, in their study of BPR implementation in a British Hospital, no case in which BPR was successful when imposed upon a physician. The overarching question then becomes: why?

A few authors have provided some answers to this question. Lozeau (2002) states that over-structured methodologies focusing on process improvement over quality diminishes motivation from clinicians. As Freidson (1984) mention, the medical community has traditionally had a perception that "medical work is complex and, therefore, not accessible to standardization", and especially if that standardization is brought about by non-medical people. This notion is discussed by Zimmerer *et al.* (1999), who highlight the mentality of "the sacred view of healthcare" as a contributing factor to inertia regarding quality improvement in this sector. What is curious though, and also highlighted by these same authors, is that other complex industries such as aviation, aerospace and law enforcement have not exhibited such inertia towards continuous improvement. This leads us back to the notions of status and power. Knowing that change such as TQM can directly target the "core-technical" activities of physicians, this might explain the various difficulties encountered by continuous improvement in healthcare.

To overcome these difficulties, some authors have suggested an emphasis be put on managerial concerns as opposed to technical issues. Bate *et al.* (2008) have highlighted that cases where successful implementation has taken place have usually focused on the social and human elements of continuous improvement, such as internal politics, culture, and structure. Cammisa *et al.* (2011) underline the importance of avoiding cost reduction

as the main justification of continuous improvement. The author emphasizes the need to focus on understanding the reasons for the change and place cost reduction in the larger context of quality improvement.

Lean, as a process of change, has many similarities with both TQM and BPR. In fact, these approaches are often difficult to distinguish for practitioners and non-experts (Pettersen, 2009). Lean and TQM appear to have more in common than BPR, both originating from the evolution of quality in Japan (Andersson *et al.*, 2006). While there are differences between the two, they are sometimes, today, difficult to differentiate when they are used and implemented in organizations. BPR tends to be associated with a more radical, "top-down", approach to change, hence is more easily distinguished from the others (Patwardhan and Patwardhan, 2008). Knowing that Lean, as a change phenomenon, has similarities with TQM and BPR, the current knowledge available in the literature represents a good starting point to investigate physicians and Lean change. We know, today, that strong clinical leadership, particularly from physicians, is essential for process improvement to be successful in healthcare (Champy and Greenspun, 2010). However, little is known as to what influences physicians to engage in Lean change and exert such leadership. Providing a perspective on this issue is the objective of this paper. More precisely, we aim to better understand what elements influence physicians' reactions towards Lean change. In the organizational behavior literature, these elements are defined as *antecedents* of change (Rafferty *et al.*, 2013). To perform our research, we base our study on Oreg *et al.'s* (2011) conceptual framework of change recipients' reaction to change.

2.5. Initial Conceptual Framework

In behavioral psychology, an antecedent is defined as "a stimulus that cues an organism to perform a learned behavior". In this work, we use the term antecedent as elements appearing prior to or during the change itself, which can influence the reaction of a change recipient towards that change.

In their study of 60 years of literature on change recipients' reactions to organizational change, Oreg *et al.* (2011) developed a framework classifying three types of reactions to

change: *affective*, such as anxiety and stress, *cognitive*, such as changes in attitudes and beliefs, as well as *behavioral,* which can be exhibited through resistance or cooperation, for example. They also identified two categories of antecedents influencing recipients' reactions to change: *pre-change* and *change* antecedents. *Pre-change* antecedents have to do with the change recipient's individual characteristics and the internal organizational context. These are initial, or pre-existing, conditions that can influence the reaction to organizational change. Change antecedents relate to the process and content of the change, as well as the perceived benefits of the change in the eyes of the recipient. We use this framework to guide our qualitative analysis based on analytic induction. We code and categorize the various antecedents according to the structure presented in table 3. In the following section, we will present our research method and address potential concerns regarding our use of secondary qualitative data.

Table 3. Initial conceptual framework inspired from Oreg *et al.* (2011*)*

Category of antecedents	**Sub-categories of antecedents**
Pre-change antecedents	Individual characteristics
	Internal organizational context
Change antecedents	Content of the change
	Process of change
	Perceived benefit(s) of the change

2.6. Research Method

This research is based on a supplementary secondary analysis (Heaton, 2008) of the qualitative data collected in our original research project studying Lean maturity, which we presented earlier (Fournier and Jobin, 2018a). Based on three case studies, this project studied the implementation of Lean in three distinct healthcare organizations over a period of three years. In total, 99 interviews were conducted with various stakeholders using open-ended questions related to the implementation their organization was going through.

To perform the study presented in this paper, a secondary analysis was done using 54 of the initial study's 99 interviews. In total, 18 participants were selected. Six participants from every organization were interviewed three times each, once a year, for three straight years. These interviews were selected because those participants were either asked specific, open-ended, questions regarding the role of physicians within their respective

organization and with regards to their Lean implementation initiatives or because they had mentioned that subject in their responses to other questions. The participants included, in all three organizations, the following:

- the General Manager (in the case of Québec hospitals, is equivalent to a CEO);
- the Human Resources Director (equivalent to a Chief Human Resources Officer);
- the Quality and Performance / Lean Program Director;
- the Medical Director (equivalent to Chief Medical Officer)
- a Middle Manager involved in a Lean change project
- a front-line physician who had participated directly in Lean change initiatives

We used a combination of structural (Guest *et al.*, 2012) and descriptive (Miles *et al.*, 2014) coding to review the transcripts. This allowed us to perform a two-stage analysis based on analytic induction (Patton, 2002) using Oreg et al's (2011) framework of change recipients' reactions to organizational change.

> "*In analytic induction, researchers develop hypotheses, sometimes rough and general approximations, prior to entry into the field, or in cases where data already are collected, prior to data analysis. These hypotheses can be based on hunches, assumptions, careful examination of theory, or combinations."* (Gilgun, 1995; p.296)

Before delving deeper into the three cases at hand, we will address the issue of secondary analysis of qualitative data.

2.6.1. Issues with secondary analysis of qualitative data

The secondary analysis of qualitative data has been a contentious subject within the social sciences research community. Hammersley (2010) mentions two key issues highlighted by researchers regarding such work. First is the problem of potential lack of fit, meaning that data collected for one purpose might not be usable for another one. The second is what the author calls the "relative lack of contextual knowledge", or as put by Heaton (2008), the "problem of not been there", meaning researchers absent from the original data collection do not possess the tacit knowledge built over the course of the initial study.

These are issues that cannot be neglected, therefore we will address them before going any further.

Regarding the issue of potential lack of fit, we would like to highlight that the objective of this paper is to study the engagement of physicians towards Lean change, which can be viewed as a subject directly related to the larger study of Lean implementation in healthcare. While those are not identical subjects, they are certainly closely related since physicians are an integral part of the Lean implementation process in healthcare. As argued by Hammersley (2010), the lack of fit does not disqualify secondary analysis of qualitative data any more than it does other kinds of research. What is more important is the degree to which the initial data set can be used for the secondary analysis. We believe that since the initial research subject and the current one are closely related, this degree of divergence is not significant enough to invalidate the re-use of the data.

Second, with regards to "relative lack of contextual knowledge", we stress that the authors of this paper were heavily involved in the original research project and the data collection process. We believe this allows us to sufficiently draw on the implicit knowledge generated in the initial research and make sense of the data in a reliable and valid manner.

2.6.2. Cases

The three cases studied for this research were three hospitals operating in the Canadian province of Québec's public healthcare system. All three of these organizations were tasked by the Ministry of Health and Social Services (MSSS), in 2012, with the implementation of Lean in many functions. They were each allowed a budget and given a timeframe of three years to implement Lean thorough various improvement projects. A large, internationally recognized consulting firm was hired to provide external support, technical knowledge, and know how over that same period. The implementation process, for each hospital, consisted of 10 large scale improvement projects, that were to be identified by every hospital. We refer you to the initial research report (Jobin and Lagacé, 2015) for more in-depth information regarding how these projects were identified and selected. It is important to note that the three organizations discussed in this paper no longer exist as such, following the passing by the provincial national assembly, in

February 2015, of bill 10 that restructured the entire public healthcare system in Québec. Therefore, information regarding these organizations is no longer readily available. These organizations were merged into larger, integrated *Health and Social Services Centers* (http://www.msss.gouv.qc.ca/).

Table 4. Characteristics of the studied organizations.

		Hospital A	Hospital B	Hospital C
Type of hospital		Community hospital	Community hospital	University-affiliated hospital
Number of employees		3900	2500	14000*
Number of physicians		250	200	1700*
Size of serviced population		140 000	200 000	700 000*
Improvement projects (sectors or processes where projects took place)	2012	- Medical imaging - Surgical operating rooms - Food services	- Emergency department - Procurement - Surgical operating rooms - Pre-admission and pre-operation	- Surgical operating rooms - Child and youth care - Emergency department
	2013	- Long-term care centers - Test center - Wheelchair rental services - Human resources (call list)	- Medical imaging - Home care - Geriatric medicine unit	- Family medicine unit - Geriatrics - Surgical central planning - Disposal of medical waste (sterilization)
	2014	- Outpatient clinics - Archives - Hospitalization planning	- Human resources (call list) - Hospitalization	- Geriatric medicine unit - Orthopedics (hip and knee replacement) - Post-partum and nursery

Hospital A was a large community hospital based on the Island of Montréal, offering both general and specialized health and social services. Consisting of around 3900 employees and 250 physicians, this hospital was subdivided into 12 distinct installations across that region, serving a population of around 140 000 people.

Hospital B was also a community hospital of about 2500 employees and 200 physicians. It was operating on the south shore of Montréal, also offering both specialized and general services to a population of around 200 000 individuals, with a focus on front-line services, mental health and addictions, youth health, chronic and cancer-related illnesses and elderly care.

Hospital C represented a subset of a large, University affiliated, hospital consisting of roughly 14 000 employees, 1700 physicians, dentists and pharmacists and 500 researchers. Roughly a third of this hospital's workforce worked in the subset where Lean implementation took place *. This hospital offered general and specialized services to the population of the greater Québec City area. They focused on second line services along with a tertiary specialization in vascular surgery, perinatal and obstetrical services as well as a high-volume emergency service. Hospital C was also charged with a teaching and research mission centered on biomaterials, women and vascular health.

Each organization was tasked with implementing Lean through a series of 10 large-scale improvement projects. You can refer to table 4 for a detailed list of those projects. We performed an interview with each of the respondents, for every organization, following the end of each phase of implementation. While other respondents were interviewed, their responses were not selected for this study because data was not present for all 3 measurements (T1, T2, and T3). T1 took place at the beginning of 2013, T2 at the beginning of 2014 and T3 at the beginning of 2015.

2.7. Analysis

2.7.1. Coding

The first stage, with-in case analysis was performed in order to identify the various change antecedents respondents highlighted as impacting the reactions of physicians towards Lean implementation. It is important to note, at this point, that our coding and further analyses looked at physicians as a cluster of individuals or a professional group within the organization. The object of our study, therefore, concerns physicians "in general", as a group of actors within each hospital.

We reviewed the interview transcripts using a combination of structural (Guest *et al.*, 2012) and descriptive (Miles *et al.*, 2014) coding. We used a synthetic analysis strategy (Langley, 1999), as exemplified by Eisenhardt (1989), by pairing each antecedent identified by respondents to the corresponding perceived reaction to change from physicians. We then coded each antecedent and classified them using Oreg *et al.'s* (2011) framework of antecedents of reactions to change. Figure 3 presents a summary of our coding method.

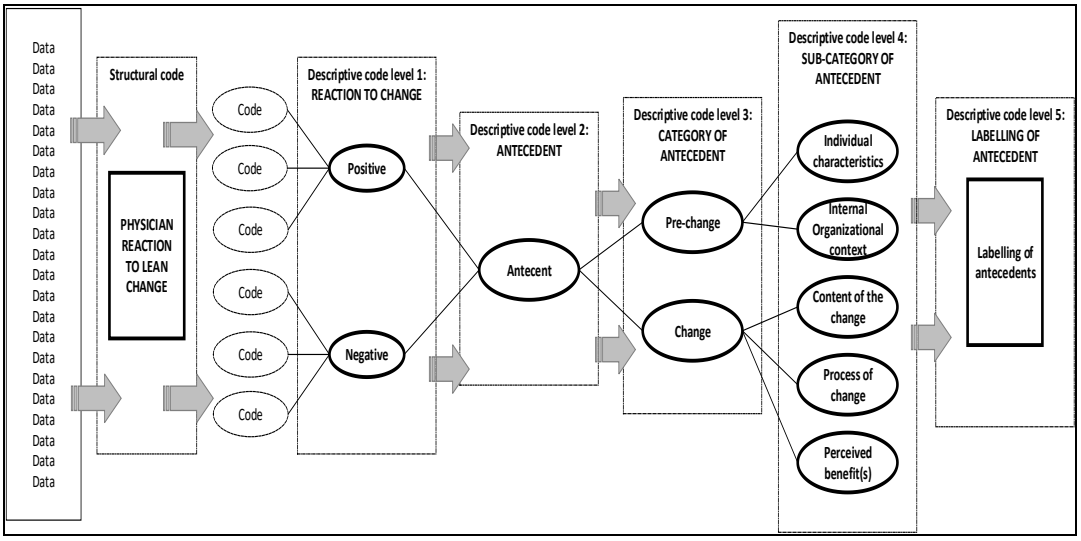


Figure 3. Summary of the coding method

We first used structural coding to identify when respondents had discussed the notion of physicians' reaction to Lean implementation. Then, within each structural code, we used four levels of descriptive coding. We first identified the nature of the reaction to Lean change, whether it was deemed to be positive or negative. From there, our second level descriptive code focused on identifying, within the respondent's statement, whether this reaction had been influenced or caused by any antecedent. The third level of coding then categorized the antecedent as either a *pre-change* or *change* antecedent, following Oreg *et al's* (2011) framework. A *pre-change antecedent* has to do with the change recipient's individual characteristics or the internal organizational context. They are, in fact, pre-existing conditions. A *change* antecedent relates to the change process itself, its content and its perceived benefits in the eyes of the recipient. Each antecedent in then slated in one of 5 corresponding subcategories. For *pre-change antecedents*, codes are categorized

as either *individual characteristics* or *internal organizational context*. For *change* antecedents, codes are classified as *content of change*, *process of change* or *perceived benefit*.

Example of code

Structural code: PHYSICIAN REACTION TO LEAN CHANGE

I:	*So can you tell me more about the improvement project you did in the operating room?*	
P:	*Yes, of course, I was present from start to finish so I can offer some input.*	
I:	*Okay, great. Can you tell me about physicians and how they were involved in all of it?*	
P:	*Oh yes, sure. Let's just say it's something we struggled with.*	
I:	*Okay, and why do you say that?*	
P:	*R1Well, most of them resisted a lot. They weren't happy about the change. Some of them were really vocal about it, and others just pretty much ignored us and kept doing their thing.*	*R1Reaction - negative*
I:	*Do you have any idea why that happened?*	
P:	*Well, I think there are a few reasons for that. You know how doctors are. They don't like being told what to do and I think they felt the Kaizen was imposed on them and they felt they weren't really consulted before doing it.[2] I think we should've probably done a better job of talking to them and getting a better feel for it. Also, remember they didn't get paid for their participation in the Kaizen.[3] That probably didn't create favorable conditions from the get go.[4]*	*1-R1Antecedent – change – process - involvement* *2-R2Antecedent – change – process - compensation* *R2Reaction - negative*

Finally, in level 5, each antecedent was given a specific label that would allow triangulation within each case and ultimately, between cases. While our preliminary labeling scheme followed a previously established one (Oreg *et al.*, 2011), we progressively refined it to allow uniformity of coding across cases. Thus, antecedent

labels were defined, refined, added or removed when sufficient data permitted so. On the previous page is also an example from an interview transcript where the respondent (Lean Program Director) identified two *change* antecedents having a negative effect (R1 and R2) on physicians' reaction to change: the top-down (imposed) nature of the change (1) and the absence of compensation (2) for their participation to the improvement initiative.

2.7.2. Within-case Analysis

Each case was individually analyzed by examining the coded interview segments. Various statements from respondents regarding the antecedents and their impact on physicians' reactions to Lean change were organized in clustered matrixes used to build a chain of evidence following each phase (T1, T2, and T3) of data collection. These matrixes are available in this chapter's appendix. To perform the analysis, we reported our findings by presenting which antecedents were identified in the respondents' statements and whether the importance of each antecedent remained constant through time. It is important to note that when discussing such trends, we discuss how respondents' preoccupations regarding antecedents appeared to evolve through time, not the value of the antecedent itself. We then used a matrix to summarize our findings.

2.7.3. Cross-case Analysis

Our cross-case analysis was performed by comparing our three cases to identify the similarities and differences over the three phases of our study. We used tables allowing us to illustrate how each case differed from the others, or not, related to the various antecedents and their relationship to physicians' reaction to Lean change that we identified in the first stage of our analysis. Overlapping the chains of evidence allowed us to detect patterns of increasing, decreasing or null importance concerning each antecedent discussed by the organizations.

2.8. Findings

In this section, we present our findings for all three case studies. We will begin by presenting the within-case analyses for each hospital (A, B, and C), followed by the cross-case analyses for each category of antecedents.

2.8.1. Within-case Analyses

Each with-case analysis is structured by first looking at each category of antecedents and the subsequent antecedents that were identified during the three phases of the research. Using the chain of evidence, we highlight how respondents' preoccupations regarding each antecedent evolved over time (trend).

2.8.1.1. Hospital A

Pre-change Antecedents

In Hospital A, four *pre-change* antecedents were identified through the three phases. First, in all three phases, two individual characteristics were repeatedly mentioned by respondents: *experience* and *Lean experience*. The consensus, for this hospital, was that physicians with more experience (how long they have been practicing medicine) tended to show more negative reactions towards Lean. The following quote from T1 illustrates this:

> *"Young doctors believe in it. They want to be involved. It is tougher with our older doctors. They're just not there yet. They don't like their work being questioned."* Medical Director (T1)

Highlighted repeatedly throughout all three phases was the positive impact previous experience with Lean tended to have on physicians' reactions to change. Some respondents talked about training while others mentioned having previously participated in Lean change initiatives as a measure of *Lean experience*.

> *"'It's not only about it taking time away from their schedule. When they've had previous experience with Lean or even had training, they get more involved."* Human resources Director (T1)

With regards to the internal organizational context, most respondents specified that the organization's historically low success rate with change had (*history of change*), they believed, induced negative initial reactions towards Lean.

> *"In the past, we weren't always successful with the things we tried to change. I think that might have stuck with them."* General Manager (T1)

However, the emphasis on the organization's historical success, or lack thereof, appeared to disappear from consideration the further along they were in their implementation process. In fact, no respondent had discussed that notion in phase 3. In the same train of thought, three of the six respondents highlighted the organization's lack of support for their physicians over the years (history of support) as an impediment to positive reactions towards Lean. The following quote, echoed by a similar statement from the Human Resources director in T2, provides evidence on the subject:

> *"Well, you know, I don't think we've done a good job of supporting them over the years. I think we have always seen them as opponents, and them as well. Maybe that's why they showed such resistance."* General Manager (T1)

As was the case with their history of change, their history of support towards their physicians appeared to take on less importance in relation to their reaction towards Lean. In T3, no respondent highlighted this when discussing physicians' reactions to change.

Change Antecedents

Respondents singled out elements of all three categories of *change* antecedents. Concerning the *content* of the change, the impact of Lean on *work organization* appeared to be negatively related to physicians' reactions to Lean change in the early phases, but not in T3.

> *"Yeah. As soon as they thought their work schedule would change, that was a no-no."* Lean Program Director (T1)

"Well, I mean, sure, they don't like it if it means they'll have to show up earlier for work. But if it's brought about accordingly, it's not a barrier." Medical Director (T3)

Respondents also highlighted physicians' perception of the *complexity of the change* as usually inductive of negative reactions towards it. This antecedent, also, was not highlighted in T3.

"They will know right away how hard the change is going to be. For example, if we have two or more departments involved, they'll know it's going to be tough to get it done and they're not going to be as motivated." Middle Manager (T1)

''When we have large and complex projects, where we have to look at a process involving two or more departments, it's tough to get doctors on board. It might have to do with our history of not being successful when addressing cross-departmental problems.'' Lean Program Director (T2)

In all three phases, respondents all strongly emphasized how perceived *core-technical change* led to negative change reactions. When physicians perceived the Lean initiatives would lead to modifications to their medical practices or change to their professional autonomy, they tended to strongly oppose the change.

''They do not like it when their practices are questioned. Even if they agree the change is a good idea, they are reluctant to convince their colleagues of it.'' Human Resources director (T1)

"To me, I feel like this is the biggest red flag for them. If you go and play on that field (medical practices), there is no way you can make it work. They'll stop you in your tracks." Middle Manager (T2)

"Even after three years, this (core-technical changes) really gets them to resist. And I mean, I get it, I wouldn't like it either. But it makes improvement that much more difficult." General Manager (T3)

Table 5. Summary of within-case analysis, Hospital A							
Antecedents			Relationship with physicians' reaction to Lean change	Presence			Trend through T1, T2, and T3
				T1	**T2**	**T3**	
Pre-change	Individual characteristics	Experience	Negative	Yes	Yes	Yes	Constant
		Lean experience	Positive	Yes	Yes	Yes	Constant
	Internal organizational context	History of change	Positive	Yes	Yes	No	Decreasing
		History of support	Positive	Yes	Yes	No	Decreasing
Change	Content of the change	Work organization	Negative	Yes	Yes	No	Decreasing
		Complexity of change	Negative	Yes	Yes	No	Decreasing
		Core-technical change	Negative	Yes	Yes	Yes	Constant
	Process of change	Communication	Positive	Yes	Yes	Yes	Constant
		Compensation	Negative	Yes	No	No	Decreasing
		Involvement	Positive	Yes	Yes	Yes	Constant
		Leadership	Positive	No	No	Yes	Increasing (strong)
	Perceived benefit(s) of the change	Cost reduction	Negative	Yes	Yes	Yes	Constant
		Quality improvement	Positive	Yes	Yes	Yes	Constant
		Patient satisfaction	Positive	Yes	No	No	Decreasing
		Work life improvement	Positive	Yes	No	No	Decreasing

As far as the process of the change is concerned, *communication*, *compensation*, *involvement,* and *leadership* were discussed by respondents. They were almost unanimous in saying *communication* was crucial. Good communication, with good information, truly favored positive reactions towards Lean from physicians.

> *"Communication was a major issue. When doctors had incorrect information, this would snowball to their colleague and there would be massive resistance. Now, we make sure to have a good communication plan in place before any Lean project starts."* General Manager (T2)

One respondent also felt that when physicians weren't compensated for their participation, resistance increased. This concern was highlighted in T1 but was not mentioned in the following interviews.

> *"Some of my colleagues… Well... Not only were they not offered compensation for their participation, they even had to take vacation time to be in the Kaizen event. Let's just say they were not very happy with the whole thing."* Physician (T1)

Involvement of physicians was deemed very important by respondents. When physicians felt change was being imposed on them, that they had not participated in the initial choices and that they were not involved in the decision-making process, they usually reacted negatively.

> *"I think we have learned from that. Now, we never start a project without physicians buying-in. We sit with them, discuss with them and involve them from start to finish."* Lean Program Director (T3)

While it was not discussed in T1 and T2, four respondents discussed how the *leadership* of the change agent played an important role in favoring positive reactions from physicians. However, it wasn't clear on what kind of leadership, such as directive or transformational, they were emphasizing.

> *"The change manager (change agent) is the most important player. They (physicians) really respond to that. It's crucial, in my opinion."*
> Lean Program Director (T3)

"What I've found is the manager in charge of the project must be engaging. He must listen to what they (physicians) are telling him. He must pay attention to their worries, constantly." Middle Manager (T3)

"So, I've been involved in two (projects) and the biggest difference was the project manager (change agent). One was really good, knew where he was headed and was engaging. And that project went well. In the other, it was the complete opposite." Physician (T3)

Throughout the interviews, the perceived benefits of the change were highlighted as important antecedents of physicians' reactions to Lean change. Most present throughout all phases was the notion of cost reduction. When physicians believed the motivation behind the implementation of Lean was to reduce costs or improve productivity, they tended to react negatively by resisting the change.

'Doctors have even come up to me and said: in the end, isn't this Lean thing simply a way for you guys to save money?''
Lean Program Director (T1)

Respondents noted, in T1 through T3, that physicians seemed to have more positive outlooks when they perceived the reasons for the change to be about the improvement of *quality*. Improvement of *patient satisfaction* and of their own *work life* was also mentioned, but not to the same extent.

"Quality is important to us. In the end, if you can convince me this is about quality, I think I'll be inclined to participate." Physician (T1)

Table 5 summarizes our findings for Hospital A with regards to the antecedents that we identified along with their proposed relationship with physicians' reactions to Lean change and if whether or not each antecedent was present in the respondents' responses over the course of our three data collections. For example, when respondents discussed *history of change*, they were suggesting that a good history of organizational change led to a positive reaction of physicians with regards to Lean change, hence the positive relationship. It was also clear that this concern decreased from T1 to T3, meaning that the

history of change appeared to be of diminishing importance in the eyes of the respondents when considering its impact on physicians' reactions to change.

2.8.1.2. Hospital B

Pre-change antecedents

Our chain of evidence allowed us to find four *pre-change* antecedents related to physicians' reaction towards Lean. In all three phases, the respondents discussed *experience* as an antecedent. It was, however, not possible to establish a consensus on the relationship between the antecedent and physician resistance to Lean. In T1, *experience* was deemed to have a negative effect on the reaction to change, while in T2, the *General Manager* pointed to the contrary.

> *"I mean, yes, our older surgeons we tough to engage. It was somewhat easier with the younger ones."* Lean Program Director (T1)

> *"You know what, I've found that it's easier with the older ones (physicians). Because they've seen these problems for so long, they kind of understand that we need to solve them. Whereas the younger ones, they are sometimes more confrontational."* General Manager (T2)

Lean experience was positively linked to physicians' reaction to Lean in all three measurements. Respondents truly emphasized this notion. It is unclear, however, if the respondents referred to previous training on Lean or actual experience in doing Lean change initiatives.

> *"I think it truly helped that we gave them (physicians) white belt training before the project. They came in with a better understanding."*
> Lean Program Director (T1)

> *"Yes, we had one of our surgeons that had done a Lean project before. He helped us to get his colleagues on board."* General Manager (T2)

The internal organizational context was highlighted only in T1. In that phase, respondents targeted the damaging effect a negative *history of change* and *history of* support had on

physicians' reactions to Lean. As mentioned, the fact this was only discussed in T1 appears to show a decreasing concern on the part of respondents regarding these two antecedents.

> *"We did a couple of large-scale construction projects in the years before we started doing Lean. Those projects impacted them (physicians) quite a bit. But in the end the results we good, so when we came to them this time around, I think that our previous results with those projects helped convince them that this could be done."* General Manager (T1)

> *"Yes, well I think they (physicians) felt supported through those large projects (construction). I think they trusted us… well, at least I think they trusted us more… with this (Lean project)."* Lean Program Director (T1)

Change Antecedents

Various respondents discussed *change* antecedents throughout all measurement phases. For the *content of the change*, changes to *work organization* were identified constantly over T1, T2, and T3 as having a negative effect on physicians' reactions to Lean change. The following quote about resistance to changes in the work schedule in eloquent regarding this:

> *"Oh yes, when we asked them (physicians) to come in earlier in the morning, they resisted massively."* Lean Program Director (T1)

The perceived *complexity of change* from physicians was discussed in T1 but was not brought up in the following interviews. It was suggested that if physicians thought the proposed change was too complex, they tended not to engage in it.

> *"When they (physicians) realized they would have to work with the radiologists to get that solved, it became more difficult, more complex. From that point, they didn't seem as interested."* Middle manager (T1)

Table 6. Summary of within-case analysis - Hospital B							
Antecedent			Relationship with physicians' reaction to Lean change	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Pre-change	Individual characteristics	Experience	Unclear	Yes	Yes	Yes	Constant
		Lean experience	Positive	Yes	Yes	Yes	Constant
	Internal organizational context	History of change	Positive	Yes	No	No	Decreasing
		History of support	Positive	Yes	No	No	Decreasing
Change	Content of the change	Work organization	Negative	Yes	Yes	Yes	Constant
		Complexity of change	Negative	Yes	No	No	Decreasing
		Core-technical change	Negative	Yes	Yes	Yes	Constant
	Process of change	Communication	Positive	Yes	Yes	Yes	Constant
		Compensation	Negative	Yes	Yes	No	Decreasing
		Involvement	Positive	Yes	Yes	Yes	Constant
		Leadership	Positive	No	Yes	Yes	Increasing (strong)
	Perceived benefit(s) of the change	Cost reduction	Negative	Yes	Yes	Yes	Constant
		Quality improvement	Positive	Yes	Yes	Yes	Constant
		Patient satisfaction	N/A	No	No	No	N/A
		Work life improvement	N/A	No	No	No	N/A

From our first interview to the last, *core-technical change* was cited as a major barrier to engagement from physicians, suggesting a strong concern from respondents regarding the negative effect it tended to have on reactions towards change.

> *"In all honesty, it's almost become a running gag. If they think we're overstepping into this (core-technical), you can forget it. You'll have massive resistance."* Lean Program Director (T1)

> *"Well, as a physician myself, I wouldn't want this either (questioning core-technical activities). But as a manager, I understand that sometimes, for the Lean to be successful, we need to go there. But my fellow physicians most likely don't have that perspective. And I understand why, but it creates a challenge, definitely."* Medical Director (T3)

Regarding the process of change, *communication* was singled out as an important antecedent of physicians' reactions to Lean change. Respondents were adamant that good communication could help create positive outlooks on Lean from physicians.

> *"It's crucial (communication). It's basic. There's no way you'll engage them (physicians) without that."* Middle Manager (T1)

> *"Yes. For every project, we had a communication plan in place, and they (physicians) we a significant part of it when they had to be involved in it (Lean project)."* Lean Program Director (T2)

We identified *compensation* in T1 and T2 inducing positive reactions from physicians. It was not found in T3, disappearing from respondents' discourse regarding physicians and Lean.

> *"Well, I think if they're (physicians) gonna do this on their own time, they need to be paid for it. Our other participants (nurses, technicians, etc.) are paid to be there. It's part of their work hours. You can't expect them to do it voluntarily."* Medical Director (T1)

As with communication, *involvement* was deemed very important throughout all measurement phases. When physicians were engaged early on, were given a say in decisions and were consulted on choices that had to be made, their reactions towards Lean tended to be much more positive.

> *"Crucial (involvement). They were the first group we met with. We involved them from the start and that made it much easier moving forward."* Lean Program Director (T1)

While it started in T2, our respondents put great emphasis, in T3, on the notion of *leadership*. In fact, five out of six respondents highlighted how they believed the leadership of the change manager positively influenced physicians' reactions.

> *"I think the change leader made a huge difference. I honestly don't think it would've worked without her. She really managed to get the doctors on board. But I can tell you it wasn't easy."* Lean Program Director (T2)

> *"I really think that's the main thing we've learned. The important role the project leader has. If he can create that productive environment and bring everybody together… I think that's why the specialists (physicians) got on board."* General Manager (T2)

Two types of perceived benefits were found to influence physicians' receptiveness to Lean. First, *cost reduction* as a perceived benefit was very much presented as negative. Respondents highlighted how physicians poorly reacted to Lean when they believed its main justification was to reduce costs or improve productivity. This was highlighted in all three phases.

> *"I know, we all know, that we need to reduce costs. But if we present it this way, it's a recipe for disaster. And especially with physicians."*
> Human Resources Director (T1)

> *"If this is your reason for doing Lean (cost reduction)… We're four years into this now. And it's not just here. My colleagues in other organizations think the same. They (physicians) have quality, patients at heart. Don't talk to them about costs."* Lean Program Director (T3)

Second and again from T1 to T3, respondents discussed how they believed physicians were more receptive to Lean when the latter targeted improvements in the quality of care.

> *"That's (quality) what matters to us (physicians). I can see the benefit it will have for my patients. I hope we can sustain it (the change) because I've seen the waiting lists reduce by a lot."* Physician (T1)

> *"I think that should always be our goal (improving quality). We're all doing this for the patients. I think that's the way to get them involved (physicians)."* Medical Director (T2)

As we did previously, our findings for Hospital B are summarized in Table 6.

2.8.1.3. Hospital C

Pre-change antecedents

In hospital C, the chain of evidence again presented four *pre-change* antecedents. *Experience* was identified in T1, albeit only from one respondent. It was not mentioned again in T2 and T3. Since only one respondent discussed the effect it might have on physicians' reaction to Lean, it is difficult to conclude on the nature of the relationship.

However, *Lean experience* was deemed very important throughout all phases. Respondents continuously raised the importance of either training or practical experience with regards to Lean as conductive to positive reactions to change from doctors.

> *"If they don't have any knowledge about Lean, they usually say something like: this isn't a factory, this whole Toyota thing doesn't work here, we're not making cars. That's why it's important to give them some training first. Explain to them what it is (Lean) and that we're not trying to make our operating room into a factory."* Lean Program Director (T1)

> *"I think my colleagues were put at ease after that quick information session. I think it made them participate more in the end."*
> Physician (T2)

The internal organizational context appeared to be of concern to respondents in the early phases. *History of change* was single out in T1 as negatively impacting physicians' reactions when it was qualified as negative.

> *"As you know, there's been so much change going on in the last, you know, 5 to 10 years. And not all of it has been very conclusive. They've (physicians) seen that, and it's kind of made us start in the negative."* General Manager (T1)

As for the *history of support*, the concern of respondents also appeared to decrease over time. Present in T1 and T2 as a positive influencer when historically good, it was not mentioned by a single respondent in T3.

> *"Some of our doctors have said to us, whether directly or not, that they've never really felt supported by the organization. I'm sure this explains some of their resistance."* Human Resources Director (T1)

> *"When you've supported them (physicians) in various situations, they're more receptive…."* General Manager (T2)

Change Antecedents

The content of the change appeared to influence physicians' reactions to Lean change. Respondents showed a constant interest in *work organization* during T1 and T3, but it was not discussed in T2. According to them, changes to such things as appointment scheduling or their autonomy resulted in negative reactions towards Lean initiatives.

> *"If we try to change things regarding their work, like standardizing how appointments are scheduled, they'll often resist that."* Lean Program Director (T1)

Respondents, across the board, from T1 to T3, were adamant on *core-technical change*. They all discussed how they believed that changes to medical practices we inductive of resistance on the part of physicians.

"You can't go there (core-technical). They'll truly resist if you do." Middle Manager (T1)

"Medical practices are a sort of protected field. When you venture there, you can expect some heavy reactions." General manager (T3)

Table 7. Summary of within-case analysis - Hospital C

Antecedents			Relationship with physicians' reaction to Lean change	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Pre-change	Individual characteristics	Experience	Unclear	Yes	No	No	Decreasing
		Lean experience	Positive	Yes	Yes	Yes	Constant
	Internal organizational context	History of change	Positive	Yes	No	No	Decreasing
		History of support	Positive	Yes	Yes	No	Decreasing
Change	Content of the change	Work organization	Negative	Yes	No	Yes	Constant
		Complexity of change	N/A	No	No	No	N/A
		Core-technical change	Negative	Yes	Yes	Yes	Constant
	Process of change	Communication	Positive	Yes	Yes	Yes	Constant
		Compensation	Negative	Yes	No	No	Decreasing
		Involvement	Positive	Yes	No	Yes	Constant
		Leadership	Positive	No	No	Yes	Increasing (strong)
	Perceived benefit(s) of the change	Cost reduction	Negative	Yes	Yes	Yes	Constant
		Quality improvement	Positive	Yes	Yes	Yes	Constant
		Patient satisfaction	N/A	No	No	No	N/A
		Work life improvement	Positive	Yes	No	No	Decreasing

Most actors we interviewed constantly highlighted, in all phases, how *communication* was an important part of the change process and how it helped to better engage physicians in their Lean projects.

> *"Yes, that's really interesting. It's the same thing with communication. It's so important. It really creates winning conditions (with regards to physicians)."* Human Resources Director (T1)

> *"When we started, communication was very important, but our concerns about it evolved I think, because we realized even more how important it is (to facilitate exchanges about Lean with physicians).".*
> Lean Program Director (T3)

Compensation was deemed impactful in T1 but was not mentioned by any respondent in the following phases.

> *"When they sit down with the others, the nurses, the professionals, the manager, it can be frustrating because they're the only ones not getting paid."* Medical Director (T1)

In T1 and T3, we identified *involvement* as an antecedent to physicians' reactions towards Lean. Respondents linked *involvement* to increased engagement from physicians.

> *"Just get them (physicians) involved from the beginning. It prevents so many problems."* General manager (T3)

In our last measurement phase (T3), *leadership* became an important concept. While it had not been discussed in T1 and T2, respondents singled it out as a major contributing factor to lower resistance. When the change agent was able to take charge and create a collaborative environment, physicians responded positively.

> *"What really struck me, after about the first 6 or 7 projects, was how important the (change) manager was. How his leadership was really central in creating engagement from them (physicians)."*
> Lean Program Director (T3)

Perceived benefits were also amply discussed by respondents, mainly *cost reduction* and *quality improvement*. In fact, these two perceived benefits remained staples through all measurement phases. *Cost reduction* was strongly associated with negative reactions to Lean from physicians.

> *"I think it was just a disguised way of cutting costs. No matter what we suggested, it always came down to that I think. No matter how they put it, you know, with their wastes and value-added tasks… I knew from the beginning that it's what this (Lean) was gonna be about. It was pointless."*
> Physicians (T1)

> *"Like Dr. Toussaint told us when we visited them, don't make Lean about costs. You'll lose them (physicians) with that."*
> Lean Program Director (T3)

On the opposite end of the spectrum, when physicians believed Lean was about improving the *quality* of care, they reacted much more positively.

> *"I remember that we talked about that project last time. I think it ended up working because we made it about quality. They (physicians) could relate to that."* Medical Director (T2)

> *"… but really it's about the quality of care. This is how you get buy-in (from physicians)."* Lean Program Director (T3)

We provide a summary of our within-case analysis in Table 7.

2.8.2. Cross-case analysis

The second stage of our analysis consists of comparing and triangulating similarities and differences across all three cases we studied. We will look at the different antecedents that were identified, their influence on physicians' reaction to Lean change and the general trends that we observed over the three measurement phases. We will first look at each antecedent individually and then move up our classification based on Oreg *et al.'s* (2011) framework, in order to investigate potential patterns.

2.8.2.1. Pre-Change Antecedents

Individual characteristics

Individual characteristics appeared as meaningful antecedents of physicians' reactions to Lean change. First, in all three cases, *Lean experience* was repeatedly identified from T1 to T3 as having a positive impact on physicians' readiness for Lean change, as can be seen in table 8 below. We could not clearly separate the notions of training and practical experience since respondents tended to equate both and talk about it in a general manner. However, respondents were almost unanimous, in each organization, on the positive influence previous *Lean experience* had on physicians' reactions to Lean initiatives.

Table 8. Cross-case analysis, Individual Characteristics

Sub-category	Antecedents	Hospital	Relationship with physicians' reaction to Lean change	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Individual characteristics	Experience	A	Negative	Yes	Yes	Yes	Constant
		B	Unclear	Yes	Yes	Yes	Constant
		C	Unclear	Yes	No	No	Decreasing
	Lean experience	A	Positive	Yes	Yes	Yes	Constant
		B	Positive	Yes	Yes	Yes	Constant
		C	Positive	Yes	Yes	Yes	Constant

Experience constantly appeared as an antecedent from T1 to T3 in Hospital A and B but was only identified in T1 for Hospital C. In hospital A, it was clear respondents felt more experienced physicians tended to react more negatively to Lean change than their less experienced colleagues. However, such a relationship was unclear in hospitals B and C, where some respondents provided statements validating that relationship, while others also contradicted those statements. Hence, it is not possible to extrapolate any conclusion on the effect experience might have as an antecedent of physicians' reactions to Lean change.

Internal Organizational Context

The internal organizational context, in this case the histories of change and support, was identified early on, in all three cases, as a positive antecedent to physicians' reactions to Lean. However, few respondents discussed it during T2 and none during T3, highlighting a strong decreasing trend of the internal organizational context as an impactful antecedent.

Table 9. Cross-case analysis, Internal Organization Context

Sub-category	Antecedents	Hospital	Relationship with physicians' reaction to Lean change	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Internal organizational context	History of change	A	Positive	Yes	Yes	No	Decreasing
		B	Positive	Yes	No	No	Decreasing
		C	Positive	Yes	No	No	Decreasing
	History of support	A	Positive	Yes	Yes	No	Decreasing
		B	Positive	Yes	No	No	Decreasing
		C	Positive	Yes	Yes	No	Decreasing

2.8.2.2. Change antecedents

Content of the Change

In our first measurement (T1), every hospital discussed changes to physicians' *work organization* as a negative antecedent. In hospital A, respondents did not show regard for this antecedent in T3, while both hospitals B and C did. Overall, it was possible to identify *work organization* as a relatively important antecedent, but not as the most important part of the content of the change.

The complexity of the change, as perceived by physicians, was highlighted in T1 in hospitals A and B. In T2, only hospital A discussed it. Hospital C did not, at any point, show concern for it. This highly decreasing trend shows that, in the eyes of the respondents, *complexity of change* is not of much concern when trying to engage physicians in Lean change initiatives.

Core-technical change was constantly identified as a significant and negative antecedent. In all cases and in all phases, respondents were adamant in discussing how perceived changes to medical practices by physicians resulted in resistance towards Lean change.

Table 10. Cross-case analysis, Content of the Change

Sub-category	Antecedents	Hospital	Relationship with physicians' reaction to Lean	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Content of the change	Work organization	A	Negative	Yes	Yes	No	Decreasing
		B	Negative	Yes	Yes	Yes	Constant
		C	Negative	Yes	No	Yes	Constant
	Complexity of change	A	Negative	Yes	Yes	No	Decreasing
		B	Negative	Yes	No	No	Decreasing
		C	Negative	No	No	No	None
	Core-technical change	A	Negative	Yes	Yes	Yes	Constant
		B	Negative	Yes	Yes	Yes	Constant
		C	Negative	Yes	Yes	Yes	Constant

Process of Change

In all three of our case studies, the process of change was found to be an important antecedent of physicians' reactions to Lean. *Communication*, *compensation,* and *involvement* were all present in T1. *Compensation*, or lack thereof, was deemed to negatively impact physicians' reactions. However, this antecedent was only identified in T1 by the three hospitals, and in T2 by hospital B. None showed concern for it in T3. When hospitals involved (*involvement*) physicians in the various aspects of their Lean projects, such as having them partake in important decisions and choices, positive reactions to Lean were often found. Hospitals A, B, and C all showed constant interest and concern for this antecedent. *Communication* was the most oft-discussed antecedent, from T1 to T3, in all cases. Respondents emphasized the importance of properly informing

and communicating with physicians, all along the process of change. This, in their experience, resulted in a much more positive reactions from physicians.

Table 11. Cross-case analysis, Process of Change

Sub-category	Antecedents	Hospital	Relationship with physicians' reaction to Lean	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Process of change	Communication	A	Positive	Yes	Yes	Yes	Constant
		B	Positive	Yes	Yes	Yes	Constant
		C	Positive	Yes	Yes	Yes	Constant
	Compensation	A	Negative	Yes	No	No	Decreasing
		B	Negative	Yes	Yes	No	Decreasing
		C	Negative	Yes	No	No	Decreasing
	Involvement	A	Positive	Yes	Yes	Yes	Constant
		B	Positive	Yes	Yes	Yes	Constant
		C	Positive	Yes	No	Yes	Constant
	Leadership	A	Positive	No	No	Yes	Increasing (strong)
		B	Positive	No	Yes	Yes	Increasing (strong)
		C	Positive	No	No	Yes	Increasing (strong)

A particularly interesting finding was respondents discussing *leadership* towards the tail end of our measurements. Not only that but the emphasis they put on it. No hospital discussed *leadership* in T1, and only one respondent from hospital B mentioned it in T2. Then, in T3, all three organizations showed deep interest in how the *leadership* of the change agent (or change manager) impacted physicians' reactions. Respondents were numerous to highlight how they believed strong *leadership* from the change agent allowed them to better engage physicians. Indeed, when performing our last data collection, we

were surprised at how much importance respondents gave to this antecedent. While they also linked it to better engagement from all healthcare stakeholders, they truly highlighted their perception of its positive influence on physicians.

Table 12. Cross-case analysis, Perceived Benefits

Sub-category	Antecedents	Hospital	Relationship with physicians' reaction to Lean	Presence			Trend through T1, T2, and T3
				T1	T2	T3	
Perceived benefits	Cost reduction	A	Negative	Yes	Yes	Yes	Constant
		B	Negative	Yes	Yes	Yes	Constant
		C	Negative	Yes	Yes	Yes	Constant
	Quality improvement	A	Positive	Yes	Yes	Yes	Constant
		B	Positive	Yes	Yes	Yes	Constant
		C	Positive	Yes	Yes	Yes	Constant
	Patient satisfaction	A	Positive	Yes	No	No	Decreasing
		B	N/A	No	No	No	None
		C	N/A	No	No	No	None
	Work life improvement	A	Positive	Yes	No	No	Decreasing
		B	N/A	No	No	No	None
		C	Positive	Yes	No	No	Decreasing

Perceived Benefits

The perceived benefits of Lean change by physicians were shown as relevant in influencing their reactions towards it. The three hospitals did not show considerable concern regarding perceived benefits related to *patient satisfaction* and *work life improvement*. These two antecedents were, in fact, not discussed at all in T2 and T3, while sporadically mentioned in T1.

Much more interesting is the repeated mentioning of cost reduction and quality improvement as influencers of physicians' reactions. Cost reduction was identified

throughout all measurements, in all three cases, as a negative antecedent, meaning that, according to respondents, when physicians felt the objective of a Lean initiative was to reduce costs, they manifested high levels of resistance towards it. Concerning quality improvement as a perceived benefit, its influence on physicians' reactions was shown to be the opposite of that caused by cost reduction.

2.9. Discussion

In this section, we will discuss our findings resulting from our analyses. First, we will tackle the diminishing roles of *pre-change* antecedents, followed by a discussion on *change antecedents* and their importance.

2.9.1. The Diminishing Role of Pre-change Antecedents

Our cross-case analysis revealed how *pre-change* antecedents appeared to be of little influence according to respondents as they moved along their implementation of Lean. Of note, the internal organizational context appeared to be of little concern to respondents as they began to face new challenges related to their Lean journey. Respondents' preoccupations focused more on *change* antecedents and how such change was managed. This is somewhat in line with the emerging literature, which is focusing more on the functional and evolutive aspects of change as opposed to its more static and largely uninfluenceable dimensions (Rafferty *et al.*, 2013). As argued by scholars, change recipients' *affective, cognitive* and *behavioral* reactions are more often than not influenced by emerging concerns regarding the ongoing change as opposed to pre-established perceptions (Maheshwari and Vohra, 2015; Oreg *et al.*, 2011).

Initially thought of as important, both the history of change and of support of the organization proved to be viewed as unimportant, related to physicians' reaction towards Lean change. Considering organizations have little to no control over these antecedents when they begin their implementation of Lean, this is a positive conclusion, because it eliminates elements that are out of their control. The same thing can be said regarding *experience*. While we couldn't conclude on the nature of the influence *experience* has on physicians' initial reactions to Lean, it does not change the fact that hospitals cannot really influence this antecedent. Should they judge that *experience* has a negative impact on

physician engagement, they could certainly decide to involve younger, less experienced physicians. However, for organizations to truly achieve Lean transformation, all physicians will ultimately have to be involved in the change.

One *pre-change* antecedent that proved to be of importance throughout all three case studies was *Lean experience*. Unclear as to whether respondents considered training or practical experience as more important, they nonetheless highlighted how they believed familiarity with Lean concepts and principles favored physicians' adhesion to the change process. Considering this is the only *pre-change* antecedent on which organizations can truly act on during their implementation of Lean, this finding is certainly interesting. This means that hospitals implementing Lean should invest in training for physicians prior to undertaking Lean initiatives and could even go as far as seeking physicians with prior experience with Lean, for their first attempts at Lean change. This could create early positive gains for the organization and improve on the initial perceptions of Lean from physicians. Physicians have been shown to react positively to their colleagues' credibility regarding various changes (Farand *et al.*, 1999). By using *Lean-experienced* physicians as early champions, organizations could capitalize on this particularity of physicians as professionals.

2.9.2. Physicians' Reactions: A Function of the Change

Our cross-case analysis provided us with evidence regarding the importance of *change* antecedents to favor physicians' engagement towards Lean change. The content of the change, the process of the change itself, and the perceived benefits were all shown, according to our data, to influence physicians' reactions to Lean implementation, albeit in different ways.

2.9.2.1. Threats to Medical Professionalism

First, when the content of the change was perceived to be about the organization of the physicians' work, resistance increased. Such things as work schedules, appointments, and waiting lists modifications were frowned upon by physicians. This certainly echoes past findings (Giaimo, 2009; Rogers *et al.*, 2004). Autonomy tends to be strongly protected by the medical community and whenever potential changes appear to threaten it, recipients

have been shown to demonstrate strong, negative reactions towards that change (Denis *et al.*, 2002).

Even more important to physicians were any beliefs or views that changes brought about by Lean change initiatives would target the *core-technical* aspects of their work. Respondents massively highlighted this, which is again echoed by current and past research on this subject. It can be argued that this type of change is the ultimate perceived threat by physicians. Our data certainly supports this conclusion. Physicians might perceive potential changes to their practices as attacks on their status as medical professionals atop the professional hierarchy of healthcare (Ferlie *et al.*, 2005; Greco and Eisenberg, 1993; Light, 2000). Furthermore, physicians draw a large part of their power as organizational actors from the protected monopoly they enjoy with regards to their medical practices (Harrison *et al.*, 1992; Kellogg, 2009). It is important for us to note that the objective of this research is not to challenge the protected nature of physicians' work. What we wish to highlight is that Lean, when focusing on changes to *core-technical* practices, can certainly be viewed as a threat by physicians to the power they have historically wielded in healthcare organizations.

2.9.2.2. Managing the Change

What our evidence also shows is the significance of change management as a catalyst for engagement or resistance. Of specific important is how healthcare organizations communicate with physicians about Lean and how they involve them throughout the change process. *Leadership* also proved to be of great value as an influencer of positive reactions towards Lean. We cover the latter in the next section. First, we will discuss *communication* and *involvement*.

As our analysis shows, *communication* about the change was deemed crucial by respondents as an antecedent to physicians' reactions to Lean change. This is certainly logical. A positive "communication climate", or the creation of a constructive "information environment" is a good predictor of change readiness on the part of change recipients (Armenakis *et al.*, 2007; Holt *et al.*, 2007). This highlights the importance of open lines of communication between the organization and its physicians, at all stages of

Lean implementation. Poor communication has been shown to create uncertainty about the change (Schweiger and Denisi, 1991) and lower levels of trust regarding management (Bordia *et al.*, 2004).

Hand in hand with *communication* is the notion of *involvement*. Our data showed how important it is for organizations to involve physicians from the early stages of Lean change. They should be integrated into the decision-making processes regarding the selection of Lean initiatives and their objectives. This is again reaffirmed by various academic works on other types of change. In their landmark study, Coch and French Jr (1948) conclude on how the involvement of change recipients in the planning and implementation of change resulted in diminished resistance. Involvement, or participation, creates positive senses of contribution, agency, and control regarding the change at hand (Armenakis and Bedeian, 1999). Other positive outcomes related to higher involvement of change recipients have been highlighted in the literature, such as a greater understanding of the reasons and meaning of the change (Bartunek *et al.*, 1999) and, more importantly, higher support for the change (Amiot *et al.*, 2006).

2.9.2.3. The Salience of Leadership

We believe our most interesting finding has to do with the sudden advent of leadership in our third measurement. As we exposed in our analysis, none of the three investigated hospitals had discussed the influence of *leadership* on physicians' reactions towards Lean implementation. Only Hospital B mentioned it in T2, although at the time only one respondent had discussed it. However, in T3, every hospital and numerous respondents discussed how they believed the *leadership* of the change agent or manager could influence physicians' engagement. Figure 4 illustrates this *salience of leadership*, where early in the implementation journey, *leadership* did not appear as a concern and then suddenly became of great importance to respondents.

The fact that *leadership* can play an important role in the success or failure of organizational change is not an alien concept. As was highlighted by Amiot *et al.* (2006), principal support during change can certainly affect change recipients' reactions to change. Principals are change agents and opinion leaders who can influence

organizational change (Oreg *et al.*, 2011). Scholars have associated principal support with high levels of change readiness (Logan and Ganster, 2007). They have also demonstrated its effect on affective and behavioral resistance to change (Oreg, 2006). Hence it is not inherently surprising to have found it to be related, by our respondents, to physicians' reactions towards Lean change. What is truly curious, however, is how it suddenly surfaced as a major concern later in their Lean implementation journeys. What is also worth discussing is what did respondents truly mean by *leadership*?

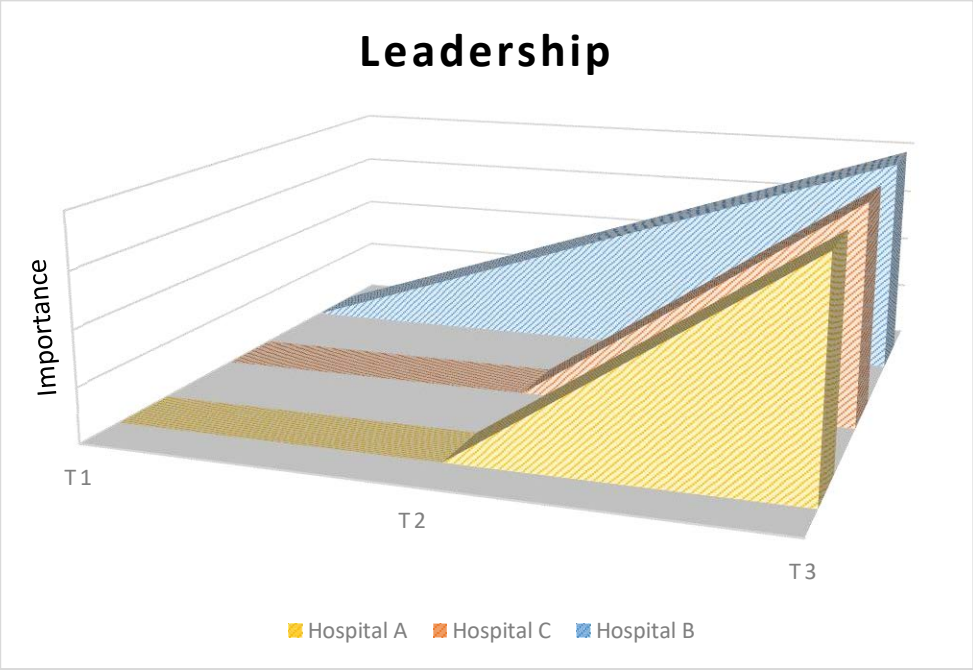


Figure 4. The increasing importance of leadership

Today, many different styles of leadership have emerged in the literature, such as ideological and pragmatic leadership (Strange and Mumford, 2002), ethical leadership (Brown *et al.*, 2005), spiritual leadership (Fry, 2003) and others (Anderson and Sun, 2017). However, *transactional* and *transformational leadership* are historically viewed as the two main constructs of leadership (Rowold and Borgmann, 2013). Transformational leadership entails that leaders motivate change recipients using a value-based, positive vision of the future and by earning their trust (Podsakoff *et al.*, 1996). On the other end of the spectrum, transactional leadership is based on well-defined transactions between the leader and the change recipient (Bass *et al.*, 2003). Our data did not allow us to precisely identify which type of leadership our respondents were

discussing. Some attributed specific characteristics of transformational leadership, such as "shared vision", "inspiring" and "stimulating" while others emphasized characteristics of transactional leadership, such as "clearly defined boundaries" and "give and take" relationship with physicians. While Lean thinking strongly advocates some form of transformational leadership in order to successfully deploy Lean (Liker and Convis, 2011) with leaders possessing characteristics such as humility (Collins, 2006; Ling *et al.*, 2018), self-realization and appreciation of diverse abilities (Taka and Foglia, 1994), it is not clear if such behaviors were actually adopted in the three organizations that we studied.

2.9.2.4. Perceptions Matter

"*At first, it is not so much what you're doing that matters to them (physicians), it's what they think you're doing.*" This quote, from one of our interviewed General Manager, illustrates how the concept of *perceived benefits* influences physicians' reactions to Lean change. This was certainly revealed in our analysis. Our respondents often discussed how, in their minds, physicians reacted to the perceived objectives of Lean initiatives. When physicians felt the main reason for Lean was to reduce costs or improve productivity, they reacted negatively. That is not to say that physicians are opposed to their organization reducing costs and improving their financial situation. We believe it has more to do with the perceived consequences physicians attach to the reduction of costs. Over the last 20 to 30 years, healthcare systems worldwide have implemented changes based on so-called managerial approaches without sustained success (Longenecker and Longenecker, 2014). Many of these changes used efficiency as the main reason for change, instead of focusing on quality and access to care, or work life considerations. Evidence has shown these changes to be historically ineffective and has created distrust on the part of front-line staff, including physicians, towards management. In Canada, physicians are independent workers and are not as subject to perceived harm to their job security as normal employees would be. Physicians are not necessarily worried that cost reductions will impact their financial well-being, but rather that they will reduce their ability to provide care and have the necessary resources to do so. This inherent wariness about cost reduction is compounded by the paradigmatic view of Lean as a manufacturing, productivity centered approach, traditionally held by healthcare workers. Using efficiency as the main

justification for Lean change can create barriers with physicians that can become very difficult to remove.

To that end, it is not surprising that our analysis suggests physicians react positively to Lean when it is perceived that it will bring about positive benefits to the quality of care provided by the organization (and physicians). Toussaint *et al.* (2017) emphasize the importance of focusing on quality as opposed to costs if one wishes to engage physicians in Lean transformations. Improving quality will ultimately lead to better financial outcomes as a result of proper Lean thinking, hence, organizations should not strive to reduce costs as their primary objective.

2.9.2.5. The Dwindling Importance of Pre-Change Antecedents

Our analysis revealed how *pre-change* antecedents became less of a concern to respondents over time. In fact, only previous *Lean experience* was globally agreed upon to be a positive antecedent of physicians' reactions to Lean change. While the internal organizational context appeared truly important early on in T1, it became a non-issue later on, whereas, concerns about the *change* antecedents either remained constant or increased throughout our investigation. The nature of the change, or *content*, was a significant contributor to physicians' reactions to Lean. So was the way the change was managed, or the *process of the change*. *Communication, involvement,* and *leadership* proved to influence physicians' reactions. Then, the *perceived benefits*, notably related to the organizational discourse regarding Lean (Pettersen, 2009), adamantly influenced these reactions. This means that organizations should not focus so much of their attention on *pre-change* matters related to the change, upon which they have very little control anyway. Efforts should be deployed to improve change management practices and to develop a coherent organizational discourse focusing on quality.

2.10. Conclusion

While academics have studied physicians as actors of organizational change for many years (Dent, 2003), very little has focused on Lean implementation. The increasing popularity of this managerial approach in healthcare has made it important to push forward the current knowledge on how it is implemented and specifically how it pertains

to physicians. Physicians have been considered barriers to Lean implementation in hospitals (de Souza and Pidd, 2011), hence better understanding of why physicians tend to resist Lean change is crucial.

2.10.1. Implications for Research and Practice

Our research has provided evidence regarding the antecedents of change that can potentially generate positive or negative reactions from physicians. It has shown how perceived threats to medical professionalism, in the form of changes to the organization of work and core-technical practices, can create an undesirable context for Lean. It has also shown how the process of change is vital in hoping to secure positive reactions from physicians during Lean initiatives. Furthermore, it has highlighted the importance the perceived benefits of change have in influencing recipients', in this case physicians, reactions to Lean.

We believe this paper also answers the call of practitioners to better understand why physicians react the way they do towards Lean and how to better engage them in Lean transformations (Toussaint *et al.*, 2017). Our findings suggest that healthcare organizations should invest more time and energy in developing their own change management competencies, in order to better communicate with physicians throughout the change process and to involve them from the early stages. They also highlight the importance of *leadership* and that organizations should be careful when choosing change agents and champions. Our analysis has also brought to light the importance of discourse related to Lean. Hospitals should not implement it as a way to reduce costs and increase productivity. This will most likely result in resistance from the medical staff and diminish the chances of success. Hospitals should also take the time to provide an understanding of what Lean is to physicians, notably through training. In the end, physicians are possibly the most critical group of actors in favoring the success, or failure, of Lean implementation. They should be viewed as such.

2.10.2. Limitations

As with any research, ours has limitations. First, our analysis uses data collected in a larger project aimed at studying Lean implementation in general. We addressed the concerns

often highlighted in the literature with regards to the secondary analysis of qualitative data (Hammersley, 2010). The potential lack of fit issue was argued to be small for our study, as was the "relative lack of contextual knowledge" considering the initial data set was collected by the same researchers. The difficulty to generalize from qualitative data is also an issue to be aware of. However, the richness provided by such data still allows us to provide a meaningful contribution. Something else to note is that we have looked at physicians as a cluster of individual actors. Hence, our findings might not apply to each individual.

2.10.3. Avenues for Future Research

Notwithstanding these limitations, our study paves the way for future research on how healthcare organizations implement Lean and how physicians are involved in that process. Future research could, notably, study how various groups of physicians such as specialists and general practitioners are influenced in their reactions towards Lean. Such research could even delve into the differences between specializations. Our study also focused on Canadian physicians who, for the most part, are independent workers. Not all jurisdictions face this situation. At large, the following question could be asked: do physicians in other legal and organizational contexts interact differently with Lean thinking?

Also of interest would the link between our findings and the concept of maturity. We discussed how respondents' preoccupations evolved as they were realizing more Lean initiatives. However, is this shift related to an increase in Lean maturity or merely a factor of experimentation? This is a question that would certainly benefit from an investigation.

The data collected for this study mostly reflected the managerial perspective of physicians' role during Lean implementation. Five of our six respondents were either executive or mid-level managers. To ensure that the perspective on physicians and Lean developed in this paper can be generalized, the medical perspective should also be investigated. More data could be collected from physicians directly and compared to the current data. Our study offers an evolutionary view of the preoccupations related to physicians' reactions towards Lean. We have shown how such preoccupations appeared to shift from *pre-change* antecedents into *change* antecedents. What remains interesting,

however, is if this finding translates to other stakeholders such as nurses, managers, and technical professionals.

To further favor generalizability, our future research will attempt to benefit from quantitative inquiry. Data is already being collected with physicians from over 60 healthcare organizations. This data will be used to study how various antecedents identified through this qualitative work influence the level of commitment and behavioral support physicians can show towards Lean change. By collecting and analyzing data from physicians directly, we hope to contribute a complementary perspective to this paper and further develop knowledge into how physicians react to Lean and organizational change in general.

References

Amiot, Catherine E, Deborah J Terry, Nerina L Jimmieson and Victor J Callan (2006). 'A longitudinal investigation of coping processes during a merger: Implications for job satisfaction and organizational identification', *Journal of Management*, vol. 32, no 4, pp. 552-574.

Anderson, Marc H. and Peter Y. T. Sun (2017). 'Reviewing Leadership Styles: Overlaps and the Need for a New 'Full-Range' Theory', *International Journal of Management Reviews*, vol. 19, no 1, pp. 76-96.

Andersson, Roy, Henrik Eriksson and Håkan Torstensson (2006). 'Similarities and differences between TQM, Six Sigma and Lean', *The TQM Magazine*, vol. 18, no 3, pp. 282-296.

Armenakis, Achilles A and Arthur G Bedeian (1999). 'Organizational change: A review of theory and research in the 1990s', *Journal of Management*, vol. 25, no 3, pp. 293-315.

Armenakis, Achilles A, Jeremy B Bernerth, Jennifer P Pitts and H Jack Walker (2007). 'Organizational change recipients' beliefs scale: Development of an assessment instrument', *The Journal of Applied Behavioral Science*, vol. 43, no 4, pp. 481-505.

Barnas, Kim (2011). 'ThedaCare's business performance system: sustaining continuous daily improvement through hospital management in a lean environment', *Joint Commission Journal on Quality and Patient Safety*, vol. 37, no 9, pp. 387-399.

Bartunek, Jean M, Danna N Greenberg and Barbara Davidson (1999). 'Consistent and inconsistent impacts of a teacher-led empowerment initiative in a federation of schools', *The Journal of Applied Behavioral Science*, vol. 35, no 4, pp. 457-478.

Bass, Bernard M, Bruce J Avolio, Dong I Jung and Yair Berson (2003). 'Predicting unit performance by assessing transformational and transactional leadership', *Journal of Applied Psychology*, vol. 88, no 2, pp. 207.

Bate, Paul, Peter Mendel and Glenn Robert (2008). *Organizing for quality: the improvement journeys of leading hospitals in Europe and the United States*, Radcliffe Publishing.

Battilana, Julie and Tiziana Casciaro (2012). 'Change agents, networks, and institutions: A contingency theory of organizational change', *Academy of Management Journal*, vol. 55, no 2, pp. 381-398.

Bordia, Prashant, Elizabeth Hunt, Neil Paulsen, Dennis Tourish and Nicholas DiFonzo (2004). 'Uncertainty during organizational change: Is it all about control?', *European Journal of Work and Organizational Psychology*, vol. 13, no 3, pp. 345-365.

Brass, Alister (1971). 'A Quality of Mercy: A Report on the Critical Condition of Hospital and Medical Care in America', *Journal of the American Medical Association*, vol. 217, no 1, pp. 84-84.

Brown, Michael E, Linda K Treviño and David A Harrison (2005). 'Ethical leadership: A social learning perspective for construct development and testing', *Organizational Behavior and Human Decision Processes*, vol. 97, no 2, pp. 117-134.

Burgess, N. and Z. Radnor (2013). 'Evaluating Lean in healthcare', *International Journal Health Care Quality Assurance*, vol. 26, no 3, pp. 220-235.

Cabana, M. D., C. S. Rand and N. R. Powe (1999). 'Why don't physicians follow clinical practice guidelines? A framework for improvement', *Journal of the American Medical Association*, vol. 282, no 15, pp. 1458-1465.

Callister, Ronda Roberts and James A Wall Jr (2001). 'Conflict across organizational boundaries: Managed care organizations versus health care providers', *Journal of Applied Psychology*, vol. 86, no 4, pp. 754.

Cammisa, Chris, Gregory Partridge, Cynthia Ardans, Katrina Buehrer, Ben Chapman and Howard Beckman (2011). 'Engaging Physicians in Change: Results of a Safety Net Quality Improvement Program to Reduce Overuse', *American Journal of Medical Quality*, vol. 26, no 1, pp. 26-33.

Champy, Jim and Harry Greenspun (2010). *Reengineering health care: A manifesto for radically rethinking health care delivery*, Pearson Education.

Coch, Lester and John RP French Jr (1948). 'Overcoming resistance to change', *Human Relations*, vol. 1, no 4, pp. 512-532.

Collins, Jim (2006). 'Level 5 leadership: The triumph of humility and fierce resolve', *Harvard Business Review*, vol. 79, pp. 66-76.

Costa, Luana Bonome Message and Moacir Godinho Filho (2016). 'Lean healthcare: review, classification and analysis of literature', *Production Planning & Control*, vol. 27, no 10, pp. 823-836.

de Souza, Luciano B and Michael Pidd (2011). 'Exploring the barriers to lean health care implementation', *Public Money & Management*, vol. 31, no 1, pp. 59-66.

Denis, Jean-Louis, Yann Hébert, Ann Langley, Daniel Lozeau and Louise-Hélène Trottier (2002). 'Explaining diffusion patterns for complex health care innovations', *Healthcare Management Review*, vol. 27, no 3, pp. 60-73.

Dent, Mike (2003). 'Managing doctors and saving a hospital: Irony, rhetoric and actor networks', *Organization*, vol. 10, no 1, pp. 107-127.

Desbiens, Geneviève (2016). *Le microcontexte politique et l'amélioration des processus: la routine chirurgicale d'un bloc opératoire*, Dissertation/Thesis, H. E. C. Montréal.

Dukerich, Janet M, Brian R Golden and Stephen M Shortell (2002). 'Beauty is in the eye of the beholder: The impact of organizational identification, identity, and image on the cooperative behaviors of physicians', *Administrative Science Quarterly*, vol. 47, no 3, pp. 507-533.

Eisenhardt, Kathleen M (1989). 'Building theories from case study research', *Academy of Management Review*, vol. 14, no 4, pp. 532-550.

Farand, Lambert, François Champagne, Arthur Amyot, Jean-Louis Denis and André-Pierre Contandriopoulos (1999). 'Évaluation de la réforme des services psychiatriques destinés aux adultes au pavillon Albert-Prévost 1', *Santé mentale au Québec*, vol. 24, no 2, pp. 90-125.

Ferlie, Ewan, Louise Fitzgerald, Martin Wood and Chris Hawkins (2005). 'The nonspread of innovations: the mediating role of professionals', *Academy of Management Journal*, vol. 48, no 1, pp. 117-134.

Fine, Benjamin A, Brian Golden, Rosemary Hannam and Dante Morra (2009). 'Leading lean: a Canadian healthcare leader's guide', *Healthcare Quarterly*, vol. 12, no 3, pp. 32-41.

Fournier, Pierre-Luc, Nadia Benormar and Marie-Hélène Jobin (2016). 'Mesurer l'impact du Lean sur la performance : leçons apprises auprès de trois établissements de santé du Québec', communication présentée au *GISEH 2016*, Casablanca, Morocco.

Fournier, Pierre-Luc and Marie-Hélène Jobin (2018a). 'Medical commitment to Lean: an inductive model development', *Leadership in Health Services*, vol. 31, no 3, pp. 326-342.

Fournier, Pierre-Luc and Marie-Hélène Jobin (2018b). 'Understanding before implementing: the context of Lean in public healthcare organizations', *Public Money & Management*, vol. 38, no 1, pp. 37-44.

Freidson, Eliot (1984). 'The changing nature of professional control', *Annual Review of Sociology*, vol. 10, no 1, pp. 1-20.

Fry, Louis W (2003). 'Toward a theory of spiritual leadership', *The Leadership Quarterly*, vol. 14, no 6, pp. 693-727.

Fullerton, Rosemary R., Cheryl S. McWatters and Chris Fawson (2003). 'An examination of the relationships between JIT and financial performance', *Journal of Operations Management*, vol. 21, no 4, pp. 383-404.

Giaimo, Susan (2009). *Markets and medicine: the politics of health care reform in Britain, Germany, and the United States*, University of Michigan Press.

Goldstein, Susan Meyer and Peter T Ward (2004). 'Performance effects of physicians' involvement in hospital strategic decisions', *Journal of Service Research*, vol. 6, no 4, pp. 361-372.

Graban, Mark (2011). *Lean hospitals: improving quality, patient safety, and employee satisfaction*, CRC Press.

Greco, Peter J. M. D. and John M. M. D. Eisenberg (1993). 'Changing physicians' practices', *The New England Journal of Medicine*, vol. 329, no 17, pp. 1271-1274.

Guest, Greg, Kathleen M MacQueen and Emily E Namey (2012). *Applied thematic analysis*, Sage.
Hammersley, Martyn (2010). 'Can we re-use qualitative data via secondary analysis? Notes on some terminological and substantive issues', *Sociological Research Online*, vol. 15, no 1, pp. 1-7.
Harris, Jeffrey E. (1977). 'The Internal Organization of Hospitals: Some Economic Implications', *The Bell Journal of Economics*, vol. 8, no 2, pp. 467-482.
Harrison, Stephen, David J Hunter, Gordon Marnoch and Christopher Pollitt (1992). *Just managing: power and culture in the National Health Service*, Springer.
Heaton, Janet (2008). 'Secondary analysis of qualitative data: An overview', *Historical Social Research/Historische Sozialforschung*, pp. 33-45.
Holt, Daniel T, Achilles A Armenakis, Hubert S Feild and Stanley G Harris (2007). 'Readiness for organizational change: The systematic development of a scale', *The Journal of Applied Behavioral Science*, vol. 43, no 2, pp. 232-255.
Huq, Ziaul and Thomas N Martin (2000). 'Workforce cultural factors in TQM/CQI implementation in hospitals', *Health Care Management Review*, vol. 25, no 3, pp. 80-93.
Jobin, M.-H. and Denis Lagacé (2014). 'La démarche Lean en santé et services sociaux au Québec: comment mesurer la maturité des établissements', *Gestion*, vol. 39, no 3, pp. 116-127.
Jobin, Marie-Hélène and Denis Lagacé (2015). *Evaluating Lean Maturity in Three Healthcare Orgnization in Québec*, Montréal, Canada, Ministère de la Santé et des Services Sociaux du Québec.
Jones, D, A Mitchell, D Ben, D Fillingham, C Makin, K Silvester*, et al.* (2006). 'Lean Thinking for the NHS: a Report Commissioned by the NHS Confederation', *Lean Enterprise Academy UK*.
Kaplan, Robert S. and Michael E. Porter (2011). 'How to solve the cost crisis in health care', *Harvard Business Review*, vol. 89, no 9, pp. 46.
Kellogg, Katherine C (2009). 'Operating room: Relational spaces and microinstitutional change in surgery', *American Journal of Sociology*, vol. 115, no 3, pp. 657-711.
Kenney, Charles (2012). *Transforming health care: Virginia Mason Medical Center's pursuit of the perfect patient experience*, CRC Press.
Krafcik, John F (1988). 'Triumph of the lean production system', *MIT Sloan Management Review*, vol. 30, no 1, pp. 41.
Langley, Ann (1999). 'Strategies for theorizing from process data', *Academy of Management Review*, vol. 24, no 4, pp. 691-710.
Lapointe, Liette and Suzanne Rivard (2005). 'A multilevel model of resistance to information technology implementation', *MIS Quarterly*, pp. 461-491.
Lapointe, Liette and Suzanne Rivard (2007). 'A triple take on information system implementation', *Organization Science*, vol. 18, no 1, pp. 89-107.
Light, Donald (2000). 'The medical profession and organizational change', *The Handbook of Medical Sociology*.
Liker and Gary L Convis (2011). *The Toyota Way To Lean Leadership: Achieving And Sustaining Excellence Through Leadership Development Author: Jeffrey Lik*.
Liker, Jeffrey (2004). *The Toyota Way*, Esensi.

Lin, Zhiang and Hui Chun (1999). 'Should lean replace mass organization systems? A comparative examination from a management coordination perspective', *Journal of International Business Studies*, vol. 30, no 1, pp. 45-80.
Ling, Yuan, Zhang Leilei and Tu Yanhong (2018). 'When a leader is seen as too humble', *Leadership & Organization Development Journal*, vol. 39, no 4, pp. 468-481.
Logan, Mary S and Daniel C Ganster (2007). 'The effects of empowerment on attitudes and performance: The role of social support and empowerment beliefs', *Journal of Management Studies*, vol. 44, no 8, pp. 1523-1550.
Longenecker, Paul D and Clinton O Longenecker (2014). 'Why hospital improvement efforts fail: a view from the front line', *Journal of Healthcare Management*, vol. 59, no 2, pp. 147-168.
Lorden, Andrea L., Yichen Zhang, Szu-Hsuan Lin and Murray J. Côté (2014). 'Measure is of Success: The Role of Human Factors in Lean Implementation in Healthcare', *The Quality Management Journal*, vol. 21, no 3, pp. 26-37.
Lozeau, Daniel (2002). 'Les chemins tortueux de la gestion de la qualité dans les hôpitaux publics au Québec', *Gestion*, vol. 27, no 3, pp. 113-122.
Maheshwari, Shweta and Veena Vohra (2015). 'Identifying critical HR practices impacting employee perception and commitment during organizational change', *Journal of Organizational Change Management*, vol. 28, no 5, pp. 872-894.
Mathie, Antonina (1997). 'Doctors and change', *Journal of Management in Medicine*, vol. 11, no 6, pp. 342-356.
Mazzocato, Pamela, Carl Savage, Mats Brommels, Håkan Aronsson and Johan Thor (2010). 'Lean thinking in healthcare: a realist review of the literature', *Quality and Safety in Health Care*, vol. 19, no 5, pp. 376-382.
McNulty, Terry and Ewan Ferlie (2002). *Reengineering health care: the complexities of organizational transformation*, OUP Oxford.
McNulty, Terry and Ewan Ferlie (2004). 'Process transformation: Limitations to radical organizational change within public service organizations', *Organization Studies*, vol. 25, no 8, pp. 1389-1412.
Miles, Matthew B, A Michael Huberman and Johnny Saldana (2014). *Qualitative data analysis*, Sage.
Moraros, John, Mark Lemstra and Chijioke Nwankwo (2016). 'Lean interventions in healthcare: do they actually work? A systematic literature review', *International Journal for Quality in Health Care*, vol. 28, no 2, pp. 150-165.
Netland, Torbjørn H., Jason D. Schloetzer and Kasra Ferdows (2015). 'Implementing corporate lean programs: The effect of management control practices', *Journal of Operations Management*, vol. 36, pp. 90-102.
Oreg, Shaul (2006). 'Personality, context, and resistance to organizational change', *European Journal of Work and Organizational Psychology*, vol. 15, no 1, pp. 73-101.
Oreg, Shaul, Maria Vakola and Achilles Armenakis (2011). 'Change recipients' reactions to organizational change: A 60-year review of quantitative studies', *The Journal of Applied Behavioral Science*, vol. 47, no 4, pp. 461-524.
Patton, Michael Quinn (2002). *Qualitative evaluation and research methods*, 3rd Edition[e] éd., SAGE Publications, inc.

Patwardhan, Anjali and Dhruv Patwardhan (2008). 'Business process re-engineering–saviour or just another fad? One UK health care perspective', *International Journal of Health Care Quality Assurance*, vol. 21, no 3, pp. 289-296.
Pettersen, Jostein (2009). 'Translating lean production: from managerial discourse to organizational practice'.
Podsakoff, Philip M, Scott B MacKenzie and William H Bommer (1996). 'Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citize', *Journal of Management*, vol. 22, no 2, pp. 259-298.
Pynoo, Bram, Pieter Devolder, Wouter Duyck, Johan van Braak, Bart Sijnave and Philippe Duyck (2012). 'Do hospital physicians' attitudes change during PACS implementation? A cross-sectional acceptance study', *International Journal of Medical Informatics*, vol. 81, no 2, pp. 88-97.
Radnor, ZJ, R Davies and N Burgess (2009). 'How much lean are English hospitals implementing', *National Health Executive*, no September/October, pp. 60-62.
Rafferty, Alannah E, Nerina L Jimmieson and Achilles A Armenakis (2013). 'Change Readiness', *Journal of Management*, vol. 39, no 1, pp. 110-135.
Rivard, Suzanne, Liette Lapointe and Antonio Kappos (2011). 'An organizational culture-based theory of clinical information systems implementation in hospitals', *Journal of the Association for Information Systems*, vol. 12, no 2, pp. 123.
Rogers, Hugh, Kate Silvester and Jill Copeland (2004). 'NHS Modernisation Agency's way to improve health care', *BMJ: British Medical Journal*, vol. 328, no 7437, pp. 463.
Rother, Mike (2010). *Toyota Kata: Managing people for improvement, adaptiveness, and superior results*, McGraw Hill New York, NY.
Rowold, Jens and Lars Borgmann (2013). 'Are leadership constructs really independent?', *Leadership & Organization Development Journal*, vol. 34, no 1, pp. 20-43.
Samuel, Donna, Pauline Found and Sharon J. Williams (2015). 'How did the publication of the book The Machine That Changed The World change management thinking? Exploring 25 years of lean literature', *International Journal of Operations & Production Management*, vol. 35, no 10, pp. 1386-1407.
Schweiger, David M and Angelo S Denisi (1991). 'Communication with employees following a merger: A longitudinal field experiment', *Academy of Management Journal*, vol. 34, no 1, pp. 110-135.
Shortell, Stephen M, Daniel Z Levin, James LO Brien and Edward FX Hughes (1995). 'Assessing the evidence on CQI: Is the glass half empty or half full?', *Journal of Healthcare Management*, vol. 40, no 1, pp. 4.
Soriano-Meier, Horacio and Paul L Forrester (2002). 'A model for evaluating the degree of leanness of manufacturing firms', *Integrated Manufacturing Systems*, vol. 13, no 2, pp. 104-109.
Spear, Steven and H Kent Bowen (1999). 'Decoding the DNA of the Toyota production system', *Harvard Business Review*, vol. 77, pp. 96-108.

Strange, Jill M and Michael D Mumford (2002). 'The origins of vision: Charismatic versus ideological leadership', *The Leadership Quarterly*, vol. 13, no 4, pp. 343-377.
Taka, Iwao and Wanda D Foglia (1994). 'Ethical aspects of "Japanese leadership style"', *Journal of Business Ethics*, vol. 13, no 2, pp. 135-148.
Toussaint, John, John E Billi and Mark Graban (2017). *Lean for Doctors*, Catalysis.
Waring, Justin J and Simon Bishop (2010). 'Lean healthcare: rhetoric, ritual and resistance', *Social Science & Medicine*, vol. 71, no 7, pp. 1332-1340.
Weiner, Bryan J, Stephen M Shortell and Jeffrey Alexander (1997). 'Promoting clinical involvement in hospital quality improvement efforts: the effects of top management, board, and physician leadership', *Health services research*, vol. 32, no 4, pp. 491.
Womack, James P and Daniel T Jones (1996). *Lean thinking: banish waste and create wealth in your corporation*, Simon and Schuster.
Womack, James P and Daniel T Jones (2015). *Lean solutions: how companies and customers can create value and wealth together*, Simon and Schuster.
Zimmerer, Linda Williams, Thomas William Zimmerer and Mahmoud M Yasin (1999). 'Overcoming barriers to effectiveness in a health care operational environment: Building on the lessons of American industry', *Health Marketing Quarterly*, vol. 17, no 1, pp. 59-81.

2.11 Appendix 1

Hospital A – chain of evidence					
Antecedents			T1	T2	T3
Pre-change	Individual characteristics	Experience	*"Young doctors believe in it. They want to be involved. It is tougher with our older doctors. They're just not there yet. They don't like their work being questioned."* Medical Director	*"The older ones (physicians) resist more. They've been doing things the same way for so long that it's hard to get them to change."* General Manager	*"Our younger doctors really want things to change. That's what I've noticed over the last three years. They also want us to work hard on changing it."* Lean Program Director
		Lean experience	*"It's not only about it taking time away from their schedule. When they've had previous experience with Lean or even had training, they get more involved."* Human Resources Director	*"Oh yes, definitely that helped. We have a few doctors that have done it before so they were good change agents and helped get their colleagues on board."* Lean Program Director	*"Well, we all give them white belts. Some of them have more training. We've found that this has really been positive."* Lean Program director

	Internal organizational context	History of change	*"In the past, we weren't always successful with the things we tried to change. I think that might have stuck with them."* General Manager	*"I think that our success in some of our first projects helped to get some adhesion to this one. I think they (physicians) saw the benefits it could bring."* Human resources director	Was not discussed
		History of support	*"Well, you know, I don't think we've done a good job of supporting them over the years. I think we always saw them as opponents, and them as well. Maybe that's why they showed such resistance.* General Manager	*"In the past, and that's what I was told also, they (physicians) maybe felt that we'd let them out to dry and that they were kind of stuck."* Human resources director	Was not discussed
Change	Content of the change	Work organization	*"Yeah. As soon as they thought their work schedule would change, that was a no-no."* Lean Program Director	*"Let's take the ER as an example. We changed the process and that meant doctors no longer had control over their schedule. That did not go over well and we weren't able to implement it."* Lean Program Director	*"Well, I mean, sure, they don't like it if it means they'll have to show up earlier for work. But if it's brought about accordingly, it's not a barrier."* Medical Director

	Complexity of change	*"They will know right away how hard the change is going to be. For example, if we have two or more departments involved, they'll know it's going to be tough to get it done and they're not going to be as motivated."* Middle Manager	*''When we have large and complex projects, where we have to look at a process involving two or more departments, it's tough to get doctors on board. It might have to do with our history of not being successful when addressing cross-departmental problems.''* Lean Program director	Was not discussed
	Core-technical change	*''They (doctors) do not like it when their practices are questioned. Even if they agree the change is a good idea, they are reluctant to convince their colleagues of it.''* Human Resources Director	*"To me, I feel like this is the biggest red flag for them. If you go and play on that field (medical practices), there is no way you can make it work. They'll stop you in your tracks."* Middle Manager	*"Even after three years, this (core-technical changes) really gets them to resist. And I mean, I get it, I wouldn't like it either. But it makes improvement that much more difficult."* General Manager

Process of change	Communication	*"It is so important. What I mean by that is, if you don't explain the reasons why and how we're going to go about it, you've lost them (physicians) from the start."* Lean Program Director	*"Communication was a major issue. When doctors had incorrect information, this would snowball to their colleague and there would be massive resistance. Now, we make sure to have a good communication plan in place before any Lean project starts."* General Manager	*"I think that the projects that didn't go well were, in part, because we didn't communicate to them properly. That created resistance, yes, definitely."* Middle Manager
	Compensation	*''Some of my colleagues… Well... Not only were they not offered compensation for their participation, they even had to take vacation time to be in the Kaizen event. Let's just say they were not very happy with the whole thing.''* Physicians	Was not discussed	Was not discussed
	Involvement	*"We really dropped the ball there. They should've been there when we chose to start the project."* Lean Program director	*"It really helps to have them involved from the start, not just when we're collecting data or doing the Kaizen."* Middle Manager	*"I think we have learned from that. Now, we never start a project without physicians buying-in. We sit with them, discuss with them and involve them from start to finish."* Lean Program director

		Leadership	Was not discussed	Was not discussed	*"So I've been involved in two (projects) and the biggest difference was the project manager (change agent). One was really good, knew where he was headed and was engaging. And that project went well. In the other, it was the complete opposite."* Physician *"The change manager (change agent) is the most important player. They (physicians) really respond to that. It's crucial, in my opinion."* Lean Program Director *"What I've found is the manager in charge of the project must be engaging. He must listen to what they (physicians) are telling him. He must pay attention to their worries, constantly."* Middle Manager

Perceived benefit(s) of the change	Cost reduction	*"Doctors have even come up to me and said: in the end, isn't this Lean thing simply a way for you guys to save money?"* Lean Program director	*"It's tough to get rid of that cost reduction label and when they (physicians) think we do this to increase productivity, well, you can just put two and two together and you have it. They won't get involved much."* General Manager	*"If that's your main motivation (cost reduction), it won't work. They're (physicians) not going to go along with it because what do they have to gain from that?"* General manager
	Quality improvement	*"Quality is important to us. In the end, if you can convince me this is about quality, I think I'll be inclined to participate."* Physician	*"We've found that we need to talk about quality, not productivity. That speaks to them (physicians). It's more positive."* Human resources director	*"What they've (physicians) been telling us, without really saying it, is if this is about improving quality, then they're interested."* Lean Program director
	Patient satisfaction	*"I think if they believe we're doing this for patients, that speaks to them and gets them to participate."* Lean Program director	Was not discussed	Was not discussed

		Work life improvement	*"I think we achieved good results in the project because physicians got involved. We got them involved by finding ways in which the change would improve their daily work, like giving them more time so they're not in such a hurry all the time."* Middle manager	Was not discussed	Was not discussed

Hospital B – chain of evidence					
Antecedents			T1	T2	T3
Pre-change	Individual characteristics	Experience	*"I mean, yes, our older surgeons we tough to engage. It was somewhat easier with the younger ones."* Lean Program Director	*"You know what, I've found that it's easier with the older ones (physicians). Because they've seen these problems for so long, they kind of understand that we need to solve them. Whereas the younger ones, they are sometimes more confrontational."* General manager	*"Well, personally, I thought our younger doctors participated more from the get-go."* Medical Director
		Lean experience	*"I think it truly helped that we gave them (physicians) white belt training before the project. They came in with a better understanding."* Lean Program Director	*"Yes, we had one of our surgeons that had done a Lean project before. He helped us to get his colleagues on board."* General Manager	*"We set up training sessions just for the (physicians) with our external consultants. I think it cleared up some of the misconceptions they had at first. It was very positive."* Human resources director

	Internal organizational context	History of change	*"We did a couple of large-scale construction projects in the years before we started doing Lean. Those projects impacted them (physicians) quite a bit. But in the end the results we good, so when we came to them this time around, I think that our previous results with those projects helped convince them that this could be done."* General Manager	Was not discussed	Was not discussed
		History of support	*"Yes, well I think they (physicians) felt supported through those large projects (construction). I think they trusted us… well, at least I think they trusted us more… with this (Lean project)."* Lean Program director	Was not discussed	Was not discussed

Change	Content of the change	Work organization	*"I'm not sure why that was. I mean, I can see why, but it's still puzzling to me. They did not want to change how the appointments were booked. That caused significant resistance."* Middle Manager	*"Yes, maybe. I don't know if that was really THE issue (changes in the schedule of physicians), but it was certainly AN issue. It made it tough to go forward."* Lean program Director	*"Oh yes, when we asked them (physicians) to come in earlier in the morning, they resisted massively."* Lean Program Director
		Complexity of change	Was not discussed	Was not discussed	*"When they (physicians) realized they would have to work with the radiologists to get that solved, it became more difficult, more complex. From that point, they didn't seem as interested."* Middle manager

	Core-technical change	*"Honestly, we tried not to touch that (core-technical). We focused more on administrative things. We knew our chances of success were better that way".* Middle Manager	*"Well, as physicians myself, I wouldn't want this either (questioning core-technical activities). But as a manager, I understand that sometimes, for the Lean to be successful, we need to go there. But my fellow physicians most likely don't have that perspective. And I understand why, but it creates a challenge, definitely."* Medical Director	*"In all honesty, it's almost become a running gag. If they think we're overstepping into this (core-technical), you can forget it. You'll have massive resistance."* Lean Program Director
Process of change	Communication	*"It's crucial (communication). It's basic. There's no way you'll engage them (physicians) without that."* Middle Manager	*"It's not really different with Lean. You need to tell them what it is you want to do, why it is important, where you are headed, and what it will mean to them (physicians)."* General Manager	*"Yes. For every project, we had a communication plan in place, and they (physicians) we a significant part of it when they had to be involved in it (Lean project)."* Lean Program Director

Compensation	*"Well, I think if they're (physicians) gonna do this on their own time, they need to be paid for it. Our other participants (nurses, technicians, etc.) are paid to be there. It's part of their work hours. You can't expect them to do it voluntarily."* Medical Director	*"Remember they need to take time out of their schedule. So in our budget for the project, we have a dedicated amount for them (physicians)."* Lean Program Director	Was not discussed
Involvement	*"Crucial (involvement). They were the first group we met with. We involved them from the start and that made it much easier moving forward."* Lean Program Director	*"Yeah, for that one (Lean project) it was tough. We only talked to them when we were collecting data and they were kind of skeptical about it. They challenged the data after."* Middle Manager	*"It's just like anything else. If we're asking them (physicians) to make changes to anything and if we didn't consult them prior to it, it's gonna be tough."* General manager

		Leadership	Was not discussed	*"I think the change leader made a huge difference. I honestly don't think it would've worked without her. She really managed to get the doctors on board. But I can tell you it wasn't easy."* Lean Program Director	*"I really think that's the main thing we've learned. The important role the project leader has. If he can create that productive environment and bring everybody together… I think that's why the specialists (physicians) got on board."* General Manager
	Perceived benefit(s) of the change	Cost reduction	*"I know, we all know that we need to reduce costs. But if we present it this way, it's a recipe for disaster. And especially with physicians."* Human Resources Director	*"You know, nurses, professionals, they all react to this (cost reduction) the same way. It's no different for doctors. It doesn't get them involved. I mean, everybody knows about our tough financial situation, but still, it's not a good selling point."* General Manager	*"If this is your reason for doing Lean (cost reduction)… We're four years into this now. And it's not just here. My colleagues in other organizations think the same. They (physicians) have quality, patients at heart. Don't talk to them about costs."* Lean Program Director

		Quality improvement	*"That's (quality) what matters to us (physicians). I can see the benefit it will have for my patients. I hope we can sustain it (the change) because I've seen the waiting lists reduce by a lot."* Physician	*"I think that should always be our goal (improving quality). We're all doing this for the patients. I think that's the way to get them involved (physicians)."* Medical Director	*"That project created good results. I think they (physicians) saw the benefits it could have for the quality of their practice."* Lean Program Director
		Patient satisfaction	Was not discussed	Was not discussed	Was not discussed
		Work life improvement	Was not discussed	Was not discussed	Was not discussed

Hospital C – Chain of Evidence					
Antecedents			T1	T2	T3
Pre-change	Individual characteristics	Experience	*"So for example, our older surgeons were tougher to deal with. They weren't very welcoming towards it (Lean project)."* Lean Program Director	Was not discussed	Was not discussed
		Lean experience	*"If they don't have any knowledge about Lean, they usually say something like: this isn't a factory, this whole Toyota thing doesn't work here, we're not making cars. That's why it's important to give them so training first. Explain to them what it is (Lean) and that we're not trying to make our operating room into a factory."* Lean Program Director	*"I think my colleagues were put at ease after that quick information session. I think it made them participate more in the end."* Physician	*"It was really easier with those (physicians) who had done it before (Lean)."* General Manager
	Internal organizational context	History of change	*"As you know, there's been so much change going on in the last, you know, 5 to 10 years. And not all of it has been very conclusive. They've (physicians) seen that, and it's kind of made us start in the negative."* General Manager	Was not discussed	Was not discussed
		History of support	*"Some of our doctors have said to us, whether directly or not, that they've never really felt supported by the organization. I'm sure this explains some of their resistance."* Human resources Director	*"When you've supported them (physicians) in various situations, they're more receptive…."* General Manager	Was not discussed

Change	Content of the change	Work organization	*"If we try to change things regarding their work, like standardizing how appointments are scheduled, they'll often resist that."* Lean Program Director	Was not discussed	*"We are still struggling with that. They (physician) enjoy their autonomy and don't like when it's being questioned. It makes them hesitant moving forward."* General Manager
		Complexity of change	Was not discussed	Was not discussed	Was not discussed
		Core-technical change	*"You can't go there (core-technical). They'll truly resist if you do."* Middle Manager	*"They resist, for example when the discussion about giving some of their tasks to the nurses came about. It creates conflicts."* Lean Program Director	*"Medical practices are a sort of protected field. When you venture there, you can expect some heavy reactions."* General Manager
	Process of change	Communication	*« Yes, that's really interesting. It's the same thing with communication. It's so important. It really creates winning conditions (with regards to physicians)."* Human Resources Director	*"And obviously we try to make communication a priority. I think that's really the starting point when it comes to our doctors. If you don't do that, you're not putting all the chances on your side."* General Manager	*"When we started, communication was very important, but our concerns about it evolved I think because we realized even more how important it is (to facilitate exchanges about Lean with physicians)."* Lean Program Director

Compensation	*"When they sit down with the others, the nurses, the professionals, the manager, it can be frustrating because they're the only ones there not getting paid."* Medical Director	Was not discussed	Was not discussed
Involvement	*"They need to feel as if they can actually influence the process (project). I don't think they necessarily want to be there all the time, but they want to know they will be involved when choices are made."* Medical Director	Was not discussed	*"Just get them (physicians) involved from the beginning. It prevents so many problems."* General manager
Leadership	Was not discussed	Was not discussed	*"What really struck me, after about the first 6 or 7 projects, was how important the (change) manager was. How his leadership was really central in creating engagement from them (physicians)."* Lean Program Director

	Perceived benefits	Cost reduction	*"I think it was just a disguised way of cutting costs. No matter what we suggested, it always came down to that I think. No matter how they put it, you know, with their wastes and value-added tasks… I knew from the beginning that it's what this (Lean) was gonna be about. It was pointless."* Physicians	*"It was hard to convince him (physician) that the project was not about reducing expenses. Once we got him over that hump, the project took off."* Middle Manager	*"Like Dr. Toussaint told us when we visited them, don't make Lean about costs. You'll lose them (physicians(with that."* Lean Program Director
		Quality improvement	*"I think we'll have more success with getting them engaged if we focus on quality in the future."* General Manager	*"I remember that we talked about that project last time. I think it ended up working because we made it about quality. They (physicians) could relate to that."* Medical Director	*… but really it's about the quality of care. This is how you get buy-in (from physicians).* Lean Program Director
		Patient satisfaction	Was not discussed	Was not discussed	Was not discussed
		Work life improvement	*"One doctor told me, up front, at the beginning of the project, that the most important for him was to make life easier at work. To solve those small problems that are really irritating every day."* Middle Manager	Was not discussed	Was not discussed

Chapter 3:
Physicians and Lean: a Quantitative Perspective

Abstract

The purpose of this paper is to study physicians' interaction with Lean change initiatives in healthcare organizations. To do so, we developed a quantitative research methodology anchored in two significant theoretical frameworks of the organizational change literature. Using the organizational change commitment model of Herscovitch and Meyer (2002) and the antecedents framework of Oreg et al. (2011), we developed a conceptual model of physicians' support of Lean change. From this model, we elaborated mediation effect hypotheses of antecedents' influence on physicians' behavioral support for Lean change, through the organizational change commitment construct. Using a survey distributed to physicians in healthcare organizations across the USA, we tested this model using structural equation modeling. The analysis revealed significant mediation effects of *pre-change* and *change* antecedents on support for Lean change. It was shown that the process of change had the largest influence on physicians' behavioral support for Lean change, through the affective commitment construct. The level of participation, the quality of change communication and the transformational leadership behaviors of change agents were the most influential antecedents, all having positive and significant indirect effects on behavioral support for Lean. We also found that the internal organizational context had very limited influence on support for Lean. We also concluded that efficiency driven Lean implementation and traditional managerial techniques of rewards and punishments were counterproductive in engaging physicians towards Lean. This paper contributes to the recent call from scholars and Lean practitioners to further investigate physicians' interaction with Lean change. Also, considering the traditional difficulty of investigating physicians with quantitative methods, this paper provides a unique contribution to organizational theory in healthcare.

Acknowledgements

We would like to acknowledge the support of the Catalysis Healthcare Value Network (www.createvalue.org) for their help in conducting this research. Their support was instrumental in distributing our survey to physicians across the USA.

3.1. Introduction

As healthcare organizations face new and old challenges, various innovations have made their way from traditional businesses into the medical domain. Notably, Lean Management has traveled from the factory into operating rooms, emergency departments and other healthcare settings (Womack and Miller, 2005), predicated on the benefits produced in other industries (Fullerton *et al.*, 2014; Tucker and Singer, 2015). Evidence of Lean implementation in healthcare can be found in developed countries across the world (Costa and Godinho Filho, 2016; Moraros *et al.*, 2016), where hospitals are increasingly using methods, tools, and principles adapted from Lean thinking. However, the benefits of Lean in healthcare have been disputed by scholars and practitioners alike, with little evidence of its benefits having been uncovered (de Souza, 2009; Mazzocato *et al.*, 2010). Recently, however, researchers have finally found conclusive evidence supporting Lean in healthcare (Shortell *et al.*, 2018). These authors have linked the adoption of Lean to improved organizational performance in hospitals across the USA.

Nevertheless, Lean implementation remains difficult for healthcare organizations. Most hospitals rely on tools and visual elements without delving into the true cultural change required for successful Lean transformations (Burgess and Radnor, 2013). Lean is first and foremost a socio-technical system, where human factors play a central role during implementation (Lorden *et al.*, 2014). This, along with many other barriers, can explain why Lean appears to be so difficult to implement in healthcare (de Souza and Pidd, 2011). Amongst these barriers is the notable resistance physicians have historically exhibited towards Lean (Lorden *et al.*, 2014). While they are notorious for resisting most types of organizational change, physicians have proven especially resistant when it comes to Lean implementation (Fournier and Jobin, 2018b). This phenomenon is even more interesting since we know that engaging physicians is essential for successful organizational

improvement (Cammisa *et al.*, 2011; Champy and Greenspun, 2010). To that extent, scholars and practitioners have called upon the scientific community to develop knowledge about physicians and Lean change (Toussaint *et al.*, 2017). This paper represents our contribution to this discussion.

Physicians are unique organizational actors because of their status and power. They sit atop healthcare's professional hierarchy and possess more decision-making power than any other stakeholders. This makes them notably particular when it comes to organizational change because they can negotiate their participation, veto decisions that would otherwise be unanimous and because they can choose not to participate in the change process without management having much influence on the matter (McNulty and Ferlie, 2002). Physicians will show great levels of resistance if they fear their professional autonomy will be threatened by a change (Denis *et al.*, 2002). It is not clear, however, what really influences physicians' reactions to Lean change. The academic literature has seldom studied this. It has, nonetheless, investigated other improvement approaches such as Total Quality Management (TQM) (Shortell *et al.*, 1995) and Business Process Reengineering (BPR) (McNulty and Ferlie, 2004). The overarching conclusion of these studies was that physicians are reluctant to get involved in improvement initiatives. This is influenced, amongst other things, by the negative perception of outside, non-medical influences, physicians tend to have. *In fine*, a better understanding of what influences physicians' reactions to Lean is needed.

The literature on organizational change is abundant. We know that behavioral support for organizational change is operationalized through commitment towards said change (Bouckenooghe *et al.*, 2015). We also know that change recipients' reactions to change are influenced by antecedents, as is specified by Oreg *et al.* (2011) in their 60-year review of the literature. According to these authors, antecedents can be found in two large categories: *pre-change* and *change* antecedents. *Pre-change* antecedents are pre-existing conditions already in place prior to a change taking form. They are either individual characteristics or elements related to the internal organizational context. *Change* antecedents relate to the nature of the change itself, the way it is managed and the perceived benefits the recipients can foresee. Antecedents can positively or negatively

influence recipients' reactions to change. While we do know which antecedents can, according to the literature, influence physicians' reactions towards Lean change, little is known as to which of these are truly impactful in creating support for Lean from them. In this study, we will investigate the influence of both *pre-change* and *change* antecedents on physicians' support of Lean, to contribute to the developing literature on Lean implementation in healthcare.

To fulfill this objective, we developed a quantitative research method based on Herscovitch and Meyer's (2002) seminal conceptualization of organizational change commitment. We combined it with Oreg *et al.'s* (2011) framework of antecedent variables. Using these two theoretical foundations, we developed a conceptual model of physician's engagement towards Lean change and formulated 12 different hypotheses. This model proposes that *pre-change* and *change* antecedents' influence on physicians' behavioral support for Lean change is mediated by the organizational change commitment construct, which can be divided into the *affective* and *continuance* dimensions. To test our model, we developed a survey questionnaire that was distributed to physicians in healthcare organizations across the USA. First, we validated the measurement model using Confirmatory Factor Analysis (CFA). We also assessed the validity and reliability of the instrument, as well as addressed any potential concerns regarding common method bias. We then used structural equation modeling in Amos 25 to test our conceptual model. We progressively refined this model by removing, one at a time, the non-significant structural relationships between variables (Gilgun, 1995; Ullman and Bentler, 2012). Following this, we tested our initial hypotheses through a mediation analysis using the bootstrapping method. This allowed us to conclude on these hypotheses.

The results and subsequent analysis provided support for some of our hypotheses, while others could not be supported. We found that *affective* and *continuance* commitment both had significant relationships with physicians' *behavioral support for Lean change*, though that relationship was much stronger for the *affective* dimension. This led to various antecedents having significant indirect-only effects on positive behaviors supporting Lean change, which provided support for some of our hypotheses. *Pre-change* antecedents

showed little to no influence on behavioral support, while *change* antecedents had a more salient impact.

Our paper is structured as follows. First, we will provide an overlook of the literature regarding Lean change in healthcare. We will then look at physicians as organizational actors and their relationship with organizational change. Then, we will review the literature on organizational change upon which we build our conceptual model and develop our hypotheses. Next, we will present our research method by first detailing our sampling procedure and measurement instrument. We will then confirm the reliability and validity of our instrument through a Confirmatory Factor Analysis, as well as address common method bias. Subsequently, we will assess the support of our hypotheses and propose a model of physicians' support for Lean change. A discussion will ensue where we will examine our findings and related managerial implications. This will be followed by a conclusion highlighting our contributions, as well as the limitations and future avenues of our research.

3.2. Literature review

3.2.1. Lean Management in Healthcare

Policy-makers and managers worldwide have used Lean Management as part of various innovations to help face the challenge of providing cost-effective healthcare (Womack and Jones, 2015). Developed by the Toyota Motor Corporation, Lean has become one of the primary management paradigms since it was first coined by John Krafcik (1988). Since its inception, it has evolved from a set of tools and principles focused on cost reduction (Spear and Bowen, 1999; Womack and Jones, 1996) into a holistic management system based on value appropriation using many so-called "soft-practices" deeply rooted in social sciences, such as respect for people (Liker and Convis, 2011), committed management (Soriano-Meier and Forrester, 2002) and the development of meta-routines of work anchored in practice-methodology (Rother, 2010). Predicated on its benefits towards organizational performance (Fullerton *et al.*, 2003; Womack and Jones, 2015), Lean's ability to improve such performance has been disputed by scholars (Lin and Chun, 1999). However, many in the academic community agree that Lean can positively

contribute to organizational performance (Bateman *et al.*, 2014; Fullerton *et al.*, 2003; Hines *et al.*, 2004).

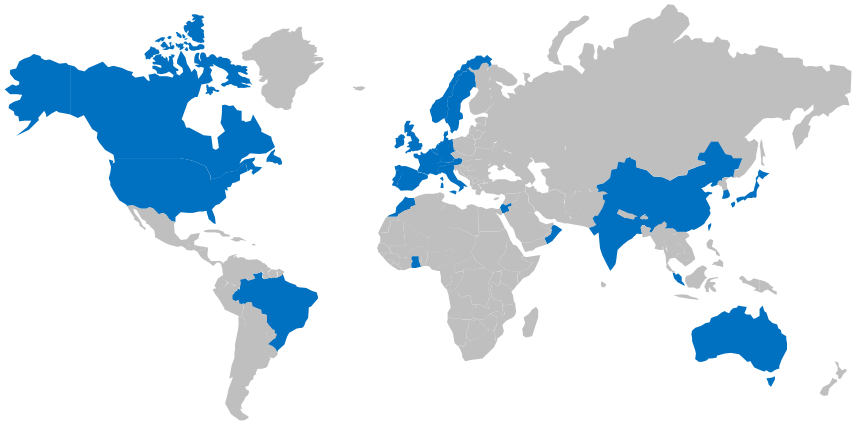


Figure 5. Lean implementation in healthcare
(Costa and Godinho Filho, 2016; Moraros *et al.*, 2016)

Lean has been implemented in various healthcare systems and organizations across the world (Costa and Godinho Filho, 2016; Moraros *et al.*, 2016). In the USA, the Virginia Mason Institute (Kenney, 2012) and ThedaCare (Barnas, 2011) were amongst the early adopters of Lean. The UK's National Health Service has also been using Lean for many years (Radnor *et al.*, 2009). In Canada, St-Boniface Hospital and Five Hills Health Region have been experimenting with Lean for years (Fine *et al.*, 2009; Graban, 2011), along with many organizations in the province of Québec (Fournier and Jobin, 2018a). Figure 5 highlights where various Lean change initiatives have taken place, based on the recent works of Costa and Godinho Filho (2016) and Moraros *et al.* (2016)

Evidence of Lean's positive impact on healthcare organizations' performance is scarce. A few years ago, we investigated the impact of Lean on hospitals' performance after three years of implementation (Fournier *et al.*, 2016). We were unable to conclude on any system-wide, positive benefits other than small, non-recurrent financial gains. Recently, however, scholars have uncovered positive effects of Lean on healthcare performance in the USA. In their study of 1222 American hospitals, Shortell *et al.* (2018) concluded that Lean was positively associated with improved organizational performance. The authors, however, also discuss how difficult it is for organizations to mature with regards to Lean thinking. This is also echoed by Jobin and Lagacé (2014) and their *Lean Maturity Model*.

Lean, as a holistic management system, remains difficult to grasp for all types of organizations, but especially hospitals (Radnor *et al.*, 2012).

Many barriers to Lean implementation in healthcare exist (de Souza and Pidd, 2011). While some are generic to numerous industries, such as unfamiliarity with the Lean jargon, some are unique to healthcare. The nature of the work performed by healthcare professionals, combined to the unique governance structure of healthcare organizations and the role of the patient as the material input and output are some of the barriers highlighted in the literature (Fournier and Jobin, 2018b). Often discussed is also the role of physicians and how they, usually negatively, impact the implementation of Lean. Lorden *et al.* (2014) argue that, more often than not, physicians act as a barrier to the successful implementation of Lean. This has led to recent calls by scholars and practitioners (Toussaint *et al.*, 2017) to pursue research on the subject of physicians and Lean, in the hopes of gaining understanding as to how organizations can better engage them to truly improve organizational performance. In the next section, we will take a quick a look at physicians as organizational actors, what makes them unique and why they are often viewed as a barrier to Lean change.

3.2.2. Physicians and Lean change

To gain a better understanding of why physicians are said to represent a barrier to Lean implementation, we need to first understand what makes them unique organizational actors.

Two synergistic factors distinguish doctors: their status and power. Physicians enjoy hierarchical supremacy in healthcare (Kellogg, 2009), which provides them with professional dominance over other stakeholders (Giaimo, 2009). They also possess a monopoly of expertise (McNulty and Ferlie, 2002), crucial to providing care. This combination of status and power allows them to, *in fine*, veto managerial decisions (Desbiens, 2016). It makes them the central "decision makers" within the organization (Battilana and Casciaro, 2012). This ends up creating a leadership paradox in which pluralism, as desired by healthcare policy-makers, cannot easily operate (Fournier and Jobin, 2018b). *In fine*, the power physicians have increases their status, and their status also increases their power.

Physicians' unique position means their inclination towards organizational change is singular. In fact, physicians are notorious for resisting change (Cabana *et al.*, 1999). When faced with change, they usually negotiate their participation tightly, in exchange for better control over the outcomes of the change (McNulty and Ferlie, 2002). According to Light (2000), they will show resistance when they feel a change will encroach on their professional boundaries. Physicians will exhibit high resistance if they believe their professional autonomy is being challenged (Denis *et al.*, 2002).

Since Lean implementation is a form of organizational change, it is natural that physicians' normal behaviors towards change would apply to it. However, levels of resistance from physicians have been shown to be even higher when it comes to Lean implementation (Lorden *et al.*, 2014). But few additional works are present in the literature regarding physicians' resistance to Lean. A body of work is available, though, on other similar quality improvement methods such as TQM and BPR. While scholars have been arguing over the differences between these improvements approaches (Andersson *et al.*, 2006; Pettersen, 2009), they do share similarities as processes of change and the phenomenon they create (Desbiens, 2016). First, scholars have long exposed healthcare's, notably physicians', paradigmatic view that "medical work is complex and, therefore, not accessible to standardization" (Freidson, 1984). This "sacred view of healthcare", as proposed by Zimmerer *et al.* (1999), is also enhanced if change is being proposed by non-clinicians. Indeed, Shortell *et al.* (1995) illustrated how physicians are under-involved in TQM initiatives. McNulty and Ferlie (2004) also concluded that BPR fails when it is imposed on physicians. But what are the main reasons for this? Scholars argue that TQM, BPR, and Lean usually end up focusing on changes to the "core-technical" aspects of medical work. Physicians tend to see this as an attack on their status and power, especially if it is suggested by individuals who, in their eyes, have little to no medical credibility (Farand *et al.*, 1999).

Physicians, as do other healthcare professionals, tend to view Lean and other improvement approaches as a (not so) hidden way for the organization to reduce costs (Cammisa *et al.*, 2011). This leads to resistance, notably because physicians tend to follow their own judgment as opposed to the organization's priorities (Dent, 2003). This is

compounded in many organizations because physicians are often independent workers not employed by the hospital (Callister and Wall Jr, 2001).

Since we know, today, that strong clinical involvement is crucial for process improvement in healthcare (Champy and Greenspun, 2010), deeper investigation of how physicians engage in Lean change is required. But what is it that truly influences physicians' commitment to Lean change? This is the question to which we will provide an answer in this paper.

3.2.3. Commitment to Change

Organizational change has been abundantly studied by scholars over the years (Oreg *et al.*, 2011). The largest body of research has focused on how organizations prepare, implement and react to organizational change. More recently, however, researchers have investigated how change recipients influence the success, or lack thereof, of organizational change. This has brought to the forefront the subject of how *individuals'* reactions can influence change (Judge *et al.*, 1999). Indeed, there is a consensus regarding the important role change recipients' reactions have towards the success of change initiatives (Bartunek *et al.*, 2006). Various studies have demonstrated the significance of change recipients' attitudes throughout the change implementation process (Caldwell *et al.*, 2004; Oreg, 2006; Rafferty and Griffin, 2006).

Change recipients can exhibit different types of reactions towards organizational change. In their 60-year review of the organizational change literature, Oreg *et al.* (2011) list three categories of individuals' reactions to change: affective, cognitive and behavioral reactions. Scholars have focused on recipients' affective reactions to change by studying how change can result in stress (Amiot *et al.*, 2006), anxiety (Oreg, 2006), fatigue (Pierce and Dunham, 1992) and negative emotions (Kiefer, 2005) experienced by change recipients. Others have looked at more positive factors, such as change-related satisfaction (Jones *et al.*, 2005) and affective aspects of change commitment (Armenakis *et al.*, 2007). Researchers have also used a cognitive approach in viewing organizational change, to study recipients' reactions with regards to their assessment of the change's value (Bartunek *et al.*, 2006). Notions such as *sensemaking*, meaning what the change recipients

believe is the meaning of the change, *perceived fairness* (Daly, 1995) and *openness to the change* (Axtell *et al.*, 2002), to name a few, have been discussed by researchers.

Of particular interest to us are behavioral reactions to organizational change. Oreg *et al.* (2011) describe behavioral reactions to change as "*either explicit behaviors in response to the change or as reported intentions to behave*". In many studies, researchers have measured how individuals have engaged in activities promoted by the change (Bartunek *et al.*, 1999; Coyle-Shapiro, 1999; Jones *et al.*, 2005). In other studies, recipients' intentions of support or resistance towards the change were analyzed (Oreg, 2006; Stanley *et al.*, 2005). Most of those studies have used measurement models based on change commitment scales as opposed to specific reactions to the change. Central to this is Herscovitch and Meyer's (2002) seminal conceptualization of organizational change commitment which they define as "a force (mindset) that binds an individual to a course of action deemed necessary for the successful implementation of a change initiative." Derived from their earlier model of organizational commitment (Meyer and Allen, 1991), the authors differentiate three types of commitment to change recipients can exhibit towards a change: *affective* (ACC), *normative* (NCC) and *continuance* (CCC) commitment. *Affective* commitment is defined as "*a desire to provide support for the change based on a belief in its inherent benefits*". *Normative* commitment is defined as "*a sense of obligation to provide support for the change*". *Continuance* commitment is defined as "*a recognition that there are costs associated with failure to provide support for the change*". The authors concluded on the effects those various types of commitment had on individuals' supporting behaviors towards the change (BSUP), encompassing resistance (active or passive), compliance, cooperation and championing. They demonstrated that all three types of commitment correlated positively with compliance behaviors, but only *affective* and *normative* commitment correlated positively with cooperation and championing (discretionary behaviors).

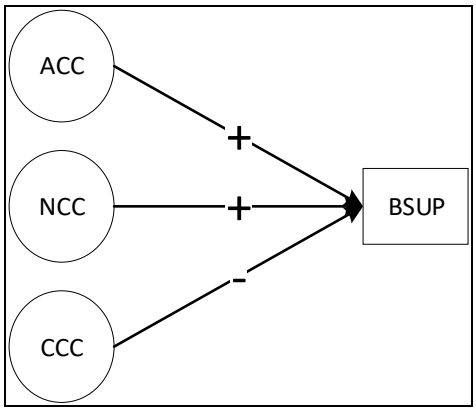


Figure 6. Model of organizational change commitment
(Herscovitch and Meyer, 2002), validated by Bouckenooghe *et al.* (2015).

More recently, Bouckenooghe *et al.* (2015) revisited Herscovitch and Meyer's (2002) model through a meta-analysis. First, they found that *affective* commitment and *normative* commitment to change were strongly and positively correlated, while *affective* and *continuance* commitment were strongly and negatively correlated. They also found that *affective* and *normative* commitment correlated positively with discretionary behaviors (cooperation and championing) and that *continuance commitment* correlated negatively with such behaviors. They concluded that Herscovitch and Meyer's (2002) model contributes largely to explaining employees' behaviors with regards to organizational change.

3.2.4. Antecedents of Change

Next, we need to look at what influences change recipients' reactions to organizational change. Oreg *et al.'s* (2011) seminal work on change reactions provides a detailed and deep perspective on this subject. Reactions to change are influenced by *antecedents*, which the authors define as "*the reasons for the reactions rather than the reaction itself*". These involve variables that predict either change recipients' explicit reactions, or the indirect, and often longer-term change consequences". The authors found two categories of antecedents, which they labeled as *pre-change* and *change* antecedents.

Pre-change antecedents are, in fact, pre-existing conditions already in place before a change initiative takes places. They can be divided into two sub-categories. First are *individual characteristics*, such as age (Bordia *et al.*, 2004a), gender (Jones *et al.*, 2005)

and experience (Coyle-Shapiro, 1999) which have been shown to influence reactions to change. Second is the *internal organizational context*, which can be made up of various factors such as managerial support (Coyle-Shapiro and Morrow, 2003) or specific job characteristics (Weber and Weber, 2001).

Change antecedents are aspects related to the change itself. They can be divided into three sub-categories: the *content of the change*, the *process of change* and the *perceived benefits of the change*. The *content of the change* relates to such things as the extent and complexity of the change (Caldwell *et al.*, 2004) or the reorganization of work induced by the change (Pierce and Dunham, 1992). The *process of change* concerns notions such as participation (Amiot *et al.*, 2006), communication (Axtell *et al.*, 2002) or the way change was managed (Rafferty and Griffin, 2006). Finally, *the perceived benefits of the change* have to do with the perceived positive or negative outcomes of the change (Armenakis *et al.*, 2007), such as a perceived threat to job security (Oreg, 2006) or financial rewards (Johnson *et al.*, 1996).

In fine, antecedents are variables that influence a change recipient's reactions to organizational change. Our study will focus on these variables pertaining to physicians and Lean change.

3.3. Conceptual model and hypotheses

To answer our research question, we have used a quantitative approach to test our conceptual model presented in figure 7, centered on Herscovitch and Meyer's (2002) seminal model of organizational change commitment.

3.3.1. Commitment to Lean Change

As discussed previously, Herscovitch and Meyer's (2002) model proposes three types of commitment to organizational change: *affective*, *normative* and *continuance*. *Affective commitment* (ACC) is usually generated when a change recipient fundamentally believes in the benefits of a change. *Normative commitment* (NCC) will take place when a change recipient feels an obligation to support the change. *Continuance commitment* (CCC) will manifest itself when a change recipient feels threatened by a change that could potentially

make him lose something of importance to him. In the literature (Bouckenooghe *et al.*, 2015), high levels of ACC are said to correlate with higher levels of *Behavioral support for change* (BSUP). NCC is usually also correlated with higher levels of BSUP. Finally, CCC has been shown to correlate negatively with BSUP. Since ACC and NCC have been demonstrated to be highly, positively correlated, we did not include it in our conceptual model. This echoes the literature and what other researchers have done in the past (Bouckenooghe *et al.*, 2015). Hence, the theoretical model we propose will be anchored in Herscovitch and Meyer's (2002) model of commitment to change. The originality of our model will then mostly reside in the mediation hypotheses we will propose next.

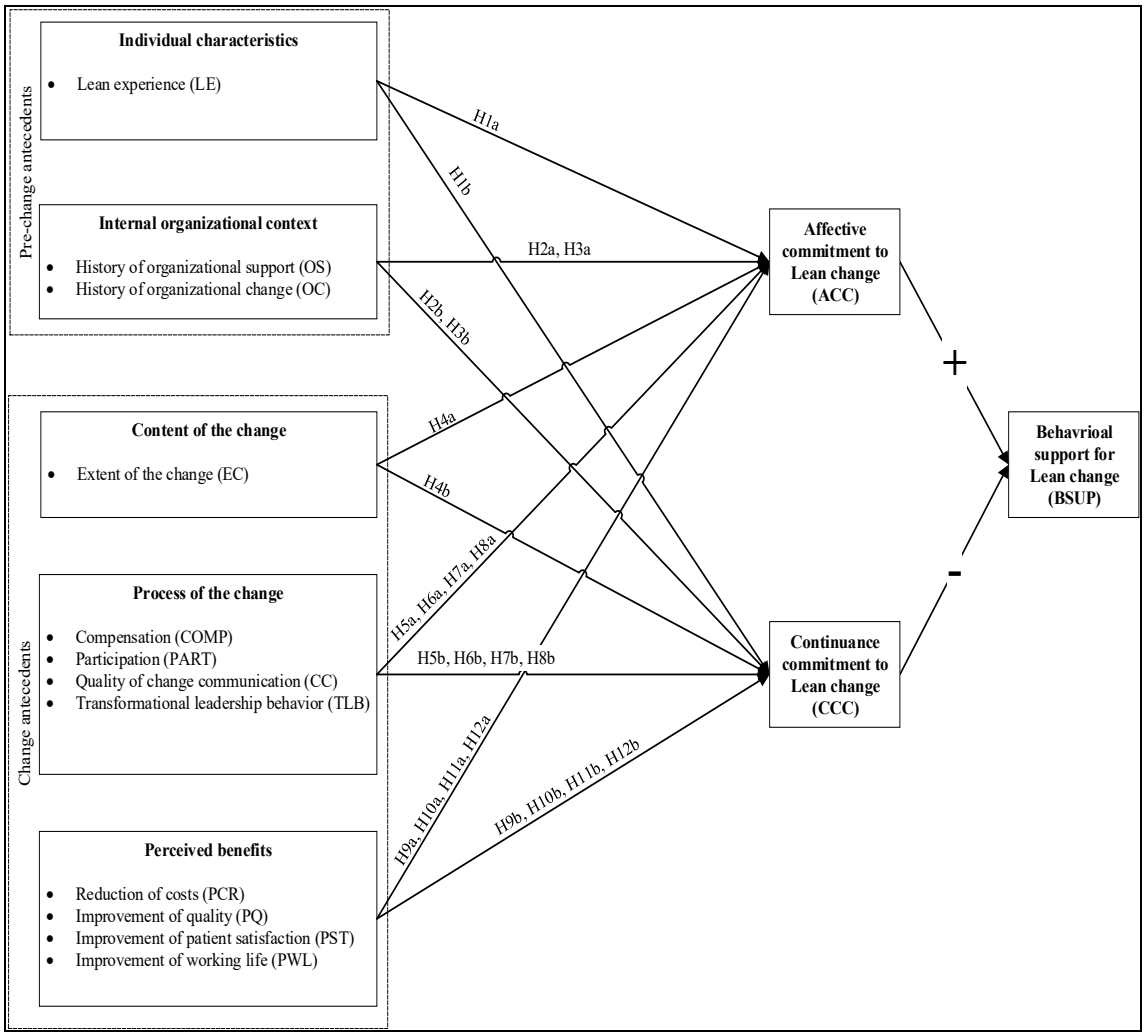


Figure 7. Conceptual model of physicians' support for Lean change

3.3.2. Antecedents of Commitment to Lean Change

Our conceptual model of physicians' commitment to Lean change relies on Oreg *et al.'s* (2011) categorization of antecedents. As presented earlier, these authors reviewed 60 years of literature on organizational change and identified two categories of antecedents influencing change recipients' reactions to change: *pre-change* and *change* antecedents. We use this framework to develop various mediation hypotheses where the effects of antecedents on behavioral support for Lean change are mediated by commitment to Lean change.

3.3.2.1. Pre-Change Antecedents of Lean Change

Pre-change antecedents are pre-existing conditions present even before a Lean change initiative takes place. They are demographic variables and individual characteristics of change recipients. Of interest too is if a physician possesses any previous *Lean experience* (LE), meaning if whether or not that physician has either had previous Lean training or already participated in a Lean change initiative prior to taking part in the Lean initiative under study. As argued by Fournier and Jobin (2018a), physicians who are already familiar with Lean thinking, either through previous training or practical experience, will more easily understand the motivations behind its implementation. They will also tend to engage emotionally with the change more easily.

H1a: physicians who have previous Lean experience (LE) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H1b: physicians who have no previous Lean experience (LE) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

The internal organizational context is also an important part of *pre-change* antecedents. Of note are how the organization has historically managed change and how it has historically supported its physicians. The *history of organizational support* (OS) perceived by physicians might influence their initial reactions towards Lean. When the

organization has not historically considered physicians' interests, beliefs, and values, they will tend to view Lean change negatively and develop higher continuance commitment (Dent, 2003).

H2a: Physicians with a positive perception of their organization's support history (OS) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H2b: Physicians with a negative perception of their organization's support history (OS) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

The *history of organizational change* (OC) can have a profound effect on change recipients' acceptance of change (Bordia *et al.*, 2011). Individual perceptions of the organization's change history influence one's beliefs regarding subsequent change. If physicians believe their organization has not been good at managing past changes, chances are they will not commit affectively to a new Lean change initiative. They will be more likely to show increased levels of continuance commitment towards it.

H3a: Physicians with a positive perception of their organization's change history (OC) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H3b: Physicians with a negative perception of their organization's change history (OC) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

3.3.2.2. Change antecedents of Lean change

As discussed previously, an important aspect influencing change recipients' reactions to Lean change is the nature of the change itself, the way it is managed and what recipients believe the outcomes will be.

The nature of the change, such as its level of complexity, plays a role in inducing reactions from change recipients. Physicians are notably resistant to change when they think it will

target their medical practices or the organization of their work (Dent, 2003). The greater the *extent of the change* (EC), the less likely they are to commit affectively towards it, and greater are the chances they will exhibit higher levels of continuance commitment.

H4a: Physicians who perceive a greater extent of change (EC) will have a lower level of ACC which will then materialize in a lower BSUP for Lean change.

H4b: Physicians who perceive a greater extent of change (EC) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

The way change is managed also permeates into physicians' reactions. As was highlighted in the literature (Fournier and Jobin, 2018a), compensating physicians outside of their regular salary or means of compensation for participating in a Lean change initiative might prove conductive to positive levels of commitment on their part. Failure to do so would have a tendency to generate behaviors influenced by continuance commitment.

H5a: physicians who received specific compensation (COMP) for their participation in the Lean change initiative will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H5b: physicians who did not receive specific compensation (COMP) for their participation in the Lean change initiative will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

Second, as demonstrated by Goldstein and Ward (2004), involving physicians in change matters. If physicians are involved in various aspects of the change, such as selection and decision-making, the chances of them believing in the proposed benefits of it are much greater. *Participation* from physicians will allow them to engage affectively and ultimately support the change. Lower participation will result in a greater inclination towards continuance commitment.

H6a: Physicians with a higher level of participation (PART) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H6b: Physicians with a lower level of participation (PART) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

The ability of management and change agents to properly communicate information regarding the change to physicians allows for better commitment to take shape. *Quality of change communication* (CC) is an essential component of sound change management principles (Axtell *et al.*, 2002). The better it is, the more likely physicians are to positively commit to the change. The contrary would lead to continuance commitment from the change recipient.

H7a: Physicians perceiving a higher level of quality of change communication (CC) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H7b: Physicians perceiving a lower level of quality of change communication (CC) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

Physicians are also influenced by the leadership exhibited by change agents. Lean notably emphasizes *transformation leadership behavior* (TLB) (Liker *et al.*, 2012) as the most conductive to successful implementation. Mathie (1997) highlights how physicians are particularly influenced in their adhesion to change by the way leaders manage and direct such change. Hence, when change agents demonstrate high levels of TLB, physicians should positively commit to Lean initiatives. When the perceived TLB of the change agent is poor, physicians will tend to commit negatively.

H8a: Physicians perceiving a higher level of transformational leadership behavior from the change agent (TLB) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H8b: Physicians perceiving a lower level of transformational leadership behavior from the change agent (TLB) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

As mentioned previously, the perceived benefits of a change impact recipients' reactions to said change. Lean has historically been viewed by healthcare actors, notably physicians, as a way for organizations to reduce costs (Cammisa *et al.*, 2011). This makes them unyielding towards Lean. Physicians tend to perceive the benefits of change from their own perspective, listening to their professional judgment and medical considerations (Dent, 2003). They will frown at the idea of changing in order to reduce costs. If they believe the change's objective is cost reduction, continuance commitment will be induced as opposed to affective commitment.

H9a: When physicians believe the objective of the Lean change initiative is to reduce costs (PRC), they will have a lower level of ACC which will then materialize in a lower BSUP for Lean change.

H9b: When physicians believe the objective of the Lean change initiative is to reduce costs (PRC), they will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

However, physicians will be more interested in a change when they believe it's objective is to *improve the quality of care* (PQ) and the *satisfaction of patients* (PST), as this aligns much more with their interests (Dent, 2003). Positive perceptions regarding these objectives will result in higher levels of affective commitment and lower levels of continuance commitment.

H10a: When physicians believe the Lean change initiative will improve the quality of care (PQ), they will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H10b: When physicians believe the Lean change initiative will negatively impact the quality of care (PQ) they will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

H11a: When physicians believe the Lean change initiative will improve patient satisfaction (PST) they will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H11b: When physicians believe the objective of the Lean change will negatively impact patient satisfaction (PST) they will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

Finally, improving the *quality of work life* (PWL) of physicians usually proves conductive to positive commitment to change. Cabana *et al.* (1999) and Pynoo *et al.* (2012) have notably argued as such. Engaging physicians by trying to improve their lives at work should favorably impact their commitment, while the opposite will result in continuance commitment motivated behaviors.

H12a: When physicians believe the Lean change initiative will improve their quality of work life (PWL) will have a higher level of ACC which will then materialize in a higher BSUP for Lean change.

H12b: When physicians believe the Lean change initiative will negatively impact their quality of work life (PWL) will have a higher level of CCC which will then materialize in a lower BSUP for Lean change.

3.4. Research Method

To conduct our study, we developed a survey in collaboration with various experts from across North America. This panel included both scholars and practitioners with extensive and recognized knowledge and experience in the field of Lean implementation in healthcare. Various iterations of the survey were submitted to the panel. The final version was the result of modifications, improvements, and refinements following feedback from this panel of experts. This was done to ensure coherence and parsimony, as well to maximize the number of potential responses.

Table 13. Demographic characteristics of the sample (n = 176)

		n	Percentage
Age	30 or under	10	5.0
	31 to 40	21	11.0
	41 to 50	63	34.0
	51 to 60	56	30.0
	61 to 70	36	19.0
Gender	Male	95	54.0
	Female	81	46.0
Medical specialty	Specialist physician	80	45.5
	General physician	96	54.5
Employment status	Employee	114	64.8
	Independent worker	62	35.2
Compensation	No	151	85.8
	Yes	25	14.2
Previous experience with Lean	No	60	34.1
	Yes	116	65.9

3.4.1. Sample

The targeted population was physicians having experienced Lean change in various healthcare organizations across the USA. Since it is known that targeting physicians as respondents to survey questionnaires is notoriously difficult, we developed our survey to ensure parsimony and minimize the time required to complete it (Kellerman and Herold,

2001). The respondents were asked to answer the questions while thinking about the latest Lean change initiative in which they had been involved. As a selection criterion, this Lean initiative had to have taken place in the last three years from the date the survey was sent. To reach the respondents, we used a database kindly provided by the *Catalysis Healthcare Value Network* (www.createvalue.org). Emails were sent to physicians spread across 63 healthcare organizations from all parts of the USA, that included a link to an online survey hosted by QUALTRICS (www.qualtrics.com). Of those 63 organizations, nine can be found in the Northwestern region of the country, 11 in the Southwest, six in the Southeast, 10 in the Northeast, 19 in the Midwest and six in the North Central states. The email included a summary explaining the reasons why physicians were being solicited to partake in this research project. Participants were also guaranteed anonymity. Following the initial solicitation, the respondents were sent subsequent reminders to complete the survey (Dillman, 2011). We would like to note that this research project was approved by HEC Montréal's committee for ethics in research (certificate #1427).

In total, the survey was sent to 632 physicians, of which 176 returned completed and usable responses, resulting in a response rate of 27.85%. Table 13 provides the demographic characteristics of the respondents. Over 60% of the respondents were physicians aged between 41 to 60 years old. A small majority of them were men (54%), which is somewhat in line with the general population of physicians in the USA according to the Kaiser Foundation (www.kff.org), where male physicians represent around 60% of the population. Most of the respondents were general practitioners (54.5%) while the rest were specialist physicians (45.5%), such as surgeons or pediatricians. This is also in line with the Kaiser Foundation numbers, where general practitioners and specialist physicians both represent roughly half of American physicians. About two-thirds of physicians were employed by their respective organization (64.8%), while the rest were independent workers (35.2%). In total, 14.2% of respondents had been compensated outside of their regular salary or compensation for their participation in the Lean change initiative, while 85.8% were not. Finally, two-thirds of respondents had previous experience with Lean before the Lean change initiative in question had taken place. That is, these physicians were already familiar with Lean, either through previous training or practical experience, prior to being involved in the Lean initiative they were asked about in the survey.

We assessed non-response bias by comparing early and late responses (Armstrong and Overton, 1977), specifically the first and last 30, in terms of *history of organizational change* (OC) and *affective commitment to change* (ACC). No significant differences were identified.

3.4.2. Measures

3.4.2.1. Commitment to Lean change

Behavioral support for Lean change (BSUP) was operationalized, along with *affective* (ACC) and *continuance* (CCC) commitment to Lean change, using Herscovitch and Meyer's (2002) model of organizational change commitment. ACC and CCC used four items each measured on a seven-point Likert scale (1 = strongly agree, 7 = strongly disagree). For ACC, an example of item used is "I believed in the value of this change". For CCC, an example of item used is "it would have been too costly for me to resist this change". BSUP used one item measured on a five-level scale identifying five types of change supporting behaviors: active resistance, passive resistance, compliance, cooperating and championing. Note that all items of the survey are available in the appendix and that alpha coefficients for all constructs and variables are presented in table 14.

3.4.2.2. Pre-Change Antecedents

In our study, we controlled for *age, gender* (0 = male, 1 = female) and *medical specialty* (0 = specialist physician, 1 = general physician). Controlling for these variables is usually recommended in the change literature, as they can sometimes have an effect on dependent variables (Oreg *et al.*, 2011). We also controlled for the employment status (EMP) of physicians using a binary coded variable (0 = employee, 1 = independent worker). As presented by Callister and Wall Jr (2001), physicians are not always employees of healthcare organizations. They are sometimes independent workers paid, *in fine*, as subcontractors. Controlling for this variable is therefore recommended to ensure the rigor of the study. This was also notably highlighted by our panel of experts.

To evaluate if whether or not the respondent had previous *Lean experience* (LE), we again used a binary coded variable (0 = no, 1 = yes). To measure whether or not the respondent

had been compensated for his participation in the Lean change initiative (COMP), we used another binary coded variable (0 = no, 1 = yes).

We operationalized the *history of organizational support* (OS) using seven items with a seven-point Likert scale (1 = strongly agree, 7 = strongly disagree) from Eisenberger *et al.'s* (1997) measure of perceived organizational support. These items measured the respondent's perception of the level of individual support his organization had traditionally offered him. Examples of items included are: "this organization cares about my well-being" and "this organization strongly considers my goals and values".

The *history of organizational change* (OC) was evaluated using eight items with a seven-point Likert scale (1 = strongly agree, 7 = strongly disagree) adapted from Bordia *et al.'s* (2011) measure of perceived change management history. The items measure the respondent's perception of previously experienced organizational change in general, such as restructuring or job reassignment. Examples of items included are: "organizational change has been positive" and "organizational change has been managed well".

3.4.2.3. Change Antecedents

The *extent of the change* (EC) scale was built using four items from scales developed by Caldwell *et al.* (2004) and Fedor *et al.* (2006). The seven-point Likert scales (1 = strongly agree, 7 = strongly disagree) measured the respondent's initial perception of how the Lean change initiative would change things such as the organization of their work and their medical practices.

The level of the responding physician's *participation* in the Lean change initiative was measured using a three-level item aimed at assessing the level of involvement displayed by the respondent during the change. Respondents were asked to choose from the following options: 1) "my involvement was limited to being informed about the change taking place", 2) "I was consulted when it came time to make decisions" and 3) "I was involved in the decision-making process from start to finish."

The perceived *quality of change communication* (CC) was appraised with six items using a seven-point Likert scale (1 = strongly agree, 7 = strongly disagree) based on Bordia *et*

al. (2004b). Using this scale, respondents were asked to rate change communication regarding the Lean change initiative concerning various dimensions such as accuracy and informativeness (Miller *et al.*, 1994). Examples of items include: "the official information provided about the change communicated the reasons for the change" and "the official information provided addressed your personal concerns regarding the change".

We measured the level of perceived *transformational leadership behavior* (TLB) from the change agent using the aggregated scale developed by MacKenzie *et al.* (2001) based on the initial scale of 22 items proposed by Podsakoff *et al.* (1996). The scale is comprised of 12, seven-point Likert scale (1 = strongly agree, 7 = strongly disagree), items that measure three core transformational leadership behaviors: the ability to articulate a vision for the change, fostering the acceptance of group goals and providing a role model. These three dimensions have been shown to be reliable and valid in measuring the TLB construct (Rubin *et al.*, 2005). Examples of items include the following: "the leader of the change had a clear understanding of where we were going" and "the leader of the change got the group to work together for the same goal."

Finally, the perceived benefits of the change were evaluated using four items on a seven-point Likert scale (1 = strongly agree, 7 = strongly disagree) asking the respondents how they felt about the Lean change's final objective(s) regarding four different aspects: the *reduction of costs* (PRC), the *improvement of the quality of care* (PQ), the *improvement of patient satisfaction* (PST) and the *improvement of the quality of work life* (PWL). The following is an example of item used for this scale: "the overall objective of this Lean change initiative was to reduce costs".

3.4.3. Measurement Reliability and Construct Validity

We tested the reliability of each construct. Reliability assesses the consistency between multiple measurements of a variable (Hair *et al.*, 2006). Although it is widely used, Cheng *et al.* (2016) note that Cronbach's alpha can underestimate the true reliability of constructs when there is a violation of the Tau-equivalent assumption of the measurement model.

Table 14. Test of the measurement model

	Standardized Regression Weights	t-value	Reliability using Graham (2006)	Composite reliability	Average variance extracted (AVE)	Cronbach's Alpha
Organizational Support History (OS)			0,940	0,940	0,692	0,940
OS_1	0,872					
OS_2	0,803	18,112				
OS_3	0,877	16,154				
OS_4	0,848	15,115				
OS_5	0,852	15,259				
OS_6	0,832	14,6				
OS_7	0,728	11,663				
Organizational Change History (OC)			0,903	0,904	0,541	0,903
OC_1	0,736					
OC_2	0,690	9,013				
OC_3	0,605	7,802				
OC_4	0,79	10,242				
OC_5	0,783	10,19				
OC_6	0,805	10,562				
OC_7	0,691	8,922				
OC_8	0,764	10,01				
Extent of Change (EC)			0,855	0,843	0,576	0,855
EC_1	0,713					
EC_2	0,823	9,715				
EC_3	0,619	9,105				
EC_4	0,858	9,904				
Quality of Change Communication (CC)			0,924	0,925	0,672	0,924
CC_1	0,830					
CC_2	0,798	12,492				
CC_3	0,865	14,168				
CC_4	0,811	12,817				
CC_5	0,844	13,616				
CC_6	0,767	11,796				

All values are significant at the 0.001 level

	Standardized Regression Weights	t-value	Reliability using Graham (2006)	Composite reliability	Average variance extracted (AVE)	Cronbach's Alpha
Transformational Leadership Behavior (TLB)			0,957	0,958	0,653	0,957
TLB_1	0,839					
TLB_2	0,797	12,971				
TLB_3	0,741	11,603				
TLB_4	0,825	13,716				
TLB_5	0,804	13,158				
TLB_6	0,808	13,25				
TLB_7	0,770	12,288				
TLB_8	0,826	13,736				
TLB_9	0,832	13,887				
TLB_10	0,773	12,368				
TLB_11	0,818	13,502				
TLB_12	0,858	14,636				
Affective Commitment to Change (ACC)			0,968	0,968	0,835	0,968
ACC_1	0,915					
ACC_2	0,922	21,242				
ACC_3	0,915	20,74				
ACC_4	0,907	20,209				
ACC_5	0,902	19,869				
ACC_6	0,920	21,098				
Continuance Commitment to Change (CCC)			0,911	0,904	0,520	0,911
CCC_1	0,804					
CCC_2	0,732	9,835				
CCC_3	0,708	9,435				
CCC_4	0,744	10,012				
CCC_5	0,657	8,634				
CCC_6	0,671	8,909				

All values are significant at the 0.001 level

Table 15. Descriptive statistics and Pearson correlations

	Constructs & variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Age	48,10	11.49	1																		
2	Gender	0,46	-	-0,117	1																	
3	MS	0,55	-	0,145	0,109	1																
4	EMP	0,35	-	-0,197**	-0,013	0,028	1															
5	LE	0,66	-	0,085	-0,009	-0,007	-0,448**	1														
6	COMP	0,14	-	-0,075	-0,114	-0,053	0,381**	-0,222**	1													
7	OS	4,29	1,44	0,065	-0,062	-0,047	-0,335**	0,509**	-0,198**	1												
8	OC	3,48	1,14	0,123	-0,214**	0,032	-0,308**	0,192*	-0,168*	0,310**	1											
9	PART	1.93	0.71	0,050	-0,105	0,155*	-0,182*	0,407**	-0,053	0,418**	0,219**	1										
10	EC	4,61	1,28	-0,201**	0,017	-0,134	0,237**	-0,032	0,033	0,062	-0,337**	-0,062	1									
11	CC	4,19	1,42	0,014	-0,026	-0,094	-0,282**	0,345**	-0,198**	0,406**	0,124	0,556**	-0,113	1								
12	TLB	4,60	1,34	0,075	-0,007	-0,107	-0,512**	0,313**	-0,337**	0,409**	0,230**	0,469**	-0,053	0,412**	1							
13	PCR	4,36	1,87	0,038	-0,271**	-0,012	0,277**	-0,238**	0,217**	-0,178*	0,009	-0,050	-0,040	-0,067	-0,223**	1						
14	PQ	4,95	1,68	0,064	-0,054	-0,007	-0,305**	0,266**	-0,211**	0,375**	0,166*	0,441**	0,021	0,365**	0,323**	-0,118	1					
15	PST	3,85	1,63	0,181*	-0,092	0,079	-0,256**	0,312**	0,007	0,241**	0,407**	0,320**	-0,190*	0,320**	0,273**	0,198**	0,349**	1				
16	PWL	3,76	1,57	-0,040	-0,049	-0,096	0,067	0,235**	-0,084	0,061	0,002	0,135	-0,084	0,350**	0,123	0,308**	0,315**	0,309**	1			
17	ACC	4,66	1,83	0,172*	-0,077*	0,045	-0,329**	0,455**	-0,404**	0,228**	0,286**	0,486**	-0,116	0,470**	0,436**	-0,279**	0,259**	0,206**	0,176*	1		
18	CCC	3,44	1,19	0,004	0,073	0,058	0,028	-0,068	0,122	-0,020	-0,296**	-0,070	0,282**	-0,034	-0,100	-0,064	0,020	0,030	-0,053	-0,183*	1	
19	BSUP	3,51	1,36	0,122	0,013	0,058	-0,476**	0,437**	-0,405**	0,235**	0,251**	0,441**	-0,114	0,401**	0,432**	-0,358**	0,195**	0,259**	0,116	0,756**	-0,099*	1

Notes: *p<0.05, **p<0.01(two-tailed), Gender: 1 = female, MS: 1 = general practitioner, EMP: 1 = employed, LE: 1 = previous Lean experience

Hence, instead of relying on the common, generally applied criteria of Cronbach's alpha > 0.70, we used the more rigorous two-step approach suggested by Graham (2006). To do so, we selected an appropriate model amongst the parallel, Tau-equivalent, essentially Tau-equivalent and congeneric models based on model fit indices and chi-square. Then, by squaring the implied correlation between the composite latent true variable and the composite observed variable, we obtained an estimation of reliability. All values ranged from 0.855 to 0.968. It is important to note that if the Tau-equivalent model is selected, then the reliability that is calculated is coefficient alpha.

Second, we performed a confirmatory factor analysis (CFA) using AMOS 25 to test the validity and composite reliability of the measurement model. Through the maximum likelihood (ML) approach, we verified the construct validity by testing the fit of the measurement model, as well as convergent and discriminant validity. Considering the significant number of measurement variables and limited sample size, results for the measurement model indicate a good fit with a $\chi 2$ of 1750.262 and 1103 degrees of freedom, root mean square error of approximation (RMSEA) = 0.058, comparative fit index (CFI) = 0.912, incremental fit index (IFI) = 0.912, standardized root mean square residual (SRMR) = 0.0691 and expected cross-validation index (ECVI) = 11.3996 smaller than the saturated model (Hair *et al.*, 2006).

The standardized factor loadings of each measurement item were examined in combination with the average variance extracted (AVE) of each latent construct to establish convergent validity. First, the factor loadings are all significant ($p < 0.001$), range from 0.605 to 0.922 and are above the suggested value of 0.5, thus indicating convergent validity (Hair *et al.*, 2006). Second, the latent constructs have AVE values ranging from 0.520 to 0.835. Those values also point to convergent validity since the constructs can account for more than 50% of the items' variance (Ambulkar *et al.*, 2015). We tested for discriminant validity by comparing each construct's square root of AVE with the correlations between each construct. This indicates discriminant validity since the square roots of AVE are bigger than the correlations between all constructs pairs in the measurement model (Fornell and Larcker, 1981). We computed the composite reliability values, which are all above the commonly recognized threshold of 0.70, ranging

from 0.843 to 0.968. The results are presented in table 14, which establish the reliability of the constructs. Table 15 also provides the descriptive statistics and correlations between constructs and variables.

3.4.4. Common Method Bias

To address potential common method bias, we used a combination of separation and statistical strategies. First, we made sure that measures were psychologically separated and that respondents were guaranteed anonymity (Podsakoff *et al.*, 2003). The questions measuring criterion and predictor variables were separated into distinct sections, to ensure that respondents could not easily link targeted measures. Second, we tested for common method bias by using Harman's single factor test (Harman, 1976). The largest explained variance by any single factor was 38.64%. Third, we also performed a CFA using the latent factor test (Podsakoff *et al.*, 2003). To conduct this test, a single latent factor is introduced to the initial measurement model. No loss of significance of the factor loadings was observed, and the model fit was not improved. This indicates minimal common method bias for our study.

3.5. Results and analysis

3.5.1. The structural model

We used structural equation modeling to test the hypotheses shown in figure 7. Table 16 summarizes our conclusions regarding each hypothesis. We started out by testing the complete structural model using AMOS 25 and then used a model-trimming approach (Ullman and Bentler, 2012) by progressively removing non-significant structural paths one at a time and verifying our model fit, all the while controlling for *age*, *gender*, *medical specialty,* and *employment status*. The resulting model is presented in figure 8. The results of the structural analysis yielded good fit statistics: $\chi 2 = 1711{,}959$ df = 1142, IFI = 0.917, CFI = 0.916, RMSEA = 0.053, Standard RMR = 0.0662 and ECVI = 11.885 for the default model versus the saturated model at 15.154. We then proceeded to perform a mediation analysis based on the bootstrapping method at 5000 samples to test our initial hypotheses.

3.5.1.1. Commitment to Change

We tested if our data supported our nested model of commitment to Lean change inspired from Herscovitch and Meyer (2002). It was shown that ACC predicted significantly and positively BSUP ($\beta = 0.796$, $p<0.001$). CCC was shown to correlate negatively and significantly with BSUP ($\beta = -0.093$, $p<0.05$), though its relationship with BSUP was not as strong as that of ACC. This validates past findings present in the literature (Bouckenooghe *et al.*, 2015; Herscovitch and Meyer, 2002). It is also important to note that while many antecedents showed significant Pearson correlations with BSUP (see table 15), these relationships became no-longer statistically significant once the mediator variables were inserted into the model.

3.5.1.2. Pre-change Antecedents

As an *individual characteristic*, LE was found to significantly predict ACC ($\beta = 0.399$, $p<0.001$), but not CCC. We also controlled for age, gender, medical specialty (MS) and employment status (EMP). Age ($\beta = 0.077$, $p<0.05$) and Gender ($\beta = -0.096$, $p<0.05$) correlated significantly with ACC, but not with CCC nor BSUP. MS had no significant relationship with any of the mediator variables and dependent variable. Finally, EMP significantly related to both ACC ($\beta = -0.091$, $p<0.05$) and BSUP ($\beta = -0.154$, $p<0.001$).

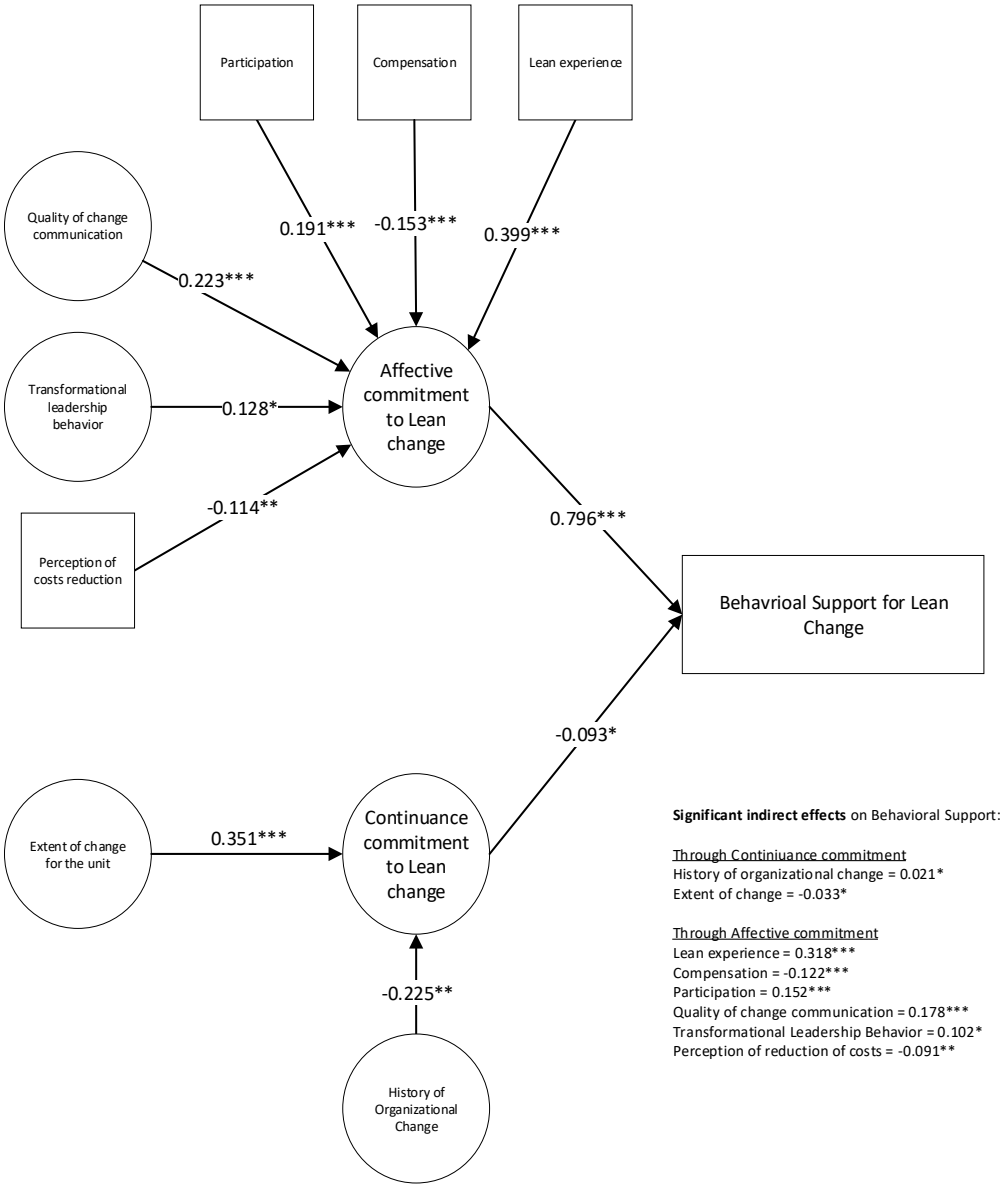
Of the *internal organizational context* variables, only OC was shown to have a significant relationship ($\beta = -0.225$, $p<0.01$) with a mediator variable, CCC. It did not have any significant effect on ACC. OS was excluded from the model because it did not show any significant relationship with the mediator variables.

3.5.1.3. Change Antecedents

Various *change* antecedents were found to have significant relationships with the two commitment to Lean change variables. First, the content of the change proved to influence commitment. EC loaded significantly and positively with CCC ($\beta = 0.351$, $p<0.001$), but it did not, however, relate significantly to ACC.

Second, the *process of change* variables had significant relations with the ACC variable. COMP correlated significantly with ACC ($\beta = -0.153$, $p<0.001$). PART had a significant

and positive relationship with ACC (β = 0.191, p<0.001). CC presented a significant and positive correlation with ACC (β = 0.223, p<0.001). TLB also significantly predicted ACC (β = 0.128, p<0.05). None of the *process of change* variables possessed a significant correlation with the mediator CCC.



Notes: p < 0.05*, p < 0.01**, p < 0.001***
Control variables : Age→ACC (0.077*), Age→CCC (n.s.), Age→BSUP (n.s.), Gender→ACC (-0.096*), Gender→CCC (n.s.), Gender→BSUP (n.s.), MS→ACC (n.s.), MS→CCC (n.s.), MS→BSUP (n.s.), EMP→ACC (-0.091*), EMP→CCC (n.s.), EMP→BSUP (-0.154***),

Figure 8. Structural model of physician behavioral support for Lean change

Of all the *perceived benefits* variables suggested in our theoretical model, only PCR proved to be significant. PQ, PST, and PWL showed no significant correlations with the commitment variables, indicating that H10, H11, and H12 could not be supported. PCR did not predict CCC but displayed a significant and negative relationship with ACC (β = -0.114, $p<0.01$).

3.5.2. Mediation Analysis

We used the bootstrapping method in AMOS 25 to test the mediation relationships of our refined model, following the recommendations of Zhao *et al.* (2010). We found significant indirect effects of antecedents on BSUP. The mediation analysis results are shown in table 16 and the summary of our hypotheses in table 17.

First, the mediating effect of ACC in the relationship between LE and BSUP was significant (β = 0.318, $p<0.001$) with the 95 percent confidence interval (CI) (0.232 to 0.404). There was no direct effect of LE on BSUP, suggesting an indirect-only mediation and supporting H1a. H1b could not be supported since no significant relationship could be found between LE and CCC. H2a and H2b could not be supported since no significant relationships between OS and CCC or ACC could be found.

The indirect effect of OC on BSUP was significant through CCC (β = 0.021, $p<0.05$) with the 95 percent CI (0.001 to 0.041) while no significant direct effect was found, signifying indirect-only mediation and offering support for H3b. H3a, however, could not be supported since no significant relationship between OC and ACC were found.

The mediating effect of CCC in the relationship between EC and BSUP was significant (β = -0.033, $p<0.05$) with the 95 percent CI (-0.068 to -0.002). No direct effect of EC on BSUP was found, suggesting indirect-only mediation in support of H4b. Since no significant correlation between EC and ACC was found, no support for H4a was provided.

The mediating effect of ACC between COMP and BSUP was significant (β = -0.122, $p<0.001$) with the 95 percent CI (-0.189 to -0.055). There was no direct effect of COMP on BSUP, signifying indirect-only mediation. However, the relationship between COMP, ACC, and BSUP proved to be negative, hence contradicting our initial hypothesis H5a.

Furthermore, no support could be found for H5b since no significant relationship between COMP and CCC was identified.

The mediating effect of PART on BSUP, through ACC, was statistically significant (β = 0.152, $p<0.001$) with the 95 percent CI (0.073 to 0.231). No significant direct effect of PART on BSUP was found, signifying indirect-only mediation and indicating support for H6a. No significant effect of PART on CCC could be found, invalidating H6b

The indirect effect between CC and BSUP through ACC was significant (β = 0.178, $p<0.01$) with the 95 percent CI (0.072 to 0.284). There was no significant direct effect of CC on BSUP, meaning indirect-only mediation and supporting H7a. Since no significant effect of CC on CCC was found, no support could be offered for H7b.

The mediating effect of TLB on BSUP through ACC was also statistically significant (β = 0.102, $p<0.05$), with the 95 percent CI (0.014 to 0.190). There was no significant direct effect of TLB on BSUP, implying indirect-only mediation and in support of H8a. Again, because no significant effect of TLB on CCC could be observed, no support was provided for H8b.

The mediation between PCR and BSUP through ACC was significant (β = -0.091, $p<0.05$) with the 95 percent CI (-0.155 to -0.027). No significant direct effect of PCR on BSUP was found, implying indirect-only mediation and supporting H9a. PCR did not correlate significantly with CCC hence, no support was found for H10a.

Finally, none of H10a, H10b, H11a, H11b, H12a, and H12b could be supported because no significant relationships between either ACC or CCC and PQ, PST, and PWL were found.

Table 16. Mediation results based on bootstrapping method (5000 resamples)

Hypothesis	Independent variable (IV)	Mediating variable (M)	Dependent variable (DV)	Direct effect (c)	Effect of IV on M (a)	Effect of M on DV (b)	Standardized indirect effect (aXb)	Standardized total effects (c)	95 percent bootstrap confidence interval for indirect effect.		
H1a	LE	ACC	BSUP	-	0,399***	0,796***	0,318***	0,318***	0,232	to	0,404
H3b	OC	CCC	BSUP	-	-0,225**	-0,093*	0,021*	0,021*	0,001	to	0,041
H4b	EC	CCC	BSUP	-	0,351***	-0,093*	-0,033*	-0,033*	-0,068	to	-0,002
H5a	COMP	ACC	BSUP	-	-0,153***	0,796***	-0,122***	-0,122***	-0,189	to	-0,055
H6a	PART	ACC	BSUP	-	0,191***	0,796***	0,152***	0,152***	0,073	to	0,231
H7a	CC	ACC	BSUP	-	0,223***	0,796***	0,178***	0,178***	0,072	to	0,284
H8a	TLB	ACC	BSUP	-	0,128**	0,796***	0,102*	0,102*	0,014	to	0,190
H9a	PCR	ACC	BSUP	-	-0,114*	0,796***	-0,091*	-0,091*	-0,155	to	-0,027

Notes: *p<0.05; **p<0.01; ***p<0.001 (two-tailed). The model includes the following control variables: age, gender and medical specialty and employment status.

Table 17. Hypotheses summary

Hypothesis		Path	Conclusion
H1	H1a	(+) LE → (+) ACC → (+) BSUP	Supported
	H1b	(-) LE → (+) CCC → (-) BSUP	Not supported
H2	H2a	(+) OS → (+) ACC → (+) BSUP	Not supported
	H2b	(-) OS → (+) CCC → (-) BSUP	Not supported
H3	H3a	(+) OC → (+) ACC → (+) BSUP	Not supported
	H3b	(-) OC → (+) CCC → (-) BSUP	Supported
H4	H4a	(+) EC → (-) ACC → (-) BSUP	Not supported
	H4b	(+) EC → (+) CCC → (-) BSUP	Supported
H5	H5a	(+) COMP → (+) ACC → (+) BSUP	Not Supported
	H5b	(-) COMP → (+) CCC → (-) BSUP	Not supported
H6	H6a	(+) PART → (+) ACC → (+) BSUP	Supported
	H6b	(-) PART → (+) CCC → (-) BSUP	Not supported
H7	H7a	(+) CC → (+) ACC → (+) BSUP	Supported
	H7b	(-) CC → (+) CCC → (-) BSUP	Not supported
H8	H8a	(+) TLB → (+) ACC → (+) BSUP	Supported
	H8b	(-) TLB → (+) CCC → (-) BSUP	Not supported
H9	H9a	(+) PCR → (-) ACC → (-) BSUP	Supported
	H9b	(-) PCR → (+) CCC → (-) BSUP	Not supported
H10	H10a	(+) PQ → (+) ACC → (+) BSUP	Not supported
	H10B	(-) PQ → (+) CCC → (-) BSUP	Not supported
H11	H11a	(+) PST → (+) ACC → (+) BSUP	Not supported
	H11b	(-) PST → (+) CCC → (-) BSUP	Not supported
H12	H12a	(+) PWL → (+) ACC → (+) BSUP	Not supported
	H12b	(-) PWL → (+) CCC → (-) BSUP	Not supported

3.6. Discussion

In our study, we propose a model of physicians' support for Lean change. This model is anchored in organizational change theory, using Herscovitch and Meyer's (2002) seminal model of organizational change commitment and Oreg *et al.*'s (2011) framework of change recipients' reactions to organizational change. We posited that *pre-change* and *change* antecedents could influence physicians' behavioral support of Lean change by being materialized through the organizational change commitment construct. In fine, we hypothesized a mediating effect of antecedents on physicians' behavioral support for Lean change. Our list of hypotheses is available in table 17. Our findings contribute to the ongoing debate and concerns regarding Lean implementation in healthcare and, most

importantly, to the subject of physicians and their interaction with Lean thinking. In this section, we discuss our findings and their implications.

First, our data and subsequent analysis allowed us to identify a strong relationship between ACC and BSUP. This indicates that physicians with a strong emotional belief in the Lean change initiative taking place tend to exhibit positive discretionary behaviors towards it, such as cooperation and championing. This echoes current knowledge developed by past researchers regarding organizational change (Rafferty *et al.*, 2013), where change recipients who develop strong fundamental beliefs in the value of a change tend to show positive support for said change. In fact, the positive relationship between ACC and BSUP has been abundantly and repeatedly demonstrated (Bouckenooghe *et al.*, 2015). However, our understanding of the relationship between CCC and BSUP remains somewhat fuzzy. While some scholars have found significant and negative links between the *continuance* dimension of the commitment construct and discretionary behaviors towards change (Iverson and Buttigieg, 1999; Meyer *et al.*, 2002), others have concluded that the link between CCC and BSUP, while present, remains weak at best (Bouckenooghe *et al.*, 2015) or isn't present at all (Herscovitch and Meyer, 2002). While we did find a significant and negative correlation between CCC and BSUP, the relationship was nowhere near as strong and its ACC counterpart. Hence, our model suggests that ACC's impact on BSUP is much stronger than CCC's, providing support to other scholars' argument that ACC can override CCC (Shin *et al.*, 2015).

Our study also provides interesting evidence regarding *pre-change* antecedents. First, previous experience with Lean change proved to be a significant influencer of the affective commitment dimension, meaning that familiarity with Lean principles, concepts and methods created a positive outlook on Lean from physicians. It did not, however, influence the continuance dimension. The indirect-only mediation of LE on BSUP through ACC shows that LE can have a meaningful impact on physicians' support for Lean. Again, this could prove important for managers going forward.

Second, interesting findings were made regarding the *internal organizational context* and its impact on physicians' support for Lean. While it was found that a poor history of

organizational change (OC) had a significant indirect effect of BSUP through the *continuance* construct, that effect was not strong ($\beta = 0.021$, $p<0.05$). The *history of organizational support* showed no significant influence on physicians' support. This means that physicians' perception of the internal organizational context had very little impact on their support of Lean. Since the organizational context has usually been building long before a change initiative takes place, organizations have little control over it. We would, therefore, argue that no significant influence of this context on physicians' BSUP towards Lean is a good thing, because organizations have little control over it when introducing a change.

The model's *change* antecedents provided a more substantial contribution to physicians' support of Lean initiatives than did *pre-change* antecedents. Recipients' perceived extent of change (EC) induced higher levels of CCC, meaning physicians who believed the change would have important impacts on their work tended to develop higher levels of CCC. However, since CCC's effect on BSUP was not strong, EC's indirect effect on BSUP was also somewhat mitigated. The perceived extent of change did not show any significant influence on ACC, meaning that a Lean initiative's proposition of change to medical practices did not create an emotional response from physicians. This is interesting, as previous research has shown that physicians tend to react strongly towards changes targeting their medical practices (Desbiens, 2016). In our study, it did not contribute largely to physicians' reactions towards Lean.

The more salient effect by *change* antecedents was found through the *affective* dimension's strong effect on behavioral support for Lean change. First, PART had a significant and positive impact on BSUP. The indirect-only mediation of PART on BSUP supported our hypothesis that physicians who are more involved during the change process will tend to support the change more. This corroborates the consensus present in the organizational change literature regarding the involvement of change recipients and how it influences their reactions (Amiot *et al.*, 2006; Coyle-Shapiro, 2002). When change recipients are involved in planning and implementing the change, positive emotions, greater understanding of the meaning of the change and greater behavioral changes are

observed (Bartunek *et al.*, 2006). Physicians are, therefore, with regards to participation, not inherently different than other change recipients.

Second, our model shows that *change management* played an important role in favoring support for Lean change from physicians. More specifically, the way organizations communicated (CC) with physicians about the change and the transformational leadership behaviors (TLB) they exhibited proved quite influential to physicians' support of Lean. Both CC and TLB had significant and positive indirect-only effects on BSUP through ACC. This conclusion emphasizes the importance of good, frequent communication about Lean change to physicians. Providing accurate information to change recipients has been repeatedly proven to create positive feelings and behaviors towards change from change recipients (Axtell *et al.*, 2002), while the lack of communication has been shown to diminish recipients' beliefs in the value of a change (Schweiger and Denisi, 1991). Lean experts advocate *transformational leadership* as a building block for successful Lean implementation (Liker and Convis, 2011). In our model, TLB is significantly related to the affective dimension of the commitment construct (ACC). TLB also had a positive and significant influence on BSUP, through an indirect-only mediating effect. This conclusion highlights the positive impact of TLB on physicians' support for Lean change and supports such propositions from scholars and practitioners (Toussaint *et al.*, 2017). What is even more interesting about these results is that this is the first time TLB has been quantitatively linked to increased support for Lean from physicians.

Interestingly, compensating physicians for their involvement in Lean change proved detrimental to BSUP. Our initial hypothesis on COMP was contradicted by the data. COMP, through indirect-only mediation, proved to have a negative effect on physicians' support for Lean change, meaning that compensating physicians outside of their regular salary or compensation scheme proved detrimental towards influencing their commitment to Lean change. At first sight, this might appear to forego the conventional wisdom of "rewards and punishments". But it is important to remember that physicians are unique "creatures", for use of a better word. Their main motivations often lie outside the realm of financial benefits and more towards their status as medical professionals, the medical profession itself and their obligations towards their patients (Dent, 2003). Our findings

echo those of McDonald and Roland (2009), who concluded that physicians often did not respond well to financial incentives. As they argue, external rewards might damage the intrinsic motivation (Amabile *et al.*, 1976) of physicians to undertake a task for its own sake, ultimately doing more harm than good. Incentivizing participation through financial-type rewards implies that such reward is necessary to induce the desired change. As McDonald and Roland (2009) state, and as proposed by Frey's (1997) "not just for the money" theory of personal motivation: "physicians are not only driven by money".

Finally, still regarding *change* antecedents, the perceived benefits of a Lean initiative did not influence physicians' support as much as we had initially thought. Perceived benefits to the quality of care, to patient satisfaction and to the quality of working life did not present any significant relations with the dimensions of the commitment construct. This is interesting, as the literature on physicians and organizational change has emphasized perceived benefits as an important component of medical support for change (Lorden *et al.*, 2014). Nevertheless, if physicians believed the Lean change initiative's objective was to reduce costs, they showed lower levels of support for it, as shown by PCR's significant indirect-only mediation effect on BSUP. This result resonates with conclusions made by researchers in that Lean implementation in healthcare tends to fail when it focuses mostly on efficiency, productivity and cost reduction (Radnor *et al.*, 2012).

In our study, we controlled for four individual characteristics: *age*, *gender*, *medical specialty* (MS) and *employment status* (EMP). None of the aforementioned variables showed any significant effect on the *continuance* dimension of the commitment construct. *Age, gender* and *employment status* showed significant ($p < 0.05$), albeit quite small, effects on the *affective* dimension. Various authors have discussed age (Bordia *et al.*, 2004a; Kiefer, 2005) and gender (Armstrong-Stassen, 1998) as components of change recipients' reactions to change. However, there is no consensus in the literature as to whether older or younger physicians tend to show higher support for Lean change (Fournier and Jobin, 2018a). Male and female change recipients have been shown to react differently to similar change initiatives (Kiefer, 2005). While our data suggest that women, in the case of physicians, appear to more easily develop affective and positive feelings towards Lean change, that relationship is not particularly strong according to our

results. Scholars have argued that general practitioners tend to engage more easily in quality improvement approaches than specialists (Mathie, 1997). In our data, however, MS did not show any significant relationship with the mediator and dependent variables.

Interestingly, EMP showed a significant and negative relationship ($\beta = -0.154$, $p<0.001$) with BSUP for Lean, meaning that independent workers showed lower levels of support for Lean than did employed physicians. We tested for the moderation of EMP on the relationship between both commitment dimensions, ACC and CCC, and the behavioral support construct but could not find any significant influence of the interaction terms. Nonetheless, the significant relationship between EMP and BSUP is interesting. In the past, full-time employees have been shown to support organizational change more than contract or part-time workers (Martin *et al.*, 2005). This notion is interesting because, in many healthcare organizations, physicians are independent workers. Combined with the already high degree of power and influence they possess, work independence can complicate managerial decisions even more. In fact, in countries such as Canada, physicians are almost exclusively independent workers paid directly by the government. Further research needs to be done in order to investigate whether our findings in the USA can translate into other jurisdictions. However, knowing that independently-working physicians showed lower levels of engagement with Lean change than employed physicians could have serious policy and managerial implications.

Overall, it is interesting to observe how *change* antecedents contributed significantly to physicians' behavioral support for Lean change, most of which did so by materializing through a fundamental belief in the value of the change (ACC). Yet, *pre-change* antecedents related to the internal organizational context had little to no impact on such support. Other than previous experience with Lean, *pre-change* antecedents exhibited minimal contributions to support from physicians towards Lean. The histories of support and change did little to influence physicians' response to Lean change. On the other hand, *Lean experience, compensation, participation, quality of change communication, transformational leadership behavior* and the *perception of cost reduction* are all antecedents upon which an organization can act, providing ample opportunities to positively influence physicians' engagement towards Lean change. *In fine*, our model

shows that healthcare organizations can activate various levers to influence physicians' engagement towards Lean.

3.6.1. Managerial Implications

The findings from our study should prove helpful for managers in healthcare organizations undergoing or thinking about Lean implementation. Physicians are at the heart of such organizations and having a better understanding of their interactions with Lean change could certainly provide meaningful contributions to their endeavors. Our results have highlighted specific areas of concern managers and Lean practitioners should pay close attention to. The impact Lean training has on physicians' initial reactions towards Lean cannot be understated. Organizations should deploy efforts to inform and provide basic training to physicians with regards to the origins of Lean, its methods, tools, and principles, as well as the challenges Lean implementation in healthcare presents. We believe managers should emphasize the need for the adaptation of Lean to the healthcare context and not merely advocate a "copy and paste" approach to Lean manufacturing. When Lean initiatives are to be launched, organizations should, for example, organize formal and informal training sessions where physicians can learn about Lean and ask questions to seasoned practitioners. Such practices are already employed by mature Lean hospitals (Jobin and Lagacé, 2014).

Healthcare managers should also take notice of their own discourse regarding Lean and their motivations for using it. Using Lean for cost reduction, as shown by our findings and corroborated by the literature, has a chance of negatively impacting physicians' support of Lean change. We recommend that healthcare organizations do not use Lean as a simple conduit to increased efficiency. In fact, and as argued by scholars and practitioners alike (Liker and Convis, 2011; Samuel *et al.*, 2015; Womack and Jones, 2015), the essence of Lean has nothing to do with cost reduction. It is about value appropriation and constant experimentation. As was demonstrated by other researchers, financial benefits can result from Lean implementation, but they will be indirect effects of improvements to quality, safety, as well as patient and employee satisfaction (Cammisa *et al.*, 2011).

Furthermore, conventional managerial thinking can lead decision-makers to adopt traditional means of "rewards and punishments" to influence physicians' behaviors towards Lean change. Our findings show that, for example, compensating physicians specifically for their participation in a Lean change initiative can actually be counterproductive and lead them not to support the change. This has also been mentioned in previous studies (Callister and Wall Jr, 2001). As we discussed previously, organizations should not look at financial incentives as conductors of medical engagement towards Lean. Not only are financial rewards potentially detrimental to medical engagement in Lean initiatives, there are also much more impactful means of influencing commitment and overcoming resistance (Lorden *et al.*, 2014).

Our findings show how the change process itself is probably the greatest contributor to physicians' support for Lean. We believe this is important for managers. First, physicians need to be involved in the planning and implementation of Lean change. They should be an integral part of the decision-making process and not merely be sporadically informed about the change, which is a practice all too common in healthcare organizations (Jobin and Lagacé, 2014). While involving physicians in the change process could lead to tensions and debates, especially due to their status and power, the benefits of doing so outweigh these consequences, as highlighted by our findings.

Second, organizations should pay attention to their change management competencies. As our findings emphasize, communication and leadership are crucial aspects influencing physicians' engagement in Lean transformations. Managers should properly assess their competencies in the matter and deploy appropriate efforts to improve potential deficiencies. Lean initiatives would benefit from a structured communication plan to ensure accurate information is disseminated to physicians across the organization. The choice of the change agent(s) is also key. Such individual(s) should be able to exhibit strong transformational leadership behaviors by engaging physicians and other professionals towards common goals. Ultimately, implementing Lean successfully is about properly managing change.

Our findings also bring to light an important consideration for policy-makers as well as managers. In certain jurisdictions, physicians are mostly independent workers essentially paid as subcontractors. Our study found that employment status significantly related to behavioral support levels of physicians, where physicians employed by their organization tended to show a higher level of support for Lean change than did independent workers. While it is not guaranteed that our results can translate outside the USA, they are nonetheless interesting and can contribute to ongoing discussions and debates related to physicians' role in various healthcare systems. Large-scale studies are currently underway in Canada, notably, in the hopes of better understanding how physicians' employment status and remuneration influence healthcare system performance (Contandriopoulos and Brouselle, 2018).

3.7. Conclusion

The goal of this study was to further develop knowledge on how physicians engage in Lean change initiatives. We extend the literature on this subject as well as provide a contribution to the wider literature on physicians as organizational actors. Physicians have proven difficult to study, especially using quantitative research methods (Kellerman and Herold, 2001). We believe this is one of the main contributions of our research, in that we were able to provide a significant and conclusive quantitative perspective of physicians' interactions with organizational change and in this particular case, Lean transformations.

By using a theoretical model grounded in a highly regarded literature, we believe our findings contribute positively to the study of Lean in healthcare. We used Herscovitch and Meyer's (2002) seminal model of organizational change commitment and combined it with Oreg *et al.*'s (2011) detailed framework of change recipients' reactions to organizational change to develop mediation hypotheses of antecedents' influence on physicians' support for Lean change. The conceptual model we proposed was used to create a measurement instrument (survey) that was distributed to physicians in healthcare organizations across the USA. We validated the measurement model using CFA all the while assessing reliability and validity. We then used structural equation modeling to test our conceptual model and its hypotheses. We refined our model by focusing on the significant statistical relationships that could be identified.

This study demonstrates that most antecedents, *pre-change* or *change related*, do not directly impact physicians' behavioral support for Lean change. They do, however, have an indirect effect on it through the organizational change commitment construct. Most notably, antecedents related to the process of change were found to be the biggest contributors to medical support for Lean. Through the *affective* dimension of the commitment construct, *Lean experience*, *participation*, *quality of change communication*, *transformational leadership behavior* and *perceived benefits related to cost reductions* all had significant indirect-only effects on the behavioral support for Lean change of physicians. Our findings also demonstrated that physicians are not influenced by traditional financial rewards often used by managers to stimulate engagement towards Lean change. In fact, this method is counterproductive when it comes to physicians. Interestingly, we found that the perceived internal organizational context had little to no effect on physicians' reaction towards Lean.

The results of this research also have managerial implications and should help healthcare organizations better engage physicians in their Lean initiatives. By focusing on training physicians with regards to Lean and on improving their change management competencies, healthcare organizations should be more successful in engaging physicians. Managers should also ensure the fundamental reasons for adopting Lean are not related to cost reduction, as this is usually detrimental in engaging medical professionals. Finally, our findings regarding the employment status of physicians and their support of Lean change offers an interesting contribution for policy-makers and managers currently debating how physicians are being remunerated.

As with any research, some limitations should be noted. First, the analysis performed in this study used cross-sectional data, which can limit the ability to conclude on causality. Hence, future research would benefit from other types of data, such as longitudinal data or case studies. Scholars should study, for example, how medical support for Lean evolves over an organization's entire implementation process and what events can potentially contribute to the increase or decay of physicians' support for Lean. Also, the target population of this study was physicians performing medicine in American hospitals. It is not currently possible for us to assert that our findings would translate to other

jurisdictions, such as those with public healthcare systems. However, we are currently collecting data from other countries with which we intend to perform comparative analyses. This could prove interesting, in that it would allow us to conclude on the generalizability of our findings or lack thereof. Finally, though scholars continue to advocate high levels of medical engagement for successful Lean implementation, it would be of great interest to empirically study if the highest levels of support are truly required from physicians for Lean change to truly take place in healthcare, or if their support can be just as effective with mid-level supporting behaviors.

References

Amabile, Teresa M, William DeJong and Mark R Lepper (1976). 'Effects of externally imposed deadlines on subsequent intrinsic motivation', *Journal of Personality and Social Psychology*, vol. 34, no 1, pp. 92.

Ambulkar, Saurabh, Jennifer Blackhurst and Scott Grawe (2015). 'Firm's resilience to supply chain disruptions: Scale development and empirical examination', *Journal of Operations Management*, vol. 33, pp. 111-122.

Amiot, Catherine E, Deborah J Terry, Nerina L Jimmieson and Victor J Callan (2006). 'A longitudinal investigation of coping processes during a merger: Implications for job satisfaction and organizational identification', *Journal of Management*, vol. 32, no 4, pp. 552-574.

Andersson, Roy, Henrik Eriksson and Håkan Torstensson (2006). *Similarities and differences between TQM, Six Sigma and Lean, The TQM Magazine*, vol. 18, 282-296 p.

Armenakis, Achilles A, Jeremy B Bernerth, Jennifer P Pitts and H Jack Walker (2007). 'Organizational change recipients' beliefs scale: Development of an assessment instrument', *The Journal of Applied Behavioral Science*, vol. 43, no 4, pp. 481-505.

Armstrong-Stassen, Marjorie (1998). 'The effect of gender and organizational level on how survivors appraise and cope with organizational downsizing', *The Journal of Applied Behavioral Science*, vol. 34, no 2, pp. 125-142.

Armstrong, J. Scott and Terry S. Overton (1977). 'Estimating Nonresponse Bias in Mail Surveys', *Journal of Marketing Research*, vol. 14, no 3, pp. 396-402.

Axtell, Carolyn, Toby Wall, Chris Stride, Kathryn Pepper, Chris Clegg, Peter Gardner, *et al.* (2002). 'Familiarity breeds content: The impact of exposure to change on employee openness and well-being', *Journal of Occupational and Organizational Psychology*, vol. 75, no 2, pp. 217-231.

Barnas, Kim (2011). 'ThedaCare's business performance system: sustaining continuous daily improvement through hospital management in a lean environment', *Joint Commission Journal on Quality and Patient Safety*, vol. 37, no 9, pp. 387-399.

Bartunek, Jean M, Danna N Greenberg and Barbara Davidson (1999). 'Consistent and inconsistent impacts of a teacher-led empowerment initiative in a federation of schools', *The Journal of Applied Behavioral Science*, vol. 35, no 4, pp. 457-478.
Bartunek, Jean M, Denise M Rousseau, Jenny W Rudolph and Judith A DePalma (2006). 'On the receiving end: Sensemaking, emotion, and assessments of an organizational change initiated by others', *The Journal of Applied Behavioral Science*, vol. 42, no 2, pp. 182-206.
Bateman, Nicola, Peter Hines and Peter Davidson (2014). 'Wider applications for Lean', *International Journal of Productivity and Performance Management*, vol. 63, no 5, pp. 550-568.
Battilana, Julie and Tiziana Casciaro (2012). 'Change agents, networks, and institutions: A contingency theory of organizational change', *Academy of Management Journal*, vol. 55, no 2, pp. 381-398.
Bordia, Prashant, Elizabeth Hobman, Elizabeth Jones, Cindy Gallois and Victor J Callan (2004a). 'Uncertainty during organizational change: Types, consequences, and management strategies', *Journal of Business and Psychology*, vol. 18, no 4, pp. 507-532.
Bordia, Prashant, Elizabeth Hunt, Neil Paulsen, Dennis Tourish and Nicholas DiFonzo (2004b). 'Uncertainty during organizational change: Is it all about control?', *European Journal of Work and Organizational Psychology*, vol. 13, no 3, pp. 345-365.
Bordia, Prashant, Simon Lloyd D Restubog, Nerina L Jimmieson and Bernd E Irmer (2011). 'Haunted by the past: Effects of poor change management history on employee attitudes and turnover', *Group & Organization Management*, vol. 36, no 2, pp. 191-222.
Bouckenooghe, Dave, Gavin M. Schwarz and Amirali Minbashian (2015). 'Herscovitch and Meyer's three-component model of commitment to change: Meta-analytic findings', *European Journal of Work and Organizational Psychology*, vol. 24, no 4, pp. 578-595.
Burgess, N. and Z. Radnor (2013). 'Evaluating Lean in healthcare', *International Journal Health Care Quality Assurance*, vol. 26, no 3, pp. 220-235.
Cabana, M. D., C. S. Rand and N. R. Powe (1999). 'Why don't physicians follow clinical practice guidelines? A framework for improvement', *Journal of the American Medical Association*, vol. 282, no 15, pp. 1458-1465.
Caldwell, Steven D, David M Herold and Donald B Fedor (2004). 'Toward an understanding of the relationships among organizational change, individual differences, and changes in person-environment fit: a cross-level study', *Journal of Applied Psychology*, vol. 89, no 5, pp. 868.
Callister, Ronda Roberts and James A Wall Jr (2001). 'Conflict across organizational boundaries: Managed care organizations versus health care providers', *Journal of Applied Psychology*, vol. 86, no 4, pp. 754.
Cammisa, Chris, Gregory Partridge, Cynthia Ardans, Katrina Buehrer, Ben Chapman and Howard Beckman (2011). 'Engaging Physicians in Change: Results of a Safety Net Quality Improvement Program to Reduce Overuse', *American Journal of Medical Quality*, vol. 26, no 1, pp. 26-33.

Champy, Jim and Harry Greenspun (2010). *Reengineering health care: A manifesto for radically rethinking health care delivery*, Pearson Education.
Cheng, Y., A. Chaudhuri and S. Farooq (2016). 'Interplant coordination, supply chain integration, and operational performance of a plant in a manufacturing network: a mediation analysis', *Supply Chain Management-an International Journal*, vol. 21, no 5, pp. 550-568.
Contandriopoulos, Damien and ASTRID Brouselle (2018). *Analyse des impacts de la rémunération des médecins sur leur pratique et la performance du système de santé au Québec*, Université de Montréal.
Costa, Luana Bonome Message and Moacir Godinho Filho (2016). 'Lean healthcare: review, classification and analysis of literature', *Production Planning & Control*, vol. 27, no 10, pp. 823-836.
Coyle-Shapiro, Jacqueline (1999). 'Employee participation and assessment of an organizational change intervention a three-wave study of total quality management', *The Journal of Applied Behavioral Science*, vol. 35, no 4, pp. 439-456.
Coyle-Shapiro, Jacqueline AM. (2002). 'Changing employee attitudes: The independent effects of TQM and profit sharing on continuous improvement orientation', *The Journal of Applied Behavioral Science*, vol. 38, no 1, pp. 57-77.
Coyle-Shapiro, Jacqueline AM. and Paula C Morrow (2003). 'The role of individual differences in employee adoption of TQM orientation', *Journal of Vocational Behavior*, vol. 62, no 2, pp. 320-340.
Daly, Joseph P (1995). 'Explaining changes to employees: The influence of justifications and change outcomes on employees' fairness judgments', *The Journal of Applied Behavioral Science*, vol. 31, no 4, pp. 415-428.
de Souza, Luciano B (2009). 'Trends and approaches in lean healthcare', *Leadership in Health Services*, vol. 22, no 2, pp. 121-139.
de Souza, Luciano B and Michael Pidd (2011). 'Exploring the barriers to lean health care implementation', *Public Money & Management*, vol. 31, no 1, pp. 59-66.
Denis, Jean-Louis, Yann Hébert, Ann Langley, Daniel Lozeau and Louise-Hélène Trottier (2002). 'Explaining diffusion patterns for complex health care innovations', *Healthcare Management Review*, vol. 27, no 3, pp. 60-73.
Dent, Mike (2003). 'Managing doctors and saving a hospital: Irony, rhetoric and actor networks', *Organization*, vol. 10, no 1, pp. 107-127.
Desbiens, Geneviève (2016). *Le microcontexte politique et l'amélioration des processus: la routine chirurgicale d'un bloc opératoire*, Dissertation/Thesis, H. E. C. Montréal.
Dillman, Don A (2011). *Mail and Internet surveys: The tailored design method--2007 Update with new Internet, visual, and mixed-mode guide*, John Wiley & Sons.
Eisenberger, Robert, Jim Cummings, Stephen Armeli and Patrick Lynch (1997). 'Perceived organizational support, discretionary treatment, and job satisfaction', *Journal of Applied Psychology*, vol. 82, no 5, pp. 812-820.
Farand, Lambert, François Champagne, Arthur Amyot, Jean-Louis Denis and André-Pierre Contandriopoulos (1999). 'Évaluation de la réforme des services psychiatriques destinés aux adultes au pavillon Albert-Prévost 1', *Santé mentale au Québec*, vol. 24, no 2, pp. 90-125.

Fedor, Donald B, Steven Caldwell and David M Herold (2006). 'The effects of organizational changes on employee commitment: A multilevel investigation', *Personnel Psychology*, vol. 59, no 1, pp. 1-29.
Fine, Benjamin A, Brian Golden, Rosemary Hannam and Dante Morra (2009). 'Leading lean: a Canadian healthcare leader's guide', *Healthcare Quarterly*, vol. 12, no 3, pp. 32-41.
Fornell, Claes and David F Larcker (1981). 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, pp. 39-50.
Fournier, Pierre-Luc, Nadia Benormar and Marie-Hélène Jobin (2016). 'Mesurer l'impact du Lean sur la performance : leçons apprises auprès de trois établissements de santé du Québec', communication présentée au *GISEH 2016*, Casablanca, Morocco.
Fournier, Pierre-Luc and Marie-Hélène Jobin (2018a). 'Medical commitment to Lean: an inductive model development', *Leadership in Health Services*, vol. 31, no 3, pp. 326-342.
Fournier, Pierre-Luc and Marie-Hélène Jobin (2018b). 'Understanding before implementing: the context of Lean in public healthcare organizations', *Public Money & Management*, vol. 38, no 1, pp. 37-44.
Freidson, Eliot (1984). 'The changing nature of professional control', *Annual Review of Sociology*, vol. 10, no 1, pp. 1-20.
Frey, Bruno S (1997). *Not just for the money*, vol. 748, Citeseer.
Fullerton, Rosemary R., Frances A. Kennedy and Sally K. Widener (2014). 'Lean manufacturing and firm performance: The incremental contribution of lean management accounting practices', *Journal of Operations Management*, vol. 32, no 7–8, pp. 414-428.
Fullerton, Rosemary R., Cheryl S. McWatters and Chris Fawson (2003). 'An examination of the relationships between JIT and financial performance', *Journal of Operations Management*, vol. 21, no 4, pp. 383-404.
Giaimo, Susan (2009). *Markets and medicine: the politics of health care reform in Britain, Germany, and the United States*, University of Michigan Press.
Gilgun, Jane F (1995). 'We shared something special: The moral discourse of incest perpetrators', *Journal of Marriage and the Family*, pp. 265-281.
Goldstein, Susan Meyer and Peter T Ward (2004). 'Performance effects of physicians' involvement in hospital strategic decisions', *Journal of Service Research*, vol. 6, no 4, pp. 361-372.
Graban, Mark (2011). *Lean hospitals: improving quality, patient safety, and employee satisfaction*, CRC Press.
Graham, James M (2006). 'Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them', *Educational and Psychological Measurement*, vol. 66, no 6, pp. 930-944.
Harman, Harry H (1976). *Modern factor analysis*, University of Chicago Press.
Harris, Jeffrey E. (1977). 'The Internal Organization of Hospitals: Some Economic Implications', *The Bell Journal of Economics*, vol. 8, no 2, pp. 467-482.

Herscovitch, Lynne and John P Meyer (2002). 'Commitment to organizational change: extension of a three-component model', *Journal of Applied Psychology*, vol. 87, no 3, pp. 474.
Hines, Peter, Matthias Holweg and Nick Rich (2004). 'Learning to evolve: a review of contemporary lean thinking', *International Journal of Operations & Production Management*, vol. 24, no 10, pp. 994-1011.
Iverson, Roderick D and Donna M Buttigieg (1999). 'Affective, normative and continuance commitment: can the 'right kind'of commitment be managed?', *Journal of Management Studies*, vol. 36, no 3, pp. 307-333.
Jobin, M.-H. and Denis Lagacé (2014). 'La démarche Lean en santé et services sociaux au Québec: comment mesurer la maturité des établissements', *Gestion*, vol. 39, no 3, pp. 116-127.
Johnson, John R, Michael J Bernhagen, Vernon Miller and Mike Allen (1996). 'The role of communication in managing reductions in work force'.
Jones, Renae A, Nerina L Jimmieson and Andrew Griffiths (2005). 'The impact of organizational culture and reshaping capabilities on change implementation success: The mediating role of readiness for change', *Journal of Management Studies*, vol. 42, no 2, pp. 361-386.
Judge, Timothy A, Carl J Thoresen, Vladimir Pucik and Theresa M Welbourne (1999). 'Managerial coping with organizational change: A dispositional perspective', *Journal of Applied Psychology*, vol. 84, no 1, pp. 107.
Kellerman, Scott E. and Joan Herold (2001). 'Physician response to surveys: A review of the literature', *American Journal of Preventive Medicine*, vol. 20, no 1, pp. 61-67.
Kellogg, Katherine C (2009). 'Operating room: Relational spaces and microinstitutional change in surgery', *American Journal of Sociology*, vol. 115, no 3, pp. 657-711.
Kenney, Charles (2012). *Transforming health care: Virginia Mason Medical Center's pursuit of the perfect patient experience*, CRC Press.
Kiefer, Tina (2005). 'Feeling bad: Antecedents and consequences of negative emotions in ongoing change', *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, vol. 26, no 8, pp. 875-897.
Krafcik, John F (1988). 'Triumph of the lean production system', *MIT Sloan Management Review*, vol. 30, no 1, pp. 41.
Light, Donald (2000). 'The medical profession and organizational change', *The Handbook of Medical Sociology*.
Liker and Gary L Convis (2011). *The Toyota Way To Lean Leadership: Achieving And Sustaining Excellence Through Leadership Development Author: Jeffrey Lik*.
Liker, Jeffrey K, Gary L Convis and Jim Meskimen (2012). *The Toyota way to lean leadership: achieving and sustaining excellence through leadership development*, McGraw-Hill.
Lin, Zhiang and Hui Chun (1999). 'Should lean replace mass organization systems? A comparative examination from a management coordination perspective', *Journal of International Business Studies*, vol. 30, no 1, pp. 45-80.

Lorden, Andrea L., Yichen Zhang, Szu-Hsuan Lin and Murray J. Côté (2014). 'Measure is of Success: The Role of Human Factors in Lean Implementation in Healthcare', *The Quality Management Journal*, vol. 21, no 3, pp. 26-37.
MacKenzie, Scott B, Philip M Podsakoff and Gregory A Rich (2001). 'Transformational and transactional leadership and salesperson performance', *Journal of the Academy of Marketing Science*, vol. 29, no 2, pp. 115-134.
Martin, Angela J, Elizabeth S Jones and Victor J Callan (2005). 'The role of psychological climate in facilitating employee adjustment during organizational change', *European Journal of Work and Organizational Psychology*, vol. 14, no 3, pp. 263-289.
Mathie, Antonina (1997). 'Doctors and change', *Journal of Management in Medicine*, vol. 11, no 6, pp. 342-356.
Mazzocato, Pamela, Carl Savage, Mats Brommels, Håkan Aronsson and Johan Thor (2010). 'Lean thinking in healthcare: a realist review of the literature', *Quality and Safety in Health Care*, vol. 19, no 5, pp. 376-382.
McDonald, Ruth and Martin Roland (2009). 'Pay for Performance in Primary Care in England and California: Comparison of Unintended Consequences', *The Annals of Family Medicine*, vol. 7, no 2, pp. 121-127.
McNulty, Terry and Ewan Ferlie (2002). *Reengineering health care: the complexities of organizational transformation*, OUP Oxford.
McNulty, Terry and Ewan Ferlie (2004). 'Process transformation: Limitations to radical organizational change within public service organizations', *Organization Studies*, vol. 25, no 8, pp. 1389-1412.
Meyer, John P and Natalie J Allen (1991). 'A three-component conceptualization of organizational commitment', *Human Resource Management Review*, vol. 1, no 1, pp. 61-89.
Meyer, John P, David J Stanley, Lynne Herscovitch and Laryssa Topolnytsky (2002). 'Affective, continuance, and normative commitment to the organization: A meta-analysis of antecedents, correlates, and consequences', *Journal of Vocational Behavior*, vol. 61, no 1, pp. 20-52.
Miller, Vernon D, John R Johnson and Jennifer Grau (1994). 'Antecedents to willingness to participate in a planned organizational change'.
Moraros, John, Mark Lemstra and Chijioke Nwankwo (2016). 'Lean interventions in healthcare: do they actually work? A systematic literature review', *International Journal for Quality in Health Care*, vol. 28, no 2, pp. 150-165.
Oreg, Shaul (2006). 'Personality, context, and resistance to organizational change', *European Journal of Work and Organizational Psychology*, vol. 15, no 1, pp. 73-101.
Oreg, Shaul, Maria Vakola and Achilles Armenakis (2011). 'Change recipients' reactions to organizational change: A 60-year review of quantitative studies', *The Journal of Applied Behavioral Science*, vol. 47, no 4, pp. 461-524.
Pettersen, Jostein (2009). 'Defining lean production: some conceptual and practical issues', *TQM Journal*, vol. 21, no 2, pp. 127-142.
Pierce, Jon L and Randall B Dunham (1992). 'The 12-hour work day: A 48-hour, eight-day week', *Academy of Management Journal*, vol. 35, no 5, pp. 1086-1098.

Podsakoff, Philip M, Scott B MacKenzie and William H Bommer (1996). 'Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship behaviors', *Journal of Management*, vol. 22, no 2, pp. 259-298.

Podsakoff, Philip M, Scott B MacKenzie, Jeong-Yeon Lee and Nathan P Podsakoff (2003). 'Common method biases in behavioral research: A critical review of the literature and recommended remedies', *Journal of Applied Psychology*, vol. 88, no 5, pp. 879-903.

Pynoo, Bram, Pieter Devolder, Wouter Duyck, Johan van Braak, Bart Sijnave and Philippe Duyck (2012). 'Do hospital physicians' attitudes change during PACS implementation? A cross-sectional acceptance study', *International Journal of Medical Informatics*, vol. 81, no 2, pp. 88-97.

Radnor, ZJ, R Davies and N Burgess (2009). 'How much lean are English hospitals implementing', *National Health Executive*, no September/October, pp. 60-62.

Radnor, Zoe J., Matthias Holweg and Justin Waring (2012). 'Lean in healthcare: The unfilled promise?', *Social Science & Medicine*, vol. 74, no 3, pp. 364-371.

Rafferty, Alannah E and Mark A Griffin (2006). 'Perceptions of organizational change: A stress and coping perspective', *Journal of Applied Psychology*, vol. 91, no 5, pp. 1154.

Rafferty, Alannah E, Nerina L Jimmieson and Achilles A Armenakis (2013). 'Change Readiness', *Journal of Management*, vol. 39, no 1, pp. 110-135.

Rother, Mike (2010). *Toyota Kata: Managing people for improvement, adaptiveness, and superior results*, McGraw Hill New York, NY.

Rubin, Robert S, David C Munz and William H Bommer (2005). 'Leading from within: The effects of emotion recognition and personality on transformational leadership behavior', *Academy of Management Journal*, vol. 48, no 5, pp. 845-858.

Samuel, Donna, Pauline Found and Sharon J. Williams (2015). 'How did the publication of the book The Machine That Changed The World change management thinking? Exploring 25 years of lean literature', *International Journal of Operations & Production Management*, vol. 35, no 10, pp. 1386-1407.

Schweiger, David M and Angelo S Denisi (1991). 'Communication with employees following a merger: A longitudinal field experiment', *Academy of Management Journal*, vol. 34, no 1, pp. 110-135.

Shin, Jiseon, Myeong-Gu Seo, Debra L. Shapiro and M. Susan Taylor (2015). 'Maintaining Employees' Commitment to Organizational Change: The Role of Leaders' Informational Justice and Transformational Leadership', *The Journal of Applied Behavioral Science*, vol. 51, no 4, pp. 501-528.

Shortell, Stephen M, Janet C Blodgett, Thomas G Rundall and Peter Kralovec (2018). 'Use of Lean and Related Transformational Performance Improvement Systems in Hospitals in the United States: Results From a National Survey', *Joint Commission Journal on Quality and Patient Safety*.

Shortell, Stephen M, Daniel Z Levin, James LO Brien and Edward FX Hughes (1995). 'Assessing the evidence on CQI: Is the glass half empty or half full?', *Journal of Healthcare Management*, vol. 40, no 1, pp. 4.

Soriano-Meier, Horacio and Paul L Forrester (2002). 'A model for evaluating the degree of leanness of manufacturing firms', *Integrated Manufacturing Systems*, vol. 13, no 2, pp. 104-109.
Spear, Steven and H Kent Bowen (1999). 'Decoding the DNA of the Toyota production system', *Harvard Business Review*, vol. 77, pp. 96-108.
Stanley, David J, John P Meyer and Laryssa Topolnytsky (2005). 'Employee cynicism and resistance to organizational change', *Journal of Business and Psychology*, vol. 19, no 4, pp. 429-459.
Toussaint, John, John E Billi and Mark Graban (2017). *Lean for Doctors*, Catalysis.
Tucker, Anita L. and Sara J. Singer (2015). 'The Effectiveness of Management-By-Walking-Around: A Randomized Field Study', *Production and Operations Management*, vol. 24, no 2, pp. 253-271.
Ullman, Jodie B and Peter M Bentler (2012). 'Structural equation modeling', *Handbook of Psychology, Second Edition*, vol. 2.
Weber, Paula S and James E Weber (2001). 'Changes in employee perceptions during organizational change', *Leadership & Organization Development Journal*, vol. 22, no 6, pp. 291-300.
Womack, James P and Daniel T Jones (1996). *Lean thinking: banish waste and create wealth in your corporation*, Simon and Schuster.
Womack, James P and Daniel T Jones (2015). *Lean solutions: how companies and customers can create value and wealth together*, Simon and Schuster.
Womack, James P and Diane Miller (2005). *Going Lean in Health Care*, Institute for Healthcare Improvement Cambridge, MA.
Zhao, Xinshu, John G. Lynch Jr and Qimei Chen (2010). 'Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis' [Article], *Journal of Consumer Research*, vol. 37, no 2, pp. 197-206.
Zimmerer, Linda Williams, Thomas William Zimmerer and Mahmoud M Yasin (1999). 'Overcoming barriers to effectiveness in a health care operational environment: Building on the lessons of American industry', *Health Marketing Quarterly*, vol. 17, no 1, pp. 59-81.

3.8. Appendix

3.9.1. Survey items

History of organizational support

7-point Likert scale from Strongly disagree to Strongly agree

In your experience:
1. This organization cares about my opinions.
2. This organization cares about my well-being.
3. This organization strongly considers my goals and values.
4. Help is available from this organization when I have a problem.
5. This organization would forgive an honest mistake on my part.
6. This organization shows very little concern for me. - R
7. This organization is willing to help me if I need a special favor.

History of organizational change

7-point Likert scale from Strongly disagree to Strongly agree

Thinking about organizational change in general (i.e., restructuring, job reassignment, job rotation, etc.), that you have previously experienced in this organization (not the current changes occurring in this organization). In your experience:
1. Organizational change has been positive.
2. Organizational change has not been properly implemented. - R
3. Past change initiatives have failed to achieve their intended purpose. - R
4. Organizational change has been managed well.
5. Organizational change has had a positive impact on the quality of service delivery.
6. Organizational change has improved organizational performance and effectiveness.
7. Employee opinions were undervalued during organizational change. - R
8. The impact of change on employee well-being was an important consideration.

Extent of change

7-point Likert scale from Strongly disagree to Strongly agree

At the start of this Lean change initiative, I believed:

1. The nature of my work would change.
2. My job responsibilities would change.
3. I would find greater demands placed on me at work.
4. I would be expected to do more work than I used to.

Participation

Throughout this Lean change initiative, how would you qualify your level of involvement?

1. My involvement was limited to being informed about the change taking place.
2. I was consulted when it came time to make decisions.
3. I was involved in the decision-making process from start to finish.

Perceived benefits

7-point Likert scale from Strongly disagree to Strongly agree

The overall objective of this Lean change initiative was to:

1. … improve patient satisfaction.
2. … improve the quality of care.
3. … reduce costs.
4. … improve the quality of working life of our unit.

Quality of change communication

7-point Likert scale from Strongly disagree to Strongly agree

Throughout this Lean change initiative, the official information provided about the change:

1. Kept you informed throughout the change process, even after the official announcement.
2. Addressed your personal concerns regarding the change.
3. Was accurate.
4. Gave as much information as possible.
5. Involved employees in the change process and decisions made.
6. Communicated the reasons for the change.

Transformational leadership behavior

7-point Likert scale from Strongly disagree to Strongly agree

---

Over the course of that Lean change initiative, the Leader* of the change...

*By Leader, we mean the actor responsible for managing the improvement initiative from start to finish.

1. Painted an interesting picture of the future for our group that would follow the change.
2. Had a clear understanding of where we were going.
3. Did not get sidetracked by issues not relevant to the change.
4. Inspired others with his/her plans.
5. Was able to get others committed to his/her vision of the future.
6. Fostered collaboration among workgroups.
7. Encouraged employees and participants to be ‘’team players’’.
8. Got the group to work together for the same goal.
9. Developed a team attitude and spirit among participants and stakeholders.
10. Lead by ‘’doing’’ rather than simply ‘’telling’’.
11. Provided a good model to follow.
12. Led by example.

Affective commitment to change

7-point Likert scale from Strongly disagree to Strongly agree

---

Thinking back on that same Lean change initiative:

1. I believed in the value of this change.
2. This change was a good strategy for this organization.
3. I think that management was making a mistake by introducing this change. - R
4. This change served an important purpose.
5. Things would have been better without this change. - R
6. This change was not necessary. - R

Continuance commitment to change

7-point Likert scale from Strongly disagree to Strongly agree

Thinking back on that same Lean change initiative:

1. I had no choice but to go along with this change.
2. I felt pressure to go along with this change.
3. I had too much at stake to resist this change.
4. It would have been too costly for me to resist this change.
5. It would have been too risky to speak out against this change.
6. Resisting this change was not a viable option for me.

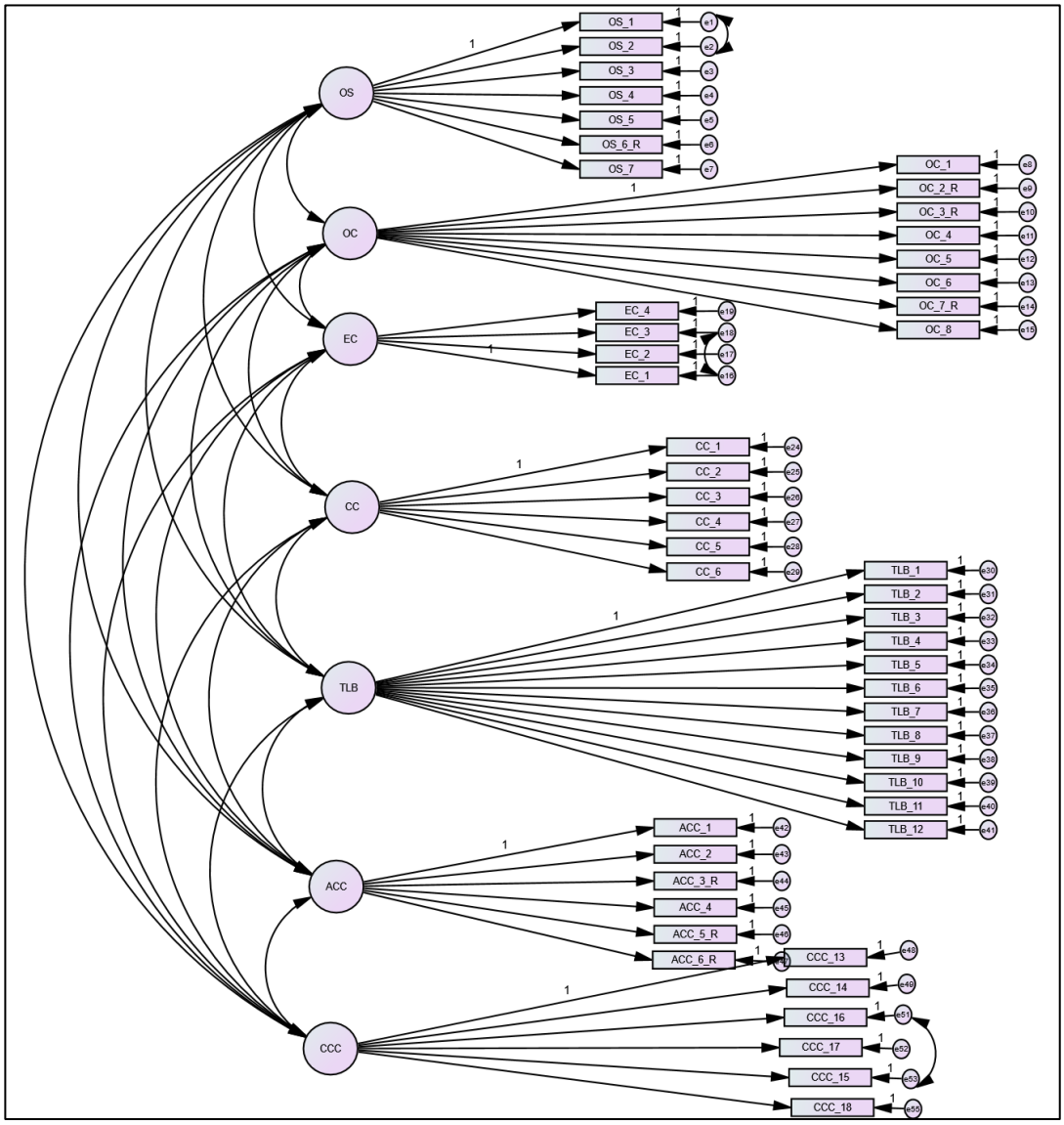
Behavioral support for change

1 to 5 scale

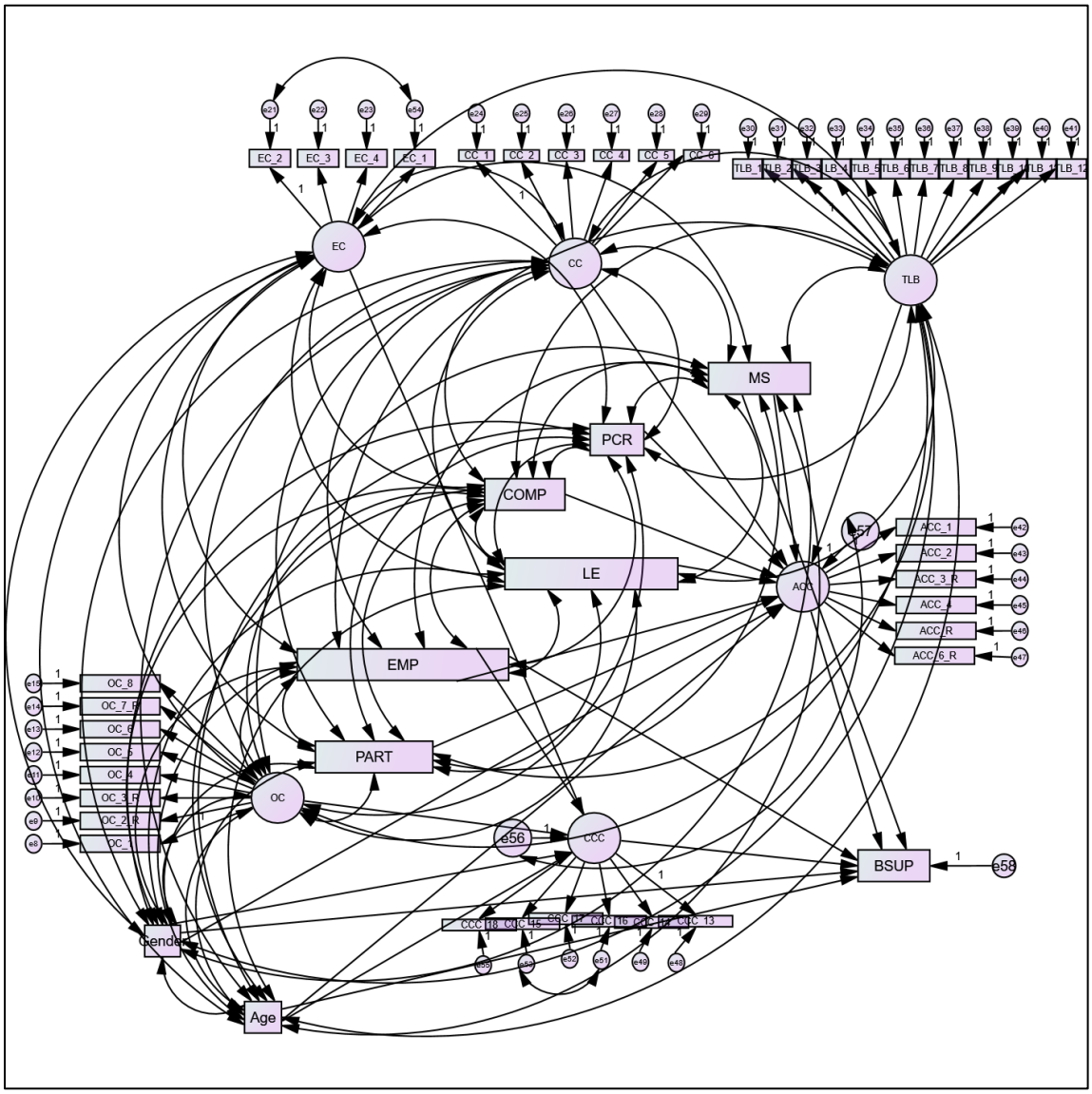
Regarding this Lean change initiative…

1. … I demonstrated opposition in response to the change by engaging in overt behaviors that were intended to ensure that the change failed.
2. … I demonstrated opposition in response to the change by engaging in covert or subtle behaviors aimed at preventing the success of the change.
3. … I demonstrated minimum support for the change by going along with the change but did so reluctantly.
4. … I demonstrated support for the change by exerting effort when it came to the change, going along with the spirit of the change, and being prepared to make modest sacrifices.
5. … I demonstrated extreme enthusiasm for the change by going above and beyond what is normally required to ensure the success of the change and promoting the change to others.

3.9.2. Measurement Model CFA in Amos 25



3.9.3. Structural Model in Amos 25



Conclusion

The objective of this thesis was to contribute to the following question: why is Lean implementation in healthcare so notoriously difficult? Our search for answers led us down the path of investigation that we presented in this document. Our first conceptual contribution allowed us to propose a holistic view of healthcare organizations' context relating to Lean implementation, which led us to highlight physicians as an important group of actors with regards to such transformations. Through the secondary analysis of a large set of qualitative data initially collected during a three-year research, we provide a managerial perspective of physicians' reactions to Lean change. Our findings highlighted how organizational actors' preoccupations evolved regarding the antecedents influencing physicians' support of Lean. Notably, we found that as organizations undertook more improvement projects, their preoccupations shifted from pre-existing conditions and context-related antecedents into the process of change and its content. To verify if these findings could be generalized further, we undertook a quantitative study in our third paper. To do so, we collected data directly from physicians. A rigorous statistical analysis allowed us to propose a model of medical support towards Lean change. Many of our validated hypotheses corroborated our qualitative findings. *Pre-change* antecedents were found to have little to no influence on the behavioral support of Lean initiatives. *Change* antecedents, however, contributed a lot more influence towards support. Ultimately, we demonstrated how an organization's ability to properly manage Lean change significantly influences physicians' support of it.

This research contributes to the ongoing creation of knowledge regarding Lean in healthcare. While scholars have only recently been able to objectively demonstrate its benefits for healthcare organizations (Shortell *et al.*, 2018), it is still difficult to grasp why they have such difficulty to successfully undertake Lean transformations. This thesis proposes meaningful insight into this phenomenon by first looking at how the organizational context in healthcare interacts with Lean and then how, arguably, the most powerful actors in healthcare are influenced in their reactions towards it. It also

contributes to the overall literature on physicians, by providing a deeper understanding of how they view and interact with organizational change.

Our first paper also contributes to organizational theory by proposing a holistic perspective on the context of public healthcare organizations. Rarely have Lean and the particular organizational context of healthcare been studied with depth on the various dimensions of services organizations. By anchoring our conceptual model to a large body literature, much of which is foreign to the OM field, we add value to the current knowledge on how healthcare organizations work and evolve.

We also contribute a fresh perspective to the OM field. By shifting away from OM's traditional structural approach to organizational theory (Bolman and Deal, 2017), we offer a view of an OM concept that is anchored in behavioral science. Seldom has this been done in the past. This cross-fertilization can potentially lead to new, innovative research that would allow OM to widen its perspective into the human, political and symbolic frames of organizational theory (Bolman and Deal, 1984).

Methodologically, this thesis has three main contributions. First, our multi-method approach allows us to combine the depth of qualitative work with the power of quantitative methods. It proposes a new standard for studying Lean transformations. It also provides a dual perspective of the Lean healthcare phenomenon, by combining the managerial and medical views to study the chain of causality of change recipients' reactions to Lean implementation. Second, we combined two important conceptual structures, the organizational change commitment model (Herscovitch and Meyer, 2002) and the change recipients' reactions framework (Oreg *et al.*, 2011), to study an organizational change phenomenon resulting from an improvement approach: Lean. To our knowledge, this has not been done previously. Third, our sampling also represents an important contribution. Scholars have historically faced considerable difficulties to collect behavioral, quantitative data from physicians (Kellerman and Herold, 2001). However, the data we were able to collect allowed us to contribute one of the few quantitative studies on physicians' organizational behaviors.

Limitations and Future Research Avenues

Naturally, this research has limitations. Taken on their own, the second and third papers present the normal limitations found in both types of research, as highlighted in each. Nevertheless, combining both methods has provided a much stronger contribution. Another limitation relates to the jurisdictional dimension of the study. While some would argue that "physicians are still physicians", we would be reminiscent that further study translating our findings in the USA to other countries and healthcare systems would bring more generalizability to our results. Our quantitative study also relies on cross-sectional data and would benefit from longitudinal inquiry, a prospect that is already being considered.

This thesis has also paved the way for interesting future research. Notably, our third essay's findings regarding the employment status of physicians are quite interesting. In many jurisdictions, physicians are almost exclusively independent workers. In Canada, notably, debates are ongoing about physicians and how they are remunerated. While we could not find any significant moderating effects of physicians' employment status on their manifestation of support for Lean change, we did find that it had a significant direct effect on behavioral support, differentiating employees and independent workers in that regard. We intend to further push this line of investigation. How do independent working physicians compare with their employed colleagues? Are Lean transformations more successful when employed rather than independent-working physicians are involved? Is organizational performance also better for that matter? Our ongoing data collection with Canadian hospitals could allow us to delve deeper into that subject and provide meaningful guidance to policy-makers.

On a more personal note, this thesis has prepared me for the next chapter of my career. It will allow me to widen the scope of my future research to other organizational actors, phenomena, and contexts using both qualitative and quantitative methods. With regards to Lean in healthcare, the investigation of actors such as nurses and other professionals would contribute to enrich our knowledge of organizational theory. Of course, Lean is not the only interesting organizational phenomena, neither is the context of healthcare. After studying the complexities of healthcare and, notably, physicians, I believe this doctoral

research has provided me with tools to undertake research on various questions, in diverse settings, with different people, using contrasting methods.

References

Bolman, Lee G and Terrence E Deal (1984). *Modern approaches to understanding and managing organizations*, JSTOR.

Bolman, Lee G and Terrence E Deal (2017). *Reframing organizations: Artistry, choice, and leadership*, John Wiley & Sons.

Herscovitch, Lynne and John P Meyer (2002). 'Commitment to organizational change: extension of a three-component model', *Journal of Applied Psychology*, vol. 87, no 3, pp. 474.

Kellerman, Scott E. and Joan Herold (2001). 'Physician response to surveys: A review of the literature', *American Journal of Preventive Medicine*, vol. 20, no 1, pp. 61-67.

Oreg, Shaul, Maria Vakola and Achilles Armenakis (2011). 'Change recipients' reactions to organizational change: A 60-year review of quantitative studies', *The Journal of Applied Behavioral Science*, vol. 47, no 4, pp. 461-524.

Shortell, Stephen M, Janet C Blodgett, Thomas G Rundall and Peter Kralovec (2018). 'Use of Lean and Related Transformational Performance Improvement Systems in Hospitals in the United States: Results From a National Survey', *Joint Commission Journal on Quality and Patient Safety*.

Appendix

Understanding before implementing: the context of Lean in public healthcare organizations

Pierre-Luc Fournier and Marie-H l ne Jobin

A three-year study of Lean implementation in public healthcare organizations in Qu bec identified poor understanding of the organizational context as a contributing factor to unsustainable Lean implementation. This paper presents a holistic perspective of the unique context of public healthcare organizations and discusses its implications with regards to Lean implementation.

Keywords: Healthcare; Lean implementation; public; Qu bec; services.

Achieving efficiency gains in healthcare is becoming increasingly difficult (Longenecker and Longenecker, 2014). Lean has been promoted by policy-makers around the world as a solution to reducing budgets and increasing demands. (Womack and Jones, 2015; Costa and Godinho Filho, 2016), A number of studies, however, have concluded that Lean in healthcare has failed to produce conclusive gains at the organizational level (Mazzocato *et al.*, 2010; Costa and Godinho Filho, 2016; Moraros *et al.*, 2016).

In 2011, three organizations in Qu bec were chosen to begin a formal implementation of Lean. We studied that implementation, as well as its impact on organizational performance for three years (Jobin and Lagac , 2014, 2015; Fournier *et al.*, 2016). Our findings echoed those of researchers in the UK (Burgess and Radnor, 2013), where implementation tended to be isolated, driven by efficiency targets, and unable to trigger cultural change. So why do public healthcare organizations (PHOs) have trouble implementing Lean?

We found that managers had great difficulty adapting Lean to their work, blindly applying tools and techniques developed in manufacturing industries. Lean implementation is contextual (Radnor and Osborne, 2012) and adaptation is required to achieve sustainable implementation. We believe better understanding of that context is critical for practitioners to properly adapt Lean and produce successful change. However, we could not find any studies in the academic literature that provided an integrated perspective of that context for PHOs. We fill that gap in this paper.

This paper first provides a short overview of the origins of Lean. Second, we present the findings from our study of Lean implementation in Qu bec's healthcare system. Third, we summarize the results of our literature review and develop an integrated view of the context of PHOs. To develop a complete contextual perspective, we used Schmenner's (1986) categorization of services. By combining professional, public and healthcare services, we performed an integrative literature review (Torraco, 2005) allowing us to develop a holistic view of that context. Finally, we discuss the implications of our findings on Lean implementation.

Origins of Lean

Lean has evolved from a simple combination of tools and techniques to reduce costs (Womack and Jones, 2015) with the focus now more on increasing value (Samuel *et al.*, 2015). Lean now encompasses many so-called 'soft-practices', such as committed management (Soriano-Meier and Forrester, 2002), respect for people and Kata (Rother, 2010). Leadership, training, problem solving and customer involvement are also crucial. Today, Lean is viewed as a management system deeply rooted in the social sciences. Its implementation is usually predicated on the various performance improvements it has exhibited (Womack and Jones, 2015). However, Lean's capacity to improve performance has been disputed (Samuel *et al.*, 2015).

The implementation of Lean in Qu bec's healthcare system

The Canadian public healthcare system has been criticized it for its lack of efficiency and long waiting times (Fine *et al.*, 2009). Lean has been one of the approaches taken by policy-makers to help overcome these challenges. Organizations such as Five Hills Health Region in Saskatchewan, St-Joseph's Health Center in Ontario and St-Boniface Hospital in Manitoba were the first to

Pierre-Luc Fournier is a doctoral candidate at HEC Montr al, Canada.

Marie-H l ne Jobin is a Professor of Logistics and Operations Management and Director of the Healthcare Management Hub at HEC Montr al, Canada.

http://dx.doi.org/10.1080/09540962.2018.1389505

experiment with Lean (Fine *et al.*, 2009, Graban, 2011). In Qu bec, formal discussions about using Lean started around 2008. In 2011, the Ministry of Health and Social Services began implementing Lean across the provincial healthcare network with three pilot organizations deploying Lean through various improvement projects over the course of three years. The initial investment of 12 million Canadian dollars (CAD) was followed, in 2013, by another targeting 16 more organizations. Through those two phases, roughly a third of the system's 275 000 employees have been touched, directly or indirectly, by various Lean initiatives.

In 2013, Qu bec's Ministry of Health and Social Services asked us to investigate Lean implementation in those three organizations. We started by developing a measurement tool to empirically assess Lean maturity in PHOs (Jobin and Lagac , 2014). Using this tool, we evaluated the maturity level of those organizations over the course of three years (Jobin and Lagac , 2015). Finally, we investigated the impact Lean had had on performance (Fournier *et al.*, 2016).

Performance was evaluated in terms of accessibility and quality of care, efficiency and user and employee satisfaction. While local gains had been made where Lean initiatives took place, such as the reduction of waiting lists in surgical departments, it was not possible to assess whether or not those had translated to the organizational level and beyond. The only evidence of organizational-level improvement was recurrent financial gains of roughly 650,000 CAD for the three organizations combined. However, it was impossible to evaluate how those gains were reinvested and if they had helped improve accessibility and quality of care.

We also studied how the organizations had implemented Lean and how they progressed along a maturity scale. Maturity was evaluated on a scale of one to five, as shown in table 1. The measurement tool assessed 78 components of a Lean culture, divided into 10 dimensions. For each of those components, a unique scale description was used to rate the maturity level. In the end, an average score was computed to determine the overall maturity level of the organization. To perform this study, 99 interviews were conducted with a variety of stakeholders. After three years of Lean implementation, the three organizations reached average maturity scores of 2.6, 2.2 and 2.4. After this period, progress had plateaued (Jobin and Lagac , 2015). While differences existed between them, none had triggered the beginning of a real cultural change. Lean was still viewed by most stakeholders simply as a set of principles and tools. Our findings also highlighted the efficiency-focused view of Lean, leading to unsustainable gains.

Our findings were very similar to studies in the UK. Indeed, Burgess and Radnor (2013) found that Lean implementation in the National Health Service (NHS) tended to be isolated, as opposed to system-wide, and mostly based on its visual elements. Lean implementation was typically driven towards internal efficiency, with short-term financial gains in mind (Radnor and Osborne, 2012). In short, healthcare organizations in Canada face many challenges also faced by those in the UK, being unable to transition from using tools and techniques into cultural change.

Our research concluded that policy-makers, managers and practitioners had great difficulty in properly adapting Lean to the public healthcare context. We believe this partly explains why PHOs have been unable to leave their *state of transition*. This led us to investigate why the public healthcare context is so unique and how does that context impact on Lean implementation? The similarities between our findings and those of researchers in the UK convinced us that exploring this question will have potential for generalization to other public healthcare systems around the world.

To understand the public healthcare context, we used Schmenner's (1986) seminal service categorization as a starting point. In this work, mass services such as public services, professional services such as doctors, and healthcare services such as hospitals correspond to three distinct categories of service providers. Historically, Lean has been adapted to fit each of those types of

Table 1. Generic Lean maturity levels.

Lean maturity levels		*Description*
1	Initiation	Few attempts at Lean, principles are unknown and expertise is external.
2	Recognition	Lean attempts are present, based on visual elements and tools. Expertise is mostly external.
3	Integration	Lean practice is significantly present, principles are known and are starting to be integrated. Expertise is becoming more and more internal. Cultural change is starting to emerge.
4	Generalization	Lean maturity is manifested by general mobilization and adoption, and into daily continuous improvement. Expertise is held internally.
5	Excellence	The epitome of Lean organizations. Lean is observed in the behaviours and roles of the stakeholders. The organization is a reference and is known as an innovator.

service organizations separately. But in PHOs, the characteristics of each are integrated into one unique context. These add distinctive factors to the internal and external environments of PHOs, creating a much more complex setting than any of those three types of organizations alone. To comprehend this context, we undertook an integrative literature review (Torraco, 2005).

Three categories of services

Our integrative literature review (Torraco, 2005) was performed using the EBSCO and ABI/INFORM databases. Using a combination of keywords such as 'services', 'management', 'operations' and 'organization', along with the keywords 'professional', 'public' and 'healthcare', we identified a total of 215 academic papers. After reviewing the abstracts of these papers, 56 publications were selected for deeper analysis, which resulted in a total of 26 articles being selected (see figure 1).

Professional services are characterized by value co-creation and knowledge work (Goodale *et al.*, 2008). The co-production phenomenon, where client and provider work together to create value (Dobrzykowski *et al.*, 2016), creates an unstable demand (Hines *et al.*, 2002). Knowledge-work creates high task uncertainty (Staats *et al.*, 2011) and requires a highly specialized workforce (Nembhard *et al.*, 2009). In the end, combining those factors generates high process variation (Boone and Ganeshan, 2001).

Public services have two main characteristics:

- Public governance, which is complex and inherently political (Bovaird, 2005; Osborne, 2006). Public governance has been highly

Figure 1. Characteristics of three types of services from Schmenner's matrix. (Read from left to right for each type of service; dashed lines indicate a relationship between concepts.)

Type of service	*Main characteristics*	*Detailed context*		
Professional services	Value co-creation	Co-production phenomenon (Dobrzykowski *et al.*, 2016)	Unstable demand (Hines *et al.*, 2002)	High process variation (Boone and Ganeshan, 2001)
	Knowledge work	High work complexity and customization require expert knowledge (Goodale *et al.*, 2008)	High task uncertainty (Staats *et al.*, 2011) High workforce specialization (Nembhard *et al.*, 2009), subject to external pressures (Harvey, 1990)	
Public services	Public governance	Public governance is highly political (Osborne, 2006) and complex (Bovaird and L ffler, 2003)	NPM paradigm (Osborne, 2006)	Results-based frameworks driven towards efficiency (Martin *et al.*, 2004) and better 'value to the users' (Bovaird, 2005)
		Innovation constantly challenged (Hartley, 2005)		
	Rigidity	Complex labour relations (Scorsone, 2008) Numerous laws, regulations and policies (Ferlie *et al.*, 2003)		
Healthcare services	High organizational complexity	Fuzzy boundaries (Champagne *et al.*, 2002)		Various missions of cure, care, control and and community (Glouberman and Mintzberg, 2001)
		Pluralistic governance and distributed leadership (Denis *et al.*, 2012)		Clinical governance (Buetow and Roland, 1999)
		Professional logic of hierarchy (Bate, 2000), powerful core of doctors (Sheaff *et al.*, 2004)		
		Complex work organization	Patient is material input and output (Schneller and Smeltzer, 2006) Complex and personalized interactions between clinicians themselves and with patients (Shah *et al.*, 2008) Highly specialized and varied workforce (Nembhard *et al.*, 2009) Dual role of physicians (Schneller and Smeltzer, 2006)	
	High environmental uncertainty	High dynamism (Dess and Beard, 1984)	Increased pace of technological change (Zhang *et al.*, 2012) Greater variety offering (Mitchell *et al.*, 2011) Volatile demand (Wiengarten *et al.*, 2012)	
		High munificence (Dess and Beard, 1984)	High scarcity of critical resources needed (Castrogiovanni, 1991)	
		External stakeholders	Knowledge monopolies, regulatory or legal bodies and private companies (Harvey, 1990)	

influenced by New Public Management (NPM), which has brought about major reforms implemented through results-based frameworks (Martin *et al.*, 2004). These target short-term efficiency, aiming to increase 'value to the users' (Bovaird, 2005). The public context also makes innovation more difficult, because it must be constantly validated by all stakeholders and, as opposed to the private sector (Hartley, 2005), is not viewed as a 'virtue in itself'.

- Public services are inherently rigid; labour relations are complex due to unionization and worker protection (Scorsone, 2008). Managers are also highly constrained by laws, regulations and policies, making decision-making inflexible (Ferlie *et al.*, 2003).

Two main characteristics of healthcare services were distinguished. The first is high organizational complexity, created by the fuzzy boundaries of healthcare organizations, which often have multiple roles such as providing social services and research (Glouberman and Mintzberg, 2001; Champagne *et al.*, 2002). It is also generated by the pluralistic nature of governance (Denis *et al.*, 2012). While pluralism involves many stakeholders, healthcare organizations also have a professional hierarchy (Bate, 2000) dominated by a powerful core (doctors) (Sheaff *et al.*, 2004). This creates a *leadership paradox*, where distributed leadership is desired, but actors other than doctors have limited influence. To overcome this, healthcare providers have adopted clinical governance to improve quality through better coordination and co-operation between clinical and managerial actors (Buetow and Roland, 1999). High complexity is also caused by the complex organization of work resulting from the patient being the material input and output of the value chain (Schneller and Smeltzer, 2006). The work performed in healthcare requires very complex and personalized interactions between the clinicians themselves, and with patients (Shah *et al.*, 2008). With a highly specialized and varied workforce (Nembhard *et al.*, 2009), important challenges arise with regards to the design of work. The centrality of physicians (Schneller and Smeltzer, 2006), who act both as suppliers by referring patients and as providers, further enhances complexity.

The second characteristic of healthcare services is high environmental uncertainty, generated by three factors. The first is high dynamism (Dess and Beard, 1984), defined as the combination of fast-paced technological change (Zhang *et al.*, 2012), increased variety of services offered (Mitchell *et al.*, 2011) and volatile demand (Wiengarten *et al.*, 2012). The second is high munificence (Dess and Beard, 1984), defined as the scarcity of critical resources needed to operate (Castrogiovanni, 1991), such as doctors, nurses and various equipment. The third is external pressures, such as knowledge monopolies, regulatory or legal bodies and private companies that can influence internal processes (Harvey, 1990). High environmental uncertainty greatly impacts decision-making. It limits information, reduces the predictability of external events and, in turn, impacts operational activities (Cannella *et al.*, 2008).

These characteristics come together to create a unique organizational context which has important implications for successful implementation of Lean.

Discussion—the context of PHOs

Our study revealed that managers and practitioners had great trouble adapting Lean to the unique context of PHOs, often opting for a 'copy and paste' application of the principles and tools used in manufacturing. We believe this is due to a lack of understanding regarding the unique context of PHOs and the issues it creates with Lean implementation. As Ovretveit (2011) states, the importance of understanding the context of improvement is critical, because it will affect its success.

The unique context of PHOs is shaped by three distinct, albeit not exclusive, organizational settings. A PHO combines professional, public and healthcare services—see figure 2. Those types of services, to different degrees, face an unstable demand generated, in part, by the co-production phenomenon. Our literature review allowed us to identify three important aspects of organizational life impacted by the unique context of PHOs, and that have important implications with regards to Lean implementation.

Customer and value

At the centre of the PHO context is a unique relationship with its customer. In professional services, customer involvement is high, because it is based on the individual needs of each client. In healthcare services, this involvement is heightened because the customer is also the material input and output of the value chain. Compounding even more the complexity of the client-provider relationship is the notion of value. In public services, value has a wider meaning than 'value to the users', because it has social implications. Co-creation of value is not limited to the client-provider relationship, it includes

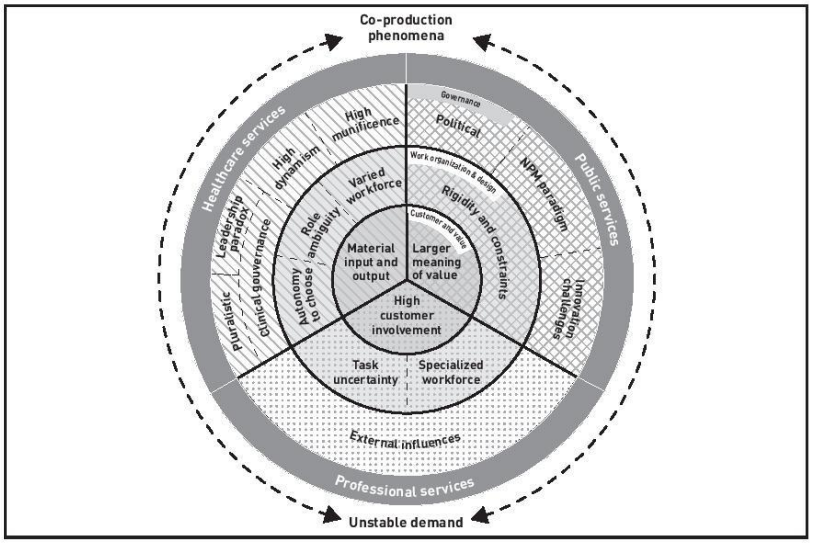
the user's wider social network (Bovaird, 2005), as well as society in general. The vision of Lean, focusing on the creation of value for the client, must be adapted to PHOs' context of a larger definition of value (Moore, 1995). Managers and professionals, as stated by Bovaird (2005), need to develop a 'mutual and interdependent relationship' with their users, meaning beliefs and behaviours have to change. Since value is at the heart of Lean management, any implementation must account for the contextual meaning of value as this will guide the organizational vision.

Governance

At a higher level, governance in PHOs is complex for many reasons. First, external influences exerted on professional services by knowledge monopolies and regulatory bodies complicate decision-making. Then, governance in public organizations is inherently political, with priorities based on the government's agenda. In healthcare organizations, it is largely pluralistic, with various stakeholders having a say in the decision-making process. Yet, for all that plurality, governance faces an important leadership paradox, because a core of actors (doctors) has more influence and power than any other stakeholders. This is particularly true in Canada, where doctors are independent workers. Their interests and priorities can differ from those of other actors. To overcome this issue, clinical governance has been adopted by some healthcare organizations as a means to bridge the gap between managerial and clinical approaches. However, rarely do Lean practitioners attempt to strengthen or improve clinical governance practices (Jobin and Lagac , 2015). These are often viewed as a type of 'waste' to be eliminated, which creates resistance from staff. Instead of improving or developing practices in collaboration with clinicians, new processes are put in place to bypass clinical governance. This can result in disjointed communication and decision-making (Jobin and Lagac , 2015). Therefore, politics, plurality and unbalanced power make it difficult to develop a clear vision of Lean. This can have important consequences towards the success of implementation, as poor vision leads to poor leadership, a main driver of unsustained Lean change (Hines *et al.*, 2008). Poor vision can result in a lack of conviction and commitment from leaders across the organization. As stated by Soriano-Meier and Forrester (2002), since this is the most basic principle of Lean implementation, great care needs to be taken in developing a strong and clear vision of Lean.

When managerial vision is unclear, leadership issues arise at all levels of the organization, resulting in a lack of support and communication. Managers will adopt a 'command-and-control' type of leadership (Boyer and Sovilla, 2003), because they will be under scrutiny for efficiency (Waring and Bishop, 2010).

Figure 2. Holistic view of the PHO organizational context.



With high munificence, managers are under pressure to secure critical resources while still being constrained by tight budgetary conditions. This is compounded by the NPM paradigm still followed in today's public governance. A 'tyranny of efficiency' is encouraged by results-based frameworks, preventing managers from providing workers with the 'license to experiment' that is essential to empower employees and create a Lean culture (Jones *et al.*, 2006). Managers become afraid to lose power and control and workers are scared of layoffs (Buesa, 2009), which creates resistance at many levels.

Lean relies heavily on worker commitment (Harrison and Storey, 1996), attitude (Groebner and Merz, 1994) and motivation (De Treville *et al.*, 2005). Hence, workers cannot be disassociated from the implementation process if true cultural change is to be achieved. In PHOs, work is often demanding and stressful, and while Lean has shown an ability to positively influence the quality of working life (Kuipers *et al.*, 2004), poor implementation has also caused negative effects. Indeed, poor management decisions during Lean adoption have been shown to create more intense and stressful work (Klein, 1989), monotonous and repetitive tasks (Schouteten and Benders, 2004), decreased job stability (Suzuki, 2004), and decreased autonomy (Parker, 2003). To avoid this, management needs to constantly co-operate with employees and their unions (Kochan *et al.*, 1997), while also adapting their training and hiring practices (LaScola *et al.*, 2002)

Furthermore, change in PHOs is dichotomous. While healthcare services are subject to high dynamism, created by constant, fast-paced change (Zhang *et al.*, 2012), innovation in public organizations is notoriously difficult, subject to high resistance and often contested. Since Lean is a radical innovation (Smeds, 1994), it will face challenges and has to be led in conjunction with other types of change.

Work organization and design

Wedged in between governance and the customer is work design and organization. Professional services require a highly-specialized workforce because they are based on knowledge work. By combining knowledge work with high customer involvement, task uncertainty increases. In a highly uncertain environment, many well-known Lean tools and techniques are difficult to apply. Work is much harder to standardize (Radnor and Osborne, 2012), and the more visual elements of Lean and the elimination of so-called 'wastes' have limited potential in many situations (Radnor and Osborne, 2012).

Healthcare services require a varied workforce with the autonomy to choose and make decisions. Lean emphasizes worker autonomy, as opposed to the autonomy to choose (De Treville *et al.*, 2005). Therefore many traditional Lean tools, aimed at standardizing work in manufacturing environments, are difficult to use (Jobin and Lagac , 2015). Hence, new tools need to be developed for use with autonomous healthcare professionals. The varied workforce and autonomy to choose in healthcare settings also make defining responsibilities difficult, resulting in ambiguity over the roles various actors play. Since successful Lean adoption relies on proper delegation of responsibilities (Lowe, 1993), teamwork (Thompson and Wallace, 1996) and clearly identified roles (Delbridge *et al.*, 2000), this role ambiguity creates an unstable foundation for implementation.

The characteristics of work organization and design in professional and healthcare services, as presented in figure 2, create significant process variation. Yet, the rigidity and constraints created by laws, regulations and the complex labour relations in public services make managing that variation arduous. Combined with low flexibility, process variation makes the use of some Lean principles, such as the levelling of production or 'heijunka', and continuous flow more difficult to implement. Ultimately, the unique context of PHOs calls for policy-makers, managers and practitioners to be very involved in their implementation approach. They must account for the distinct natures of the customer and how value is created for society, while acknowledging the unique features of governance and work organization.

Conclusion

Lean implementation had difficulty taking hold and PHOs were plateauing in their journey to cultural change. Managers and practitioners had great difficulty adapting Lean to their particular context. This led us to investigate what was so specific about the context of PHOs and why it was important with regards to Lean implementation.

We conclude that a better understanding of the context of PHOs will allow researchers, policy-makers, managers and practitioners to re-think their vision of Lean and have a better chance of successful implementation. It will also help PHOs leave the state of transition they are in, where they are unable to make the leap from using Lean tools and principles, and into true cultural change.

Further work needs to be done to understand

how the singularities of PHOs impact the way Lean is implemented and how it affects organizations. This paper has limitations, mostly due to its conceptual nature. Hence, it should be enhanced by empirical research into the factors regulating the interactions between the various characteristics of PHOs and the implementation of Lean. Particularly, the role doctors play on a daily basis in creating a culture of continuous improvement appears of interest to us, knowing the central role they have in PHOs.

References

Bate, P. (2000), Changing the culture of a hospital. *Public Administration*, *78*, 3, pp. 485–512.

Boone, T. and Ganeshan, R. (2001), The effect of information technology on learning in professional service organizations. *Journal of Operations Management*, *19*, 4, pp. 485–495.

Bovaird, T. (2005), Public governance: balancing stakeholder power in a network society. *International Review of Administrative Sciences*, *71*, 2, pp. 217–228.

Bovaird, T. and L ffler, E. (2003), Evaluating the quality of public governance. *International Review of Administrative Sciences*, *69*, 3, pp. 313–328.

Boyer, M. and Sovilla, L. (2003), How to identify and remove the barriers for a successful Lean implementation. *Journal of Ship Production*, *19*, 2, pp. 116–120.

Buesa, R. J. (2009), Adapting Lean to histology laboratories. *Annals of Diagnostic Pathology*, *13*, 5, pp. 322–333.

Buetow, S. A. and Roland, M. (1999), Clinical governance: bridging the gap between managerial and clinical approaches to quality of care. *Quality in Health Care*, *8*, 3, pp. 184–190.

Burgess, N. and Radnor, Z. (2013), Evaluating Lean in healthcare. *International Journal of Health Care Quality Assurance*, *26*, 3, pp. 220–235.

Cannella, A. A. *et al.* (2008), Top management team functional background diversity and firm performance. *Academy of Management Journal*, *51*, 4, pp. 768–784.

Castrogiovanni, G. J. (1991), Environmental munificence. *Academy of Management Review*, *16*, 3, pp. 542–565.

Champagne, F. *et al.* (2002), *Developing a Conceptual Model for Security Analysis in Health Organizations* (Health Canada).

Costa, L. B. M. and Godinho Filho, M. (2016), Lean healthcare. *Production Planning & Control*, *27*, 10, pp. 823–836.

De Treville, S. *et al.* (2005), Can standard operating procedures be motivating? *Total Quality Management & Business Excellence*, *16*, 2, pp. 231–241.

Delbridge, R. *et al.* (2000), Shopfloor responsibilities under Lean teamworking. *Human Relations*, *53*, 11, pp. 1459–1479.

Denis, J.-L. *et al.* (2012), Leadership in the plural. *Academy of Management Annals*, *6*, 1, pp. 211–283.

Dess, G. G. and Beard, D. W. (1984), Dimensions of organizational task environments. *Administrative Science Quarterly*, pp. 52–73.

Dobrzykowski, D. D. *et al.* (2016), Examining pathways to safety and financial performance in hospitals. *Journal of Operations Management*, *42*, pp. 39–51.

Ferlie, E. *et al.* (2003), Changing public service organizations. *British Journal of Management*, *14*, S1, pp. S1–S14.

Fine, B. A. *et al.* (2009), Leading Lean: a Canadian healthcare leader's guide. *Healthcare Quarterly*, *12*, 3, pp. 32–41.

Fournier, P.-L. *et al.* (2016), Mesurer l'impact du Lean sur la performance: le ons apprises aupr s de trois tablissements de sant du Qu bec. Paper presented at GISEH 2016, Casablanca.

Glouberman, S. and Mintzberg, H. (2001), Managing the care of health and the cure of disease. *Health Care Management Review*, *26*, 1, pp. 56–69.

Goodale, J. C. *et al.* (2008), Influence factors for operational control and compensation in professional service firms. *Journal of Operations Management*, *26*, 5, pp. 669–688.

Graban, M. (2011), *Lean Hospitals* (CRC Press).

Groebner, D. F. and Mike Merz, C. (1994), The impact of implementing JIT on employees' job attitudes. *International Journal of Operations & Production Management*, *14*, 1, pp. 26–37.

Harrison, A. and Storey, J. (1996), New wave manufacturing strategies. *International Journal of Operations & Production Management*, *16*, 2, pp. 63–76.

Hartley, J. (2005), Innovation in governance and public services: past and present. *Public Money & Management*, *25*, 1, pp. 27–34.

Harvey, J. (1990), Operations management in professional service organisations. *International Journal of Operations & Production Management*, *10*, 4, pp. 5–15.

Hines, P. *et al.* (2002), Demand chain management. *Journal of Operations management*, *20*, 6, pp. 707–728.

Hines, P. *et al.* (2008), Testing the boundaries of Lean thinking. *Public Money & Management*, *28*, 1, pp. 35–40.

Jobin, M.–H. and Lagac , D. (2014), La d marche Lean en sant et services sociaux au Qu bec: comment mesurer la maturit des tablissements. *Gestion*, *39*, 3, pp. 116–127.

Jobin, M.–H. and Lagac , D. (2015), *Evaluating Lean Maturity in Three Healthcare Organizations in Qu bec* (HEC Montr al),

Jones, D. *et al.* (2006), *Lean Thinking for the NHS* (NHS Confederation).

Klein, J. A. (1989), The human costs of manufacturing reform. *Harvard Business Review*, *67*, 2, pp. 60–66.

Kochan, T. A. *et al.* (1997), *After Lean Production: Evolving Employment Practices in the World Auto Industry* (Cornell University Press).

Kuipers, B. S. *et al.* (2004), Design or development? *International Journal of Operations & Production Management*, *24*, 8, pp. 840–854.

LaScola, K. *et al.* (2002), Assessing human capital: a Lean manufacturing example. *Engineering Management Journal*, *14*, 3, pp. 35–39.

Longenecker, P. D. and Longenecker, C. O. (2014), Why hospital improvement efforts fail. *Journal of Healthcare Management*, *59*, 2, pp. 147–168.

Lowe, J. (1993), Manufacturing reform and the changing role of the production supervisor. *Journal of Management Studies*, *30*, 5, pp. 739–758.

Martin, V. *et al.* (2004), *La gestion axe sur les résultats: comparaison des cadres de gestion de huit juridictions* (HEC Montréal).

Mazzocato, P. *et al.* (2010), Lean thinking in healthcare. *Quality and Safety in Health Care*, *19*, 5, pp. 376–382.

Mitchell, J. R. *et al.* (2011), Erratic strategic decisions. *Strategic Management Journal*, *32*, 7, pp. 683–704.

Moore, M. H. (1995), *Creating Public Value: Strategic Management in Government* (Harvard University Press),

Moraros, J. *et al.* (2016), Lean interventions in healthcare. *International Journal for Quality in Health Care*, *28*, 2, pp. 150–165.

Nembhard, I. M. *et al.* (2009), Why does the quality of health care continue to lag? Insights from management research. *Academy of Management Perspectives*, *23*, 1, pp. 24–42.

Osborne, S. P. (2006), The new public governance? *Public Management Review*, *8*, 3, pp. 377–387.

Ovretveit, J. (2011), Understanding the conditions for improvement. *BMJ Quality & Safety*, *20*, pp. 18–23.

Parker, S. K. (2003), Longitudinal effects of Lean production on employee outcomes and the mediating role of work characteristics. *Journal of Applied Psychology*, *88*, 4, pp. 620–634.

Radnor, Z. and Osborne , S. P. (2012), Lean: a failed theory for public services? *Public Management Review*, *15*, 2, pp. 265–287.

Rother, M. (2010), *Toyota Kata* (MacGraw Hill).

Samuel, D. *et al.* (2015), How did the publication of the book *The Machine That Changed the World* change management thinking? *International Journal of Operations & Production Management*, *35*, 10, pp. 1386–1407.

Schmenner, R. W. (1986), How can service businesses survive and prosper? *Sloan Management Review*, *27*, 3, pp. 21–32.

Schneller, E. S. and Smeltzer, L. R. (2006), *Strategic Management of the Health Care Supply Chain* (Jossey-Bass).

Schouteten, R. and Benders, J. (2004), Lean production assessed by Karasek's job demand–job control model. *Economic and Industrial Democracy*, *25*, 3, pp. 347–373.

Scorsone, E. A. (2008), What are the challenges in transferring Lean thinking to government? *Public Money & Management*, *28*, 1, pp. 61–64.

Shah, R. *et al.* (2008), Explaining anomalous high performance in a health care supply chain. *Decision Sciences*, *39*, 4, pp. 759–789.

Sheaff, R. *et al.* (2004), Governmentality by network in English primary healthcare. *Social Policy & Administration*, *38*, 1, pp. 89–103.

Smeds, R. (1994), Managing change towards Lean enterprises. *International Journal of Operations & Production Management*, *14*, 3, pp. 66–82.

Soriano-Meier, H. and Forrester, P. L. (2002), A model for evaluating the degree of Leanness of manufacturing firms. *Integrated Manufacturing Systems*, *13*, 2, pp. 104–109.

Staats, B. R. *et al.* (2011), Lean principles, learning, and knowledge work. *Journal of Operations Management*, *29*, 5, pp. 376–390.

Suzuki, Y. (2004), Structure of the Japanese Production System. *Asian Business & Management*, *3*, 2, pp. 201–219.

Thompson, P. and Wallace, T. (1996), Redesigning production through teamworking. *International Journal of Operations & Production Management*, *16*, 2, pp. 103–118.

Torraco, R. J. (2005), Writing integrative literature reviews: guidelines and examples. *Human Resource Development Review*, *4*, 3, pp. 356–367.

Waring, J. J. and Bishop, S. (2010), Lean healthcare: rhetoric, ritual and resistance. *Social Science & Medicine*, *71*, 7, pp. 1332–1340.

Wiengarten, F. *et al.* (2012), Supply chain environmental investments in dynamic industries. *International Journal of Production Economics*, *135*, 2, pp. 541–551.

Womack, J. P. and Jones, D. T. (2015), *Lean Solutions* (Simon and Schuster).

Zhang, D. *et al.* (2012), The moderating role of contextual factors on quality management practices. *Journal of Operations Management*, *30*, 1, pp. 12–23.

IMPACT

This paper will help healthcare managers and policy-makers develop a clearer vision of Lean in order to better adapt their approaches to achieve sustainable change.

Medical commitment to Lean: an inductive model development

Pierre-Luc Fournier and Marie-Hélène Jobin
Department of Logistics and Operations Management, Ecole des Hautes Etudes Commerciales Montréal, Montréal, Canada

Received 28 February 2018
Revised 9 April 2018
Accepted 11 April 2018

Abstract

Purpose – The purpose of this paper is to study the factors influencing doctors' involvement in Lean change initiatives in public healthcare organizations in Canada.

Design/methodology/approach – An inductive research was conducted over a three-year span studying Lean implementation across three healthcare organizations in Canada. Various interviews were conducted with healthcare actors. Through analytical induction, analysis of the data allowed for multiple factors to be triangulated from which a conceptual model was developed.

Findings – Fifty-four interviews with 18 Lean healthcare actors allowed for the identification of ten factors possibly influencing the commitment of doctors towards Lean change. These factors are categorized into pre-change antecedents and change antecedents. Also, the level of transformational leadership demonstrated by a project manager was shown to potentially moderate the effect of medical behavioral support for change on change outcomes. These findings allowed us to develop a conceptual model of medical commitment and its impact of Lean change outcomes.

Originality/value – The paper investigates the role doctors play in Lean implementation, currently an important issue discussed among healthcare actors and researchers. Yet, very little academic research has been published on this subject.

Keywords Lean, Antecedents, Change, Healthcare, Commitment, Doctors

Paper type Research paper

Introduction

For the past decades, policymakers worldwide have faced challenges regarding the performance of healthcare systems (Kaplan and Porter, 2011). While various efforts have been put forth, change has proven notoriously difficult (Longenecker and Longenecker, 2014). Among these is Lean Management, a holistic management system based on a culture of continuous improvement (Womack and Jones, 2015), implemented in various countries and settings (Costa and Godinho Filho, 2016). However, many authors have recently concluded that while it has produced gains at the local level, in units or departments where initiatives have taken place, Lean has failed to provide definite gains at the organizational level (Costa and Godinho Filho, 2016; de Souza, 2009; Mazzocato *et al.*, 2010; Moraros *et al.*, 2016).

Our three-year study of Lean implementation in three Canadian healthcare organizations from the province of Québec highlighted the central role played by doctors during Lean change initiatives (Jobin and Lagacé, 2014). From 2013 to 2015, we conducted 99 individual interviews in three distinct organizations attempting major Lean transformations. Through this research, we identified the implication of doctors as a central issue for Lean implementation in public healthcare organizations. Their status as independent workers was often highlighted as a concern for managers and Lean practitioners. Doctors themselves emphasized how they and their colleagues played a central role during successful Lean implementation. Our study identified varying degrees of commitment from doctors when it

Leadership in Health Services
Vol. 31 No. 3, 2018
pp. 326-342

1751-1879
DOI 10.1108/LHS-02-2018-0015

came to Lean change, as well as different antecedents that are believed to correlate to commitment from doctors.

The results of that study led us down a path to further investigate the role of doctors during Lean initiatives. In a recent paper (Fournier and Jobin, 2018), we developed a conceptual model of complexity in healthcare organizations regarding Lean implementation. In this model, clinical governance was highlighted as a critical aspect impacting Lean implementation. It was argued that doctors play a central role in the success or failure of Lean initiatives. Public healthcare organizations (PHO) must deal with an important leadership paradox that results from the unique position of doctors as powerful stakeholders. The current academic literature views the commitment of doctors to change as a necessary component of successful organizational change in healthcare. Yet, no conclusive empirical evidence is available to determine if higher levels of commitment from doctors result in positive impacts of Lean initiatives in particular.

The next step in our research is to investigate how doctors influence Lean initiatives. To investigate this, we will build on what was identified in our three-year study of Lean implementation in healthcare organizations. With these results, we use analytic induction to develop a conceptual model of medical commitment's influence on Lean change success, centered around Herscovitch and Meyer's (2002) seminal conceptualization of organizational change commitment. Commitment is influenced by various antecedents, some of which have to do with the individual himself and some having to do with how change is performed and managed. In the end, we aim to study how various change antecedents can potentially correlate with various commitment levels and how commitment can potentially have an influence on the outcomes of Lean initiatives.

This paper is structured as follows. First, we will present a short overview of the origins of Lean. Second, we will discuss the implementation of Lean in healthcare organizations and summarize our findings from our three-year study in Canada's healthcare system. Third, we will discuss the complexity of Lean implementation in healthcare and why doctors play a central role in this process. Fourth, we will present our methodology, findings and propositions related to doctors' commitment to Lean change from our interviews with various actors of healthcare. Finally, we will discuss our proposed model of medical commitment to Lean change and address the following steps of our research.

Origins of Lean

Originated in Japan, Lean has become one of the most important management paradigms of the past 30 years. "Lean" was coined in 1988 by John Krafcik, an MIT graduate student at the time. Over the years, it has evolved from a generic definition of the Toyota Production System (TPS), into a holistic value system adapted to different realities, from manufacturing to services and beyond (Samuel *et al.*, 2015). Originally viewed as a combination of tools and techniques (Liker, 2004; Spear and Bowen, 1999; Womack and Jones, 1996) focusing on cost reduction, it has shifted into a value appropriation vision encompassing many "soft-pratices" such as respect for people (Emiliani, 2007), committed management (Soriano-Meier and Forrester, 2002) and Kata (Rother, 2010). As a management system deeply rooted in social sciences, leadership, training and problem solving are now core elements of Lean.

While it is predicated on the benefits it has been shown to provide (Fullerton *et al.*, 2003; Womack and Jones, 2015), the causality between Lean implementation and improved performance has been disputed abundantly by scholars (Lin and Chun, 1999), who have argued that gains related to performance are found only when companies appropriate the value created by Lean and not simply through implemention. Hence, leadership,

management and culture are now prominent subjects in the Lean management literature, because they highly influence value appropriation.

Lean in healthcare – evidence from Canada

Evidence of Lean implementation in healthcare organizations can be found across the world. In the USA, places such as ThedaCare in Wisconsin (Barnas, 2011) and the Virginia Mason Institute (Kenney, 2012) have achieved incredible success through their implementations. The United Kingdom has been experimenting with Lean for many years (Burgess and Radnor, 2013; Radnor *et al.*, 2009), which has led to a substantial body of academic research on the subject. In Canada, St-Joseph's Health Center in Ontario, Five Hills Health Region in Saskatchewan and St-Boniface Hospital in Manitoba were the first ones to experiment with Lean thinking (Fine *et al.*, 2009; Graban, 2011). In the province of Québec, discussions regarding Lean began around 2008 leading to a policy-driven implementation across three healthcare organizations in 2011, accompanied by an investment of $12m over three years. This initial implementation was followed, in 2013, by a second phase that targeted a further 12 organizations. The impact Lean had on those organizations' performance was inconclusive (Fournier *et al.*, 2016). Over the course of three years, we studied how the first three hospitals had implemented Lean, the challenges they faced, the results they achieved and how they had matured with regards to Lean. This allowed us to develop the *Lean Healthcare Maturity Model* (Jobin and Lagacé, 2014). Over those three years, 99 individual interviews and six focus groups were conducted with various stakeholders, including general managers, senior managers, doctors, clinical and administrative staff, union representatives and patients. The data collected during this process allowed us to develop a comprehensive perspective of Lean in a healthcare setting, comprised of 10 dimensions amalgamating 78 components. A measurement tool was then developed to allow for the evaluation of Lean maturity in a healthcare organization. This tool evaluates each component on a five-level scale, as presented in Table I. Using this tool, we empirically concluded on the difficulty faced by healthcare organizations in developing greater Lean maturity. The three organizations that we studied showed plateauing in their maturity progression at around 2.5, unable to leave a *state of transition* from local Lean initiatives based on visual elements and external expertise, into an organization-wide integration.

Our research concluded that policymakers, managers and practitioners had difficulty to properly adapt Lean to the public healthcare context. These findings echoed those made in the UK (Burgess and Radnor, 2013), where Lean implementation in English Hospitals had a tendency to be isolated, efficiency-driven and unable to trigger cultural change. But why do PHOs have such difficulty in adapting Lean to their unique context? Our interviews with

Table I.
Generic Lean maturity levels

Lean maturity levels	Description
1 – Initiation	Few attempts at Lean, principles are unknown and expertise is external
2 – Recognition	Lean attempts are present, based on visual elements and tools. Expertise is mostly external
3 – Integration	Lean practice is significantly present, principles are known and are starting to be integrated. Expertise is becoming more and more internal. Cultural change is starting to emerge
4 – Generalization	Lean maturity is manifested by general mobilization and adoption and into daily continuous improvement. Expertise is held internally
5 – Excellence	The epitome of Lean organizations. Lean is observed in the behaviors and roles of the stakeholders. The organization is a reference and is known as an innovator

various actors of Lean implementation highlighted the complexities of the public healthcare setting. But they also showed that most stakeholders did not have a proper understanding of why their context was important regarding Lean implementation. Our study therefore led us into investigating what that unique context exactly is and why it is important with regards to Lean implementation. To do so, we performed an integrative literature review on Lean implementation in professional, public and healthcare services. In the following section, we summarize our findings and present our recently published (Fournier and Jobin, 2018) conceptual view of the context of PHOs related to Lean Management.

The context of Lean in public healthcare organizations

Our 2018 paper (Fournier and Jobin, 2018) defined the holistic view of the PHO context regarding the implementation of Lean Management. Three dimensions of complexity were identified through an integrative literature review: professional, healthcare and public services. By integrating the various characteristics of those three distinct settings, a conceptual model of the PHO context was developed, divided into three levels. First is governance, which in healthcare is inherently pluralistic (Denis *et al.*, 2012) and faces high environmental dynamism and munificence. Yet, governance also faces a leadership paradox, because it must cope with a professional hierarchy (Bate, 2000) and a core of actors (doctors) that has more influence and power than other stakeholders (Sheaff *et al.*, 2004). To balance this, clinical governance (Buetow and Roland, 1999) is usually put in place to help bridge the gap between medical and managerial approaches. In public services, governance is not only political (Bovaird, 2005), it is still engrained into the *New Public Management* paradigm (Osborne, 2006) that views public organizations no differently than private ones, which has resulted in short-term, efficiency-driven, results-based management frameworks. Public organizations also have a troublesome relationship with innovation, because it is almost always challenged by the numerous stakeholders and must be constantly validated (Hartley, 2005). Then, professional services are subject to many external influences such as knowledge monopolies, because of the highly regulated work they must accomplish (Harvey, 1990).

The second level of complexity is the organization and design of work. Professional services face high task uncertainty (Staats *et al.*, 2011), which is also accomplished by a very specialized workforce (Nembhard *et al.*, 2009). In healthcare, the variety of workforce required to operate is second to no other sector. In addition, healthcare professionals face role ambiguity and usually have a large autonomy to choose, which comes into conflict with the Lean-advocated *worker autonomy*. This is especially true in Canada, where doctors are independent workers. This reality would normally require great managerial flexibility, yet public services are notoriously rigid and constrained (Scorsone, 2008).

The third level has to do with the relationship a PHO has with the customer and how value is created. In professional services, customer involvement is high (Dobrzykowski *et al.*, 2016). In healthcare, the customer is usually the material input and output of the value chain (Schneller and Smeltzer, 2006). Finally, because of the public nature of PHOs, they must consider the larger meaning of value as they are mandated to create value for society in general and not only their patients.

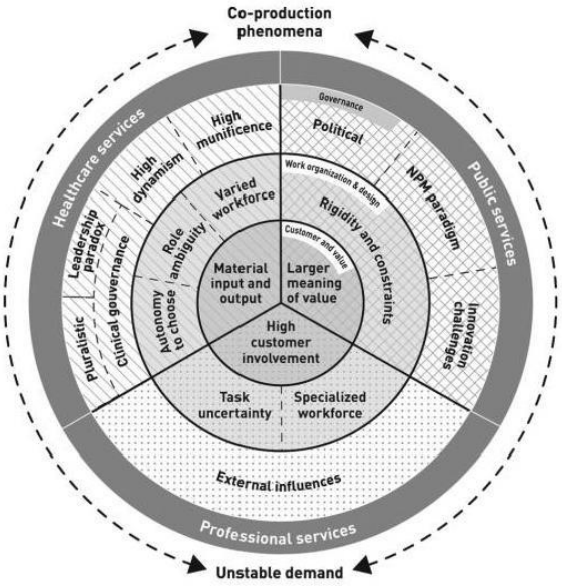
This global perspective puts in place a framework by which Lean implementation in PHOs can be driven and questioned. PHOs are unique and complex organizations, with many aspects influencing decision-making and control. The components of the three levels of complexity manifest themselves in many ways. Particularly, our three-year study of Lean implementation in three PHOs revealed that doctors contribute largely to the complexity of Lean implementation in healthcare, sometimes positively and sometimes negatively.

Doctors and (Lean) change

As illustrated in Figure 1, the centrality of physicians in decision-making and work design makes them a focal point of organizational life. As is the case with other healthcare professionals, physicians possess a large *professional autonomy* allowing considerable freedom in how they choose to perform their work. What sets them apart, however, is their power and status compared to other stakeholders. Their power is entrenched is a professional dominance over other healthcare professions (Light, 2000), and their status within the organization provides them with control over specific role divisions (Giaimo, 2009). The power and influence of physicians create a *leadership paradox* in which one group of stakeholders possesses a disproportionate amount of power over the others within pluralistic governance mechanisms.

The unique place held by physicians makes them a focal point of organizational change. When it comes to Lean change, practitioners and academics alike have identified the role of doctors as a central issue during Lean implementation (Jones *et al.*, 2006). Lorden *et al.* (2014) state that doctors are becoming a barrier to successful Lean implementation in healthcare. This has led to much questioning regarding the ways in which physicians can be engaged in Lean transformations, as it is postulated by many that medical commitment to change is critical to successful Lean implementation (Toussaint *et al.*, 2017).

While very little is available in the academic literature regarding doctors and Lean change, there is a specific body of knowledge concerning doctors and organizational change in general. It has been highlighted that resistance to organizational change from physicians is notoriously particular (Lapointe and Rivard, 2005; Lapointe and Rivard, 2007; Rivard *et al.*, 2011). The literature on this subject highlights various factors that can



Source: Fournier and Jobin (2018)

Figure 1.
Holistic view of the PHO organizational context

generate different levels of resistance to change. At first, as with any other stakeholder, when physicians perceive a threat to their economic well-being, resistance to the change creating this threat tends to be greater (Light, 2000). The same can be said when a proposed change is perceived to bring about a reorganization of work encroaching on their professional autonomy (Rogers *et al.*, 2004) or when the change is perceived to have a negative impact on patients (Brass, 1971). However, the core factor influencing medical staff's resistance to change has to do with their power and status. As highlighted previously, doctors are at the top of healthcare's professional hierarchy (Light, 2000; Giaimo, 2009). The status related to medical professionalism provides doctors with a professional dominance over other stakeholders. When physicians perceive a threat to this status and power, resistance to change has a tendency to increase rapidly (Giaimo, 2009). These factors illustrate the complexity of doctors' reaction to organizational change. The aim of this paper is to delve deeper into the nuances of physicians' commitment to Lean change and to attempt to identify the various antecedents influencing that commitment in the context of Lean implementation.

Hypotheses

Oreg *et al.* (2011), in their 60-year review of recipients' reactions to organizational change, classify the antecedents of organizational change into two categories: pre-change antecedents and change antecedents. Pre-change antecedents have to do with the change recipient's individual characteristics and the internal organizational context. These are initial conditions that can influence the reaction to organizational change. Our first hypothesis is that such initial conditions (factors) do exist in the case of physicians, and that these factors impact the commitment of physicians towards Lean change.

H1. Physicians' level of commitment to Lean change is influenced by pre-change antecedents.

Change antecedents, as per Oreg *et al.* (2011) have to do with the change process itself, the content of the change and the perceived benefit of the change in the eyes of the recipient. Our second hypothesis suggests that physicians are also subject to change antecedents that can influence their level of commitment towards Lean change.

H2. Physicians' level of commitment to Lean change is influenced by change antecedents.

In the following section, we will present the research methodology we have used to investigate those hypotheses.

Methodology

For this research, we have used the same data set from our three-year study of Lean implementation in three healthcare organizations presented earlier. That research project was based on three case studies of different healthcare organizations who attempted Lean transformations over a three-year period. In total, we used 54 out of the 99 interviews recorded in that study. Part of a larger data collection that focused of many topics, such as policy deployment and the impact of Lean on performance, those 54 interviews were used because they all included a large set of data where respondents were asked open-ended questions discussing the role of physicians over the course of a large scale Lean implementation. The remaining 45 interviews were not used either because they did not include questions regarding that topic or because the respondents did not have or were not in a position, to have interactions with physicians. For all three organizations, participants included (18 in total), the General Manager, Human Resources Director, Quality and Performance Director, Physical Health Director (head of doctors), Lean Programme

Director as well as a doctor who had participated directly in Lean change initiatives. The participants were questioned on the following subjects: the factors potentially influencing the level of commitment of doctors, the commitment of doctors towards Lean in general and the impact of doctors' commitment on the outcomes of Lean initiatives.

After full review of the 54 interview transcripts, we used a combination of structural (Guest *et al.*, 2012) and descriptive (Miles *et al.*, 2014) coding to identify themes and categories. We used analytic induction (Patton, 2002) in a two-stage analysis process to develop a proper understanding of the data.

> In analytic induction, researchers develop hypotheses, sometimes rough and general approximations, prior to entry into the field, or in cases where data already are collected, prior to data analysis. These hypotheses can be based on hunches, assumptions, careful examination of theory, or combinations (Gilgun, 1995).

The first stage within-case analysis focused on the identification of pre-change and change antecedents influencing the commitment of doctors to Lean change. Then, a cross-case analysis was performed for pattern identification of the relationships between those pre-change and change antecedents with medical commitment. In the following section, we will present our findings and related propositions.

Findings

Pre-change antecedents

The participants were first asked to discuss the various elements that, according to them, had influenced doctors' commitment to Lean initiatives before the change had actually taken place (initial conditions). These pre-change antecedents can potentially create predispositions towards commitment. If an actor has a positive outlook on the change about to take place, he is more likely to exhibit a high level of commitment. Using data from the interviews, we were able to identify two pre-change antecedents having potential influence on doctor commitment to Lean change.

First are demographics, mainly experience. According to the respondents, younger, less experienced doctors were more prone to commit to a Lean initiative and tended to participate more in problem solving and implementation than older, more experienced doctors.

> Young doctors believe in it. They want to be involved. It is tougher with our older doctors. They're just not there yet. They don't like their work being questioned.

Director of physical health

P1. More experienced doctors will tend to have a lower level of commitment towards Lean change.

Second was the level of training and past experience with Lean. Out of the 18 respondents, 17 identified previous Lean training and experience as having a positive impact on a doctor's commitment.

> It's not only about it taking time away from their schedule. When they've had previous experience with Lean or even had training, they get more involved.

Human resources director

P2. When doctors have more training and experience with regards to Lean, their level of commitment towards Lean change will tend to be higher.

Change antecedents

Interviewed stakeholders were also questioned about the elements of the change process itself, the content of the change and the perceived benefits of the change that might influence the commitment of physicians towards the change. Their opinions varied, based on their history of successes and failures over the three years of implementation efforts. Eight antecedents were identified as well as their foreseen impact on the commitment of doctors to change. These do not represent the entirety of antecedents possibly influencing commitment. Other factors could also have an effect such as the organizational context and climate or more personal attributes. They are, however, antecedents that were highlighted by Lean change stakeholders who had experienced Lean implementation on a large scale, over many years.

Perceived benefits

First, all the respondents identified, at one point or another, "personal interest" towards the change initiative as an important antecedent for commitment. When doctors perceived their personal interests to be in-line with the proposed change, commitment tended to be higher.

> Doctors are independent workers. They are individualists. The doctor needs to understand that he has a personal interest in the matter.
>
> *Director of physical health*

P3. When doctors perceive their interests to be aligned with the proposed Lean change, their level of commitment will tend to be higher.

Second, nearly all actors interviewed, 16 out of 18, identified compensation as an important factor influencing commitment. Since doctors are independent workers, they are normally not compensated for their participation to improvement efforts. Setting aside a dedicated budget to compensate them on the same level as other employees being paid was highlighted as a positive contributor to commitment. One of the interviewed doctors stated:

> Some of my colleagues [. . .] Well [. . .] Not only were they not offered compensation for their participation, they even had to take vacation time to be in the Kaizen event. Let's just say they were not very happy with the whole thing.
>
> *Specialist doctor*

P4. When doctors perceive they are or will be properly compensated for their efforts, their level of commitment to the Lean change will tend to be higher.

Content of the change

The third antecedent identified through the data was the official discourse from top management. When Lean was presented as an efficiency-driven undertaking, commitment from doctors tended to be much lower. One participant is quoted saying:

> Doctors have even come up to me and said: in the end, isn't this Lean thing simply a way for you guys to save money?

Director of Lean programme

P5. When doctors perceive the managerial discourse about the Lean change to be efficiency-driven, their level of commitment will tend to be lower.

Of all interviewed participants, 15 brought to light the nature of the change initiated by the improvement effort. When the change was targeting medical practices, doctors tended to be less committed to the change, often viewing this as a loss of power and autonomy. As one HR director put it:

> They (doctors) do not like it when their practices are questioned. Even if they agree the change is a good idea, they are reluctant to convince their colleagues of it.

Human resources director

P6. When doctors perceive that the Lean change is driving changes to medical practices, their level of commitment will tend to be lower.

The level of complexity of the change taking place was also identified as an important change antecedent, on two levels: individual and collective. When doctors perceived the change to have an important impact on their jobs, such as more work or more pressure being put on them, they tended to commit less. When the improvement project targeted not only their team or unit but also multiple units across departmental boundaries, commitment were viewed as more difficult to generate. It was not clear, however, if this phenomenon was actually due to high complexity of change or if it had more to do with past failures. One respondent provided a possible explanation:

> When we have large and complex projects, where we have to look at a process involving two or more departments, it's tough to get doctors on board. It might have to do with our history of not being successful when addressing cross-departmental problems.

Lean programme director

P7. When doctors perceive the Lean change to be highly complex, their level of commitment will tend to be lower.

Change process

Information and communication about Lean change were also brought up as impacting the level of commitment from doctors. When a proper definition of Lean is carefully presented, when the justification for change is offered and when the objectives are clearly stated, there is a better chance that commitment will be high.

> Communication was a major issue. When doctors thought they had incorrect or inaccurate information, this would snowball to their colleague and there would be massive resistance. Now, we make sure to have a good communication plan in place before any Lean project starts.

General manager

P8. When doctors perceive the quality of information and communication about the Lean change to be poor, their level of commitment will tend to be lower.

Medical representation was mentioned as a trigger for commitment. Participants stated that when a Lean project or initiative had a medical sponsor or champion, the medical staff was much more likely to support the change and also show commitment towards it. A general manager stated:

> We have learned from this. Now, whenever we are attempting or launching a project in a medical area, we do not start unless we have a strong medical leader leading the project. This truly helps with getting our doctors on board.
>
> *General manager*

P9. When doctors perceive they are well represented throughout the Lean change, their level of commitment will tend to be higher.

Also associated to commitment by various actors was the level of support offered to medical staff. Not only was support during the change initiative, either internal or external, highlighted as impactful towards reaching the objectives but also letting doctors know there would be support during the change process played a role in securing their agreement and hence, their commitment. A Lean programme director was quoted as saying:

> Most of our doctors have not been trained for Lean, which influences their engagement. Knowing they will have support during the project eases their minds.
>
> *Lean programme director*

P10. When doctors perceive they are being offered a high level of support from the organization during the Lean change, their level of commitment will tend to be higher.

Leadership from the project manager or change leader was also identified as playing an important role in the larger scheme of medical commitment towards Lean change. Thirteen participants emphasized on the role of the project manager or leader, in creating a collaborative context with the medical staff. The type of leadership required for this was described using words such as: "inspiring", "considerate", "thoughtful", "demanding", "leading by example", "stimulating" and "respectful". Those attributes are often considered traits of transformational leadership (Rubin *et al.*, 2005). We will discuss this antecedent later as part of our conceptual modelization of medical commitment towards Lean change.

Commitment to change

Some participants qualified doctor commitment to Lean change as very high, in just about every improvement initiative having taken place. Others stated that commitment was difficult to find and varied greatly from one individual to another. Various statements from the participants were made regarding the type of commitment required for Lean change to be successful. Some respondents emphasized the need for doctors to fundamentally believe in the change, which relates to affective commitment (Herscovitch and Meyer, 2002). Otherwise, the Lean initiative could not result in a positive outcome. One of the interviewed general managers said, to this regard:

> The medical staff cannot simply be a part of the project, they must stand behind it, support it and believe in it. If not, it won't work.

General manager

Another participant was quoted as saying:

> As long as they have a generally positive attitude, it's fine. As long as they are not against it, it's not a problem.

Human resources director

This type of involvement would refer much more to normative commitment (Herscovitch and Meyer, 2002). But then, some of the doctors we interviewed mentioned that for them to convince their colleagues to adhere to the change, they had to believe they would be losing something if they didn't. This echoes continuance commitment (Herscovitch and Meyer, 2002). The following citation is particularly evocative:

> If I go to my colleagues who haven't been very welcoming to the Lean, if they don't think they're gonna lose something if they don't agree, then it's going to be really difficult to get them to come on board.

Specialist doctor

In the end, it was clear for all respondents that a high level of commitment from doctors would relate positively to the results of Lean initiatives. However, while it is possible to conclude that affective commitment can lead to successful lean implementation, it is not possible to conclude if either normative or continuance commitment from physicians can also favor successful Lean change. Our research also highlighted the need for further inquiry on that subject. In the end, the actors we interviewed allowed us to identify various antecedents potentially influencing commitment to Lean change from doctors. This has allowed us to develop a conceptual model of medical commitment towards Lean change, which we will present next.

Conceptual model of medical commitment to Lean change

To study the relationships between change antecedents, doctor commitment and Lean change outcomes, we have developed a model based on our findings. Figure 2 presents this model, which reflects our propositions.

We identified ten factors deemed to be related to the commitment to change of doctors during Lean transformations. Of those, two can be characterized as pre-change antecedents representing pre-existing individual conditions. The other eight factors are deemed to be change antecedents related to the change recipient's (doctors) perceived benefits of the change, the content of change and the change process itself.

The pre-change antecedents included in the model create an initial setting that potentially influences commitment. *Experience* (EXP) refers to how long the participant has been practicing medicine. It is believed younger and less experienced doctors tend to have higher levels of commitment to change. *Lean history* (LH) indicates the level of Lean training of the participant prior to the improvement project as well as his previous experiences with Lean. We believe doctors with past training and positive experiences with Lean thinking usually show higher commitment towards Lean change.

The *perceived benefits* change antecedents include both the *perception of personal interest* (PPI) and the *perception of compensation* (PCOMP). PPI means the level to which a doctor feels he or she will benefit directly from the change. High PPI is thought to have a positive

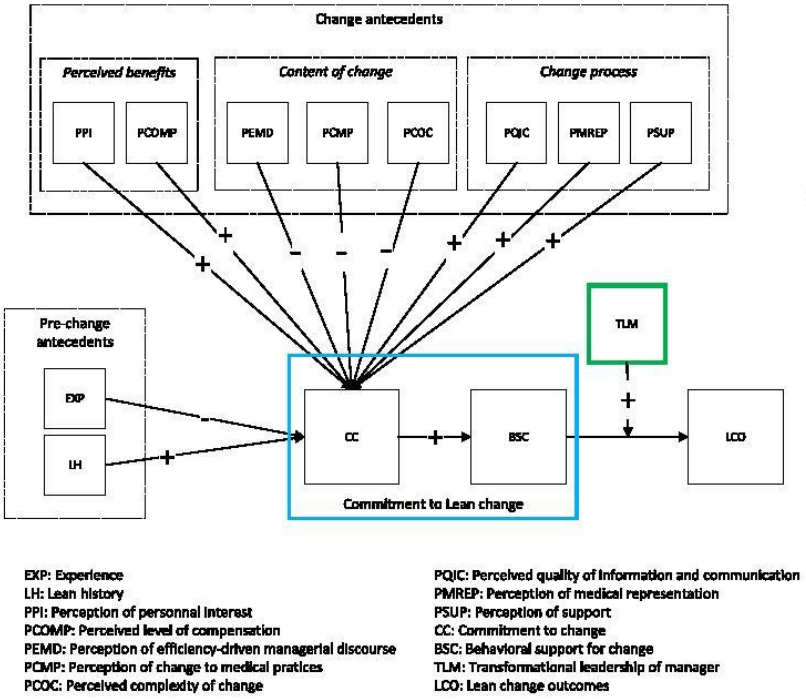


Figure 2.
Conceptual model of medical commitment to lean change

impact on commitment. PCOMP refers to the perceived level of compensation related to individual efforts deployed during the change. When doctors feel they will be properly compensated, either monetarily or otherwise, they will usually show higher commitment to change.

The *content of change* antecedents include three factors. First is the *perception of an efficiency-driven managerial discourse* (PEMD). When the discourse of Lean change is perceived by doctors to be driven towards efficiency, commitment tends to be lower according to our interviews. Second, when physicians perceive the change is targeting their medical practices (PCMP), they will usually show lower commitment to the improvement efforts. Third, when doctors perceive the complexity of the change (PCOC) to be high, the level of commitment tends to be lower than when they perceive the change can be brought about more easily.

Antecedents related to the *change process* itself are also suggested to impact medical commitment towards Lean change. The perceived *quality of information and communication* (PQIC) about the change was deemed to influence commitment. When a comprehensive definition of Lean is offered, when the justification for change is properly presented and when the objectives of the change are clearly stated, doctors have a tendency to more easily commit to the change. Also, if doctors perceive that the Lean initiative is supported by a medical sponsor or champion (PMREP), if they feel that proper medical

representation is in place at the start of the improvement initiative, commitment is likely to be greater. Finally, if doctors perceive they have or will have sufficient support (PSUP) over the course of the change process, higher commitment will be favored.

Commitment and behavior

Commitment itself is a rather large concept. In 1991, organizational commitment was conceptualized on three levels: affective, continuance and normative commitment (Meyer and Allen, 1991). Affective commitment signifies an emotional attachment to the organization. Continuance commitment reflects the perceived costs of leaving the organization. Normative commitment is associated to an individual's perception of his obligation to remain in the organization. These three components relate differently to work-related behaviors. Ten years later, this model was extended to organizational change by Herscovitch and Meyer (2002). This model is now a reference in its field and has been repeatedly cited and used over the past 15 years (Bouckenooghe *et al.*, 2015). In their seminal work, the authors found that only affective and normative commitment correlated positively with a high level of change-related behavior, while continuance commitment correlated positively with a "compliance level" of behavior. However, our findings were not exactly in line with these conclusions. Commitment generates different levels of behavioral support for change, from resistance to championing, with compliance being the middle ground. Normally, the higher the commitment level, the higher the behavioral support will be.

Outcomes and leadership

According to the participants, there was a clear positive correlation between doctors' behavioral support for change and the outcomes of the Lean initiatives. Some mentioned positive outcomes regarding the quality of working life, while others established a direct link to better organizational performance. The following quote from a Lean programme manager summarizes this:

> When our doctors get involved, our Lean projects are successes.
>
> *Lean programme director*

However, an important factor was singled out by many participants. While the leadership of the change leader or project manager was identified as possibly influencing the behavior of doctors, data from our interviews revealed a possible moderating role of leadership. The two following quotes were particularly revealing on that matter:

> I've seen quite a few projects now and I think it really takes two things. First our doctors need to be involved, but also, our project manager needs to be a leader. In my experience, when the project manager acts according to Lean principles, it helps doctors to get more involved and better contribute. It's easier to reach the goals
>
> *Lean programme director*
>
> When we have a good project coordinator. You know [. . .] as they put it during our Lean training [. . .] when the coordinator is a Lean leader. For me, I thought it really helped me better contribute and help the team reach the goals. And we did.

Specialist doctor

We believe that Lean leadership from the project manager or *transformational leadership* as it is labeled in the literature (Rubin *et al.*, 2005), actually has a moderating effect on the relationship between doctors' behavioral support to a Lean change and the outcomes of this change. When the actor responsible for managing the Lean initiative demonstrates a high level of transformational leadership, the effect from the behavior of doctors on the outcomes of the Lean change becomes greater. This leads us to our final proposition:

P11. The level of *transformational leadership* shown by the change leader positively moderates the the relationship between physicians' *behavioral support* for the Lean change and the outcomes of the change.

Conclusion

Our three-year study of Lean implementation across three healthcare organizations in Canada led to the development of a conceptual model of medical commitment and its impact on Lean change outcomes. This paper proposes a contribution to the limited body of knowledge currently available on doctors' role during Lean implementation. We identified, through an inductive research, two pre-change and eight change antecedents influencing medical commitment towards Lean change, thus validating our initial hypotheses. We also identified that the level of transformational leadership displayed by a Lean project manager might have a moderating effect on the relationship between medical behavioral support for change and the outcomes of Lean initiatives. These findings were used to put forth eleven propositions pertaining to medical commitment towards Lean change. Of course, these affirmations require further inquiry due to our limited sample size of three organizations. We are currently developing a quantitative measurement tool derived from our suggested model. Using that tool, we aim to further study the mechanisms involved in medical commitment to Lean change. A quantitative study will help address the lack of generalizability from our initial qualitative work. As healthcare organizations travel deeper into Lean transformations and questions arise regarding the role of doctors, we believe this paper will provide an interesting baseline from which to continue this journey.

References

Barnas, K. (2011), "ThedaCare's business performance system: sustaining continuous daily improvement through hospital management in a lean environment", *Joint Commission Journal on Quality and Patient Safety*, Vol. 37 No. 9, pp. 387-399.

Bate, P. (2000), "Changing the culture of a hospital: from hierarchy to networked community", *Public Administration*, Vol. 78 No. 3, pp. 485-512.

Bouckenooghe, D., M. Schwarz, G. and Minbashian, A. (2015), "Herscovitch and Meyer's three-component model of commitment to change: meta-analytic findings", *European Journal of Work and Organizational Psychology*, Vol. 24 No. 4, pp. 578-595.

Bovaird, T. (2005), "Public governance: balancing stakeholder power in a network society", *International Review of Administrative Sciences*, Vol. 71 No. 2, pp. 217-228.

Brass, A. (1971), "A quality of mercy: a report on the critical condition of hospital and medical care in America", *Jama: The Journal of the American Medical Association*, Vol. 217 No. 1, p. 84.

Buetow, S.A. and Roland, M. (1999), "Clinical governance: bridging the gap between managerial and clinical approaches to quality of care", *Quality in Health Care*, Vol. 8 No. 3, pp. 184-190.

Burgess, N. and Radnor, Z. (2013), "Evaluating lean in healthcare", *International Journal of Health Care Quality Assurance*, Vol. 26 No. 3, pp. 220-235.

Costa, L.B.M. and Godinho Filho, M. (2016), "Lean healthcare: review, classification and analysis of literature", *Production Planning & Control*, Vol. 27 No. 10, pp. 823-836.

De Souza, L.B. (2009), "Trends and approaches in lean healthcare", *Leadership in Health Services*, Vol. 22 No. 2, pp. 121-139.

Denis, J.-L., Langley, A. and Sergi, V. (2012), "Leadership in the plural", *Academy of Management Annals*, Vol. 6 No. 1, pp. 211-283.

Dobrzykowski, D.D., Mcfadden, K.L. and Vonderembse, M.A. (2016), "Examining pathways to safety and financial performance in hospitals: a study of lean in professional service operations", *Journal of Operations Management*, Vols 42/43, pp. 39-51.

Emiliani, M. (2007), *Real Lean: Understand the Lean Management System*, Center for Lean Business Management.

Fine, B.A., Golden, B., Hannam, R. and Morra, D. (2009), "Leading lean: a Canadian healthcare leader's guide", *Healthcare Quarterly*, Vol. 12 No. 3, pp. 32-41.

Fournier, P.-L. and Jobin, M.-H. (2018), "Understanding before implementing: the context of Lean in public healthcare organizations", *Public Money & Management*, Vol. 38 No. 1, pp. 37-44.

Fournier, P.-L., Benormar, N. and Jobin, M.-H. (2016), *Mesurer L'impact Du Lean Sur La Performance: leçons Apprises Auprès De Trois Établissements De Santé Du Québec*, GISEH, Casablanca, Morocco.

Fullerton, R.R., Mcwatters, C.S. and Fawson, C. (2003), "An examination of the relationships between JIT and financial performance", *Journal of Operations Management*, Vol. 21 No. 4, pp. 383-404.

Giaimo, S. (2009), *Markets and Medicine: The Politics of Health Care Reform in Britain, Germany, and the United States*, University of Michigan Press.

Gilgun, J.F. (1995), "We shared something special: the moral discourse of incest perpetrators", *Journal of Marriage and the Family*, Vol. 57 No. 2, pp. 265-281.

Graban, M. (2011), *Lean Hospitals: improving Quality, Patient Safety, and Employee Satisfaction*, CRC Press.

Guest, G., Macqueen, K.M. and Namey, E.E. (2012), *Applied Thematic Analysis*, Sage.

Hartley, J. (2005), "Innovation in governance and public services: past, and present", *Public Money and Management*, Vol. 27 No. 4, pp. 27-34.

Harvey, J. (1990), "Operations management in professional service organisations: a typology", *International Journal of Operations & Production Management*, Vol. 10 No. 4, pp. 5-15.

Herscovitch, L. and Meyer, J.P. (2002), "Commitment to organizational change: extension of a three-component model", *Journal of Applied Psychology*, Vol. 87 No. 3, p. 474.

Jobin, M.-H. and Lagacé, D. (2014), "La démarche Lean en santé et services sociaux au Québec: comment mesurer la maturité des établissements", *Gestion*, Vol. 39 No. 3, pp. 116-127.

Jones, D., Mitchell, A., Ben, D., Fillingham, D., Makin, C., Silvester, K., Brunt, D. and Glenday, I. (2006), *Lean Thinking for the NHS: A Report Commissioned by the NHS Confederation*, Lean Enterprise Academy UK.

Kaplan, R.S. and Porter, M.E. (2011), "How to solve the cost crisis in health care", *Harvard Business Review*, Vol. 89 No. 9, p. 46.

Kenney, C. (2012), *Transforming Health Care: Virginia Mason Medical Center's Pursuit of the Perfect Patient Experience*, CRC Press.

Lapointe, L. and Rivard, S. (2005), "A multilevel model of resistance to information technology implementation", *MIS Quarterly*, pp. 461-491.

Lapointe, L. and Rivard, S. (2007), "A triple take on information system implementation", *Organization Science*, Vol. 18 No. 1, pp. 89-107.

Light, D. (2000), "The medical profession and organizational change", *The Handbook of Medical Sociology*.

Liker, J.K. (2004), *The Toyota Way*, Esensi.

Lin, Z. and Chun, H. (1999), "Should lean replace mass organization systems? A comparative examination from a management coordination perspective", *Journal of International Business Studies*, Vol. 30 No. 1, pp. 45-80.

Longenecker, P.D. and Longenecker, C.O. (2014), "Why hospital improvement efforts fail: a view from the front line", *Journal of Healthcare Management*, Vol. 59 No. 2, pp. 147-168.

Lorden, A.L., Zhang, Y., Lin, S.-H. and Côté, M.J. (2014), "Measure is of success: the role of human factors in lean implementation in healthcare", *The Quality Management Journal*, Vol. 21 No. 3, pp. 26-37.

Mazzocato, P., Savage, C., Brommels, M., Aronsson, H. and Thor, J. (2010), "Lean thinking in healthcare: a realist review of the literature", *Quality and Safety in Health Care*, Vol. 19 No. 5, pp. 376-382.

Meyer, J.P. and Allen, N.J. (1991), "A three-component conceptualization of organizational commitment", *Human Resource Management Review*, Vol. 1 No. 1, pp. 61-89.

Miles, M.B., Huberman, A.M. and Saldana, J. (2014), *Qualitative Data Analysis*, Sage.

Moraros, J., Lemstra, M. and Nwankwo, C. (2016), "Lean interventions in healthcare: do they actually work? A systematic literature review", *International Journal for Quality in Health Care*, Vol. 28 No. 2, pp. 150-165.

Nembhard, I.M., Alexander, J.A., Hoff, T.J. and Ramanujam, R. (2009), "Why does the quality of health care continue to lag? Insights from management research", *The Academy of Management Perspectives*, pp. 24-42.

Oreg, S., Vakola, M. and Armenakis, A. (2011), "Change recipients' reactions to organizational change", *A 60-Year Review of Quantitative Studies. The Journal of Applied Behavioral Science*, Vol. 47 No. 4, pp. 461-524.

Osborne, S.P. (2006), "The new public governance?", *Public Management Review*, Vol. 8 No. 3, pp. 377-387.

Patton, M.Q. (2002), *Qualitative Evaluation and Research Methods*, SAGE Publications.

Radnor, Z., Davies, R. and Burgess, N. (2009), "How much lean are English hospitals implementing", *National Health Executive*, pp. 60-62.

Rivard, S., Lapointe, L. and Kappos, A. (2011), "An organizational culture-based theory of clinical information systems implementation in hospitals", *Journal of the Association for Information Systems*, Vol. 12 No. 2, p. 123.

Rogers, H., Silvester, K. and Copeland, J. (2004), "NHS Modernisation Agency's way to improve health care", *BMJ: British Medical Journal*, Vol. 328 No. 7437, p. 463.

Rother, M. (2010), *Toyota Kata*, MacGraw Hill.

Rubin, R.S., Munz, D.C. and Bommer, W.H. (2005), "Leading from within: the effects of emotion recognition and personality on transformational leadership behavior", *Academy of Management Journal*, Vol. 48 No. 5, pp. 845-858.

Samuel, D., Found, P. and Williams, S.J. (2015), "How did the publication of the book the machine that changed the world change management thinking? Exploring 25 years of lean literature", *International Journal of Operations & Production Management*, Vol. 35 No. 10, pp. 1386-1407.

Schneller, E.S. and Smeltzer, L.R. (2006), *Strategic Management of the Health Care Supply Chain*, Jossey-Bass.

Scorsone, E.A. (2008), "New development: what are the challenges in transferring lean thinking to government?", *Public Money and Management*, Vol. 28, pp. 61-64.

Sheaff, R., Marshall, M., Rogers, A., Roland, M., Sibbald, B. and Pickard, S. (2004), "Governmentality by network in English primary healthcare", *Social Policy and Administration*, Vol. 38 No. 1, pp. 89-103.

Soriano-Meier, H. and Forrester, P.L. (2002), "A model for evaluating the degree of leanness of manufacturing firms", *Integrated Manufacturing Systems*, Vol. 13 No. 2, pp. 104-109.

Spear, S. and Bowen, H.K. (1999), "Decoding the DNA of the Toyota production system", *Harvard Business Review*, Vol. 77, pp. 96-108.

Staats, B.R., Brunner, D.J. and Upton, D.M. (2011), "Lean principles, learning, and knowledge work: evidence from a software services provider", *Journal of Operations Management*, Vol. 29 No. 5, pp. 376-390.

Toussaint, J., Billi, J.E. and Graban, M. (2017), *Lean for Doctors*, Catalysis.

Womack, J.P. and Jones, D.T. (1996), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon and Schuster.

Womack, J.P. and Jones, D.T. (2015), *Lean Solutions: How Companies and Customers Can Create Value and Wealth Together*, Simon and Schuster.

About the authors

Pierre-Luc Fournier is a PhD candidate in the Operations Management and Logistics Department of HEC Montréal. He is a professional engineer with an MSc in Industrial Engineering. He is a Researcher affiliated with the *Healthcare Management Hub* at HEC. Pierre-Luc Fournier is the corresponding author and can be contacted at: pierre-luc.fournier@hec.ca

Marie-Hélène Jobin is a Professor in the Operations Management and Logistics Department of HEC Montréal. She is also the Director of the MSc programme and Associate Director of the *Healthcare Management Hub* at HEC Montréal.