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An Integrated Model of Organizational Culture and Climate: A Case Study in Obstetrics Practice in Ontario

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Reflecting on all the people who have cheered me on, provided counsel, and helped me make this journey, two frequent quotes come to mind. First, is the African proverb, “It takes a whole village to raise a child.”[1] This proverb most succinctly captures the significance of various people who have contributed to the success of this project and simultaneously acknowledges my personal growth. It also reinforces the sense of community and personal compassion that I felt from so many people associated with this project across the United States, United Kingdom, and Canada.

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[1] http://www.afriprov.org/african-proverb-of-the-month/23-1998proverbs/137-november-1998-proverb.html

qualitative portion of this study, which was integral to this project. Therefore, they have also played a critical role in the success of this project. I am also grateful for the academic freedom afforded by Saint Louis University; it allowed me to pursue research interests in new directions and helped me continue to grow and develop as a productive member of the faculty.

The second quote is attributed to John of Salisbury, a 12th Century Theologian and Author[2], who said, “We are like dwarfs sitting on the shoulders of giants. We see more, and things that are more distant, than they did, not because our sight is superior or because we are taller than they, but because they raise us up, and by their great stature add to ours.” This research project was a tremendous learning experience for me and an opportunity to make a modest contribution to the advancement of theory on organizational culture and climate. The works of many renowned scholars have informed my thinking, and the encouragement and guidance of many mentors has stretched my knowledge and skillset. Now, I hope that this work encourages more integrated studies of culture and climate.

Also, as I reflect on this quote, I know that most of the times, it is used in reference to preceding works by notable scholars; however, I want to acknowledge another type of “giants” who helped me succeed in this project. These are “giants of heart”—these are the near and dear friends and family members who became my “candles” through some of the darkest times and helped me not only complete this project, but also emerge as a better, stronger person. I have been very fortunate to have so many wonderful, caring friends in my life. They have been with me when I had nothing material to give; they have cheered me on, and helped me see new opportunities of hope.

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Finally, I want to acknowledge the work of thousands of family doctors, obstetricians, nurses, midwives, and patient safety advocates who are tirelessly striving to make maternal and newborn care safer.

This work is dedicated to mothers and patient safety champions.

[2] http://www.phrases.org.uk/meanings/268025.html

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ABSTRACT

The goal of this study was to determine whether a training intervention would be sufficient to produce a cultural change. A comprehensive review of literature on culture and climate indicated that these separately studied constructs could be integrated; thus, an integrated model of culture and climate, and the associated theory, was developed. Three studies were conducted within the obstetrics practice in Ontario, Canada. The specific training intervention used in this study was the MORE^{OB} program (Managing Obstetric Risks Efficiently), which was a proprietary program developed by the Salus Global Corporation, Canada. This program sought to improve safety culture in the field of obstetrics through a strategic approach to knowledge-building and team-training. Over the past decade, more than 300 hospitals across Canada have implemented this program. However, the impact of this program on the culture of respective obstetrics units had not been evaluated. The sample for this research consisted of 68 hospitals from Ontario that had implemented the MORE^{OB} program.

Overall, this study used a mixed-methods approach, consisting of both quantitative and qualitative analyses, and explored five research questions and two hypotheses. The study was structured in terms of three sub-studies: Study#1 focused on quantitative assessment of knowledge gained through the training intervention, changes in clinical outcomes, and changes in the patient safety climate; Study #2 focused on qualitative assessment aimed at analyzing interview narratives and artifacts to develop a deeper understanding of how various external influences as well as internal factors and the MORE^{OB} training may have shaped the organizational culture at the subject hospitals. Study #3 took a longitudinal approach and presented an integrated analysis of culture and climate at two subject hospitals.

Ultimately, the three studies arrived at the following conclusions:

1. Contemporary environmental factors such as economics, geo-social conditions, legal requirements, and professional coalitions played a vital role in influencing organizational values as well operationalizing them. By asking the study participants how external environmental factors might have influenced their organizational culture, the researcher was able to map the role played by the changing external conditions in shifting the participants' unquestioned assumptions.
2. Leadership's role in shaping organizational culture was not limited to imprinting of his/her personal values on the organization. First, key influencers outside the organization raised awareness about critical issues, questioned the norms, and presented ideas and test-cases about best practices that could be used to solve the issues. Next, formal leaders within the organization interpreted these external signals in the context of

local conditions and engaged internal mechanisms to revise or reinforce corresponding organizational values. Internal key influencers, on the other hand, took the signal from their formal leaders and developed group-level standards of practice, enforced those standards, and served as role models.

3. Three levels of shared experiences were noted: (a) experiences resulting from external influences (e.g., the experiences resulting from placing one subject hospital under supervisory control); (b) experiences resulting from internal implementation mechanism (e.g., the use of the Lean methodology across one of the subject hospitals); and (c) experiences resulting from the MORE^{OB} program as a training intervention aimed at improving the patient safety culture in obstetrics.
4. A 2x2 matrix of internal versus external and formal versus informal feedback mechanisms was noted. External mechanisms, whether formal or informal, were aligned with external influence factors. For example, overall transparency regarding every hospital's clinical performance provided means to compare hospital performance across peers and enabled patients to choose their care providers based on quality of care metrics. Since patient volume was linked with financial health of the hospital, the benchmarked performance measures received significant attention from senior management. Thus, the study of feedback mechanisms revealed how such mechanisms could work in concert with external factors and have substantial impact on the organizational culture.
5. There was a positive influence of training on participants' knowledge, clinical outcomes, and safety climate factors. Additionally, the training was aligned with shared organizational values. However, it was evident from the low-to-moderate relationship between improvements in clinical knowledge (the focus of the training intervention) and the safety climate improvements that training alone was not sufficient to cause a climatic or cultural change. Results of the qualitative analysis were helpful in understanding the influence of MORE^{OB} training on shared values, practices, leadership commitment, and use of feedback mechanisms. Thus, while training may improve the organizational climate, its impact on culture is dependent on its alignment with shared organizational values, leadership commitment, and appropriate use of feedback mechanisms (including alignment of incentives).

The emergent model of culture and climate was revised to better represent the various mechanisms that influence organizational culture and climate. As a macro-level integrative model, it presents an alternate perspective compared to other models that generally tend to focus on specific elements like values or leadership. Future studies should consider different domains and different planned interventions in order to test the transferability of the proposed integrated model of culture and climate.

Chapter 1: Introduction

1.1 Introduction

Over the last decade, the interest in organizational culture, particularly in the context of patient safety, has spiked in the United States, Canada and the United Kingdom. In the United States, the severity of the problem of medical errors was brought to light in arguably the most factual and compelling manner by the Institute of Medicine's (IOM) report, *To Err is Human* (Kohn, Corrigan, & Donaldson, 2000). The Institute of Medicine is a division of the National Academies of Sciences, Engineering, and Medicine, a highly prestigious group of scientists that advises the United States Government and informs public policy. Thus, when it estimated that between 44,000 and 98,000 Americans die each year due to medical errors, the claim was taken very seriously. While the volume of such deaths was shocking, the range of the estimate also pointed to the fact that medical errors may not be measured, or accounted for, consistently. A more recent report on high-performing healthcare systems points out that among six developed nations (Australia, Canada, Germany, New Zealand, United Kingdom, and United States), although the United States spends the most on healthcare per capita, it ranks lowest in the overall quality of care, access, efficiency, equity, and life expectancy (Baker et al., 2008). Among eleven countries (Australia, Canada, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom, and the United States) the United States and the United Kingdom reported the two highest number of avoidable deaths per 100,000 population: 96 and 83, respectively (Thomson, Osborn, Squires, & Miraya, 2013). In a more focused study of 10 hospitals in North Carolina, harm to patients was common and there was no decrease in this harm during the five-year study (Landrigan et al., 2010). This study recommended that future studies should focus on developing programs and protocols that begin the cultural change necessary. Also, according to a 2016 study at Johns Hopkins University, medical errors are the third leading cause of death in the United States (Cha, 2016). Thus, patient safety continues to be a formidable challenge in the United States.

In Canada, residents receive comprehensive health care at about half of the cost of healthcare in the United States and at about one-third more than the cost of healthcare in the United Kingdom. The Canadian healthcare system could be described as a “publicly-funded, privately-provided, universal, comprehensive, affordable, single-payer, provincially-administered, national health care system” (Bernard, 2013, p.2). As a result of the provincial-federal partnership (both in cost-sharing as well as power-sharing), individual provinces have substantial autonomy in adopting certain practices and funding them; their outcomes can also vary considerably. Table 1 presents an overview of comparative healthcare expenditure across Canada, United States, and the United Kingdom. It is also important to note that in all three countries majority of the population is in urban areas, which tend to have relatively more advanced care facilities; thus, majority of the population has access to relatively high quality medical care.

Table 1: Comparative healthcare expenditure across Canada, United States, and the United Kingdom

	Canada	United States	United Kingdom
Total Population [1]	35,524,732	322,583,006	63,489,234
1 Year Change[1]	0.98%	0.79%	0.56%
Urban [1]	81%	83%	80%
Per capita Health Expenditure[2]	US$3,850 (10.4% of GDP)	US$7,349 (16.9% of GDP)	US$2,904 (8.9% of GDP)

Notes:

(1). 2014 Data; http://www.worldometers.info/world-population/population-by-country/

(2). 2012 Data; per capita spending in US$ at 2005 PPP rate (OECD, 2015)

In spite of the high per capita spending and majority of the population having access to relatively high quality medical care, the 2013-2014 Health Care in Canada Survey (HCIC, 2014) of a sample of the Canadian adult population, doctors, nurses, pharmacists, and administrators (n=1,405) reports the following:

- Fifty-eight per cent of the public claim to be receiving quality health care; 38 per cent claim that they do not receive quality health care.
- The doctors' perception of quality of care has been generally positive, in the 70-76 per cent range over a decade; however, the administrators' perception has dropped from 91 per cent in 2007 to 73 per cent in 2013.
- The biggest issue with healthcare in Canada is wait time—the survey respondents believe that it is already bad and will get worse in the future with a net negative momentum of as high as 24 per cent, and the quality of care is also perceived to get worse by about 4 per cent.

Although not as serious as the wait time issue, the perception of quality of care, among Canadians, is dropping and patient safety and adverse events are part of the metrics for quality of care. Thus, it is useful to review the definitions of patient safety and adverse event per the Royal College of Physicians and Surgeons of Canada. Patient safety is defined as "the reduction and mitigation of unsafe acts within the health care system, as well as through the use of best practices shown to lead to optimal patient outcomes," and adverse events are defined as, "unexpected and undesired incidents directly associated with the care or services provided to the patient" (RCPSC, 2003).

On the quality front, there seems to be a paradox: on the one hand, new scientific breakthroughs are enabling innovative interventions and improving both quality and expectancy of life, while on the other hand, avoidable medical errors are causing deaths and disabilities. Acknowledging this paradox and keeping sight of the overarching goal of striving toward improvements in both quality and affordability, the Institute of Medicine (IOM, 2015) released a core set of metrics for health and health care progress—Patient Safety is one of those metrics:

> Avoiding harm is among the principal responsibilities of the health care system, yet adverse outcomes are common. Ensuring patient safety will require a culture that prioritizes and assesses safety through a reliable index of organizational results. (p.3).

With respect to cost, it is clear that an increase in per capita spending on healthcare is neither viable nor proven to be correlated with superior quality of care (Baker et al., 2008; Thomson et al., 2013). Thus, in order to address the challenge of affordable, quality healthcare, one may have to seek innovative solutions that leverage the lessons learned by other industries and customize them to the unique needs and environment of healthcare. A number of such interventions have already proven to be successful. Some examples include the use of checklists (HRET, 2013), team training (Weaver, Dy, & Rosen, 2014), and simulation-based training (Aggarwal et al., 2010). It is essential to continue the quest toward systemic and sustainable enhancements to patient safety concurrent with cost containment—thus, there is a demand for a "culture of safety."

Today, high-quality healthcare at an affordable cost has become a scientific, financial, and political goal in the United States (Blumenthal, Malphrus, & McGinnis, 2015), Canada (Verma, Petersen, Samis, Akunov, & Graham, 2014), and the United Kingdom (NPSA, 2011). In order to address this goal, academic researchers and clinical practitioners are seeking sustainable, long-term solutions, which will constitute a cultural transformation. However, in this pursuit, there has been unabashed enthusiasm for survey-style assessment (Flin, Mearns, O'Connor, & Bryden, 2000; Fruhen, Mearns, Flin, & Kirwan, 2013; Guldenmund, 2007) and training-based interventions (Aggarwal et al., 2010; Grunebaum, 2007; Pratt et al., 2007; Weaver et al., 2014) with the hope that the survey results would identify problem areas and the corresponding training programs would address them. Unfortunately, many of these survey instruments have not been psychometrically validated and the training interventions seemed to be episodic rather than grounded in a broader commitment toward cultural transformation. Thus, the overarching research question of this study was as follows:

- Would an intervention, such as training, alone be sufficient to produce a cultural change?

In response to the above research question, this study reviewed the current literature regarding the complex constructs of culture and climate and applied a systems lens per the principles of systems thinking outlined by Checkland (1981).

This approach resulted in framing of internal organizational culture as an open system influenced by the external environment in which the organization operates and constituting of several interdependent components; on the other hand, organizational climate served as the psychological response to the underlying culture.

Although the proposed integrated model of organizational culture and climate could have been tested in any domain, there was compelling practical need to find ways to improve the patient safety culture in Canada, United States, and the United Kingdom; and the researcher had access to extensive datasets and key personnel from obstetrics practice in Ontario, Canada. Furthermore, Canada's medical facilities were comparable in technical sophistication and quality of care to those in the United States and the United Kingdom, but its single-payer insurance system provided an opportunity to control for variations in practice due to different payment schemes at different hospitals, regions, or for different types of patients. Also, obstetrics practice is considered a high-risk area and due to long periods of care (pre-conception through postpartum care) there are many opportunities for lapse in quality of care. Thus, obstetrics practice in Ontario, Canada, was chosen as the domain for this study.

1.2 The Chosen Domain: Obstetrics Practice in Canada

The healthcare industry has achieved numerous scientific breakthroughs in new drug discoveries, improvements in treatment protocols, as well as new and improved medical instrumentation. Concurrently, however, the global population is projected to rise by 38 per cent by 2050 (Kochhar, 2014) and 66 per cent of the population is projected to be urban, creating unprecedented stress on urban healthcare facilities while leaving the rural facilities with limited expertise and resources (UN, 2014). Thus, it is not difficult to visualize a pattern wherein if the rate of medical errors does not decrease, the avoidable deaths will increase exponentially. While such errors and consequential injuries and/or deaths may have a direct financial impact on the healthcare facilities and on the clinicians' ability to practice, they will not reduce the need to seek healthcare services.

In ongoing efforts to improve the quality and affordability, the healthcare industry has been creating new technical solutions (e.g., electronic health records and automated medication dispensing devices), developing human factors-based communication and teamwork protocols (e.g., CRM-based team training, specific communication-based interventions to prevent hospital-acquired infections and trips and falls, and improvements to patient discharge protocols), and using an outcomes-based approach to identify risks in specific practice specialties and appealing to the professional and organizational values to infuse and sustain longer-term cultural changes (e.g., practice guidelines focused on patient safety, educational techniques to encourage team training, and policy changes such as legislation, accreditation, and reimbursement rules) (Pratt et al., 2007; Kaveh Shojania, Duncan, McDonald, & Wachter, 2001) .

In the case of pregnancy and child birth, a woman is probably under medical care from a certain period prior to conception through the first few weeks postpartum. During this period, she is under medication, goes through several medical tests and screenings, visits both family physician and obstetrician/gynecologist several times, is hospitalized, and after delivery, the baby (or babies) is also under medical supervision, including medication, hospitalization, and possibly some form of neonatal treatment. Thus, there are many opportunities for lapse in quality of care or adverse events, but "everyone expects a perfect outcome; anything less is unsatisfactory; anything tragic is unforgiveable" (CRICO, 2010, p.6). In fact, over "1,700 birth traumas per year were reported between years 2003-2004 and 2005-2006 in Canadian hospitals outside Quebec…obstetrical trauma during childbirth was suffered by 1 out of every 21 women having a vaginal delivery" (CIHI, 2007), p.18). For 2013/2014, 385,937 births are estimated across Canada, out of which, Ontario accounts for 142,448 (about 37% —largest among the provinces) (StatisticsCanada, 2015). Thus, this study of a safety program in obstetrics focused on the data from Ontario.

1.3 The MORE^{OB} Program

In order to empirically test the viability of an integrated model of culture and climate and also determine whether a training intervention could be used to effect a long-term cultural change, it was essential to identify a training intervention that met the following criteria: (a) its goal was to improve safety culture; (b) it was implemented across at least three organizations and in a domain where safety culture was of high significance; (c) pretest/post-test safety climate data were available; (d) third-party performance data were available; (e) a representative sample of those involved in the implementation was accessible for interviews; and (f) the intervention was initiated at least 10 years ago. After a review of multiple intervention programs and access to data, the MORE^{OB} program (Managing Obstetric Risk Efficiently) was selected for this study. Since the MORE^{OB} program was a highly specialized intervention, a case-study approach was used to analyze its effects on the organization, as well as understand the general context within which it was employed.

The MORE[OB] program for obstetric clinicians was a safety strategy, which was aimed at reducing specific undesirable outcomes in maternal, fetal, and neonatal care (group-level outcomes). This program was a *strategic* intervention because it conforms to Henderson's classic definition of a strategy (Stern & Deimler, 2006):

> All competitors who persist over time must maintain a unique advantage by differentiation over all others. Managing that differentiation is the essence of long-term business strategy. (p.1)

Most change programs or interventions are developed within the firm and are exercised to achieve specific tactical goals like improving productivity, reducing accidents, or developing better systems of communication, etc. The MORE[OB] program, however, was developed by the Society of Obstetricians and Gynecologists of Canada (SOGC) and was implemented as a continuing medical education (CME) program (Milne & Lalonde, 2007; Milne, Walker, & Vlahaki, 2013) at most birthing centers across Canada. It was founded on the principles from High Reliability Organizations (Roberts, 1993) and was aimed at building a non-punitive, learning organization similar to that proposed by Senge (1990). Based on the published literature on the MORE[OB] program (Milne & Lalonde, 2007; Milne et al., 2013; Thanh, Jacobs, Wanke, Hense, & Sauve, 2010), it offers strategic differentiation from most other patient safety programs as follows:

a. The overall strategy is to focus on one practice specialty (obstetrics), but include all the interacting professionals (physicians, nurses, midwives, administrators, etc.). It begins with a signed commitment by an interdisciplinary core team consisting of the hospital management and the clinicians involved in leading the implementation of the program. It goes deep with an extensive awareness and behavioral training programs aimed at improving specific clinical outcomes.

b. It was designed and developed by a national professional society; thus, it is a peer-to-peer program rather than a management-driven program or a regulatory compliance program. By focusing on clinical outcomes at both maternal and neonatal levels, this program appeals to the innate desires of the clinicians to excel in technical aspects and it appeals to their intrinsic motivation to serve their patients. It is not driven by external incentives such as rankings or insurance reimbursements. Furthermore, by making this program available at minimal direct cost to the participating hospitals, the cost barrier is lowered.
c. It involves both awareness training through interactive presentations and multidisciplinary group activities including workshops, skills drills, emergency drills and simulations; thus, it addresses both the attitudinal aspects as well as the behavioral aspects of patient safety. By identifying clear clinical goals at both maternal and neonatal levels, it emphasizes operational excellence.
d. It is focused on one specific specialty; thus, given the diversity of specialties in the medical profession and their respective needs, this program is narrowly applied, but deeply committed to improving clinical outcomes in the specific specialty.
e. Its initial implementation was funded by an insurance company—a major stakeholder in patient safety—leveling the playing field for all its clients and possibly creating a competitive advantage for itself. Once the clinical and financial outcomes had been demonstrated, the program was funded by provincial ministries; again, lowering the direct financial burden on an individual hospital or a rural healthcare facility.

f. The developers of this program made a financial case for the professional society, insurance companies, and provincial health ministries to invest in the program. Ahead of their estimate, the program produced a positive return by the end of three years.

g. Fundamentally, the MORE^{OB} program presents a different cultural intervention model. While most cultural intervention models have focused on organization-level (e.g., Safety Management System) or discipline-level programs (e.g., Crew Resource Management), the MORE^{OB} program uses an inter-professional model to influence the professional culture among all clinicians engaged in the practice of obstetrics. Also, while most cultural intervention models focus on the changes in employee perceptions (climate) or outcomes (performance), this model presents an opportunity to assess the influence of, as well as influence on, values and unquestioned assumptions.

Thus, assuming that the MORE^{OB} program provides sustainable clinical and financial advantages, it seeks to position the adopting hospitals (firms) at a competitive advantage against those who do not: improved clinical and financial outcomes will be perceived as better quality of care at a lower cost, thereby increasing patient volume and overall reputational and revenue gains.

1.4 Two Comparable Studies of Safety Climate and Outcomes in Obstetrics

In a longitudinal study of effects of a series of interventions, Grunebaum (2011) reviewed the effects on safety climate and clinical outcomes. The intervention process started with a consulting review in 2002 and proceeded with team training, electronic medical records implementation, and communication training in the labor and delivery unit in 2003. In 2004, a dedicated gynecologist was added to serve as the attending physician on call and limitations were placed on how the labor was managed in the case of nonviable fetus. In 2005, they proactively identified higher risk cases to ensure additional checks-and-balances were attributed to such cases, standardized key medication procedures for all cases, and color-coded certain medications that were prone to administration errors. In 2006, they focused on improving team communication and coordination, enhancing the clinical knowledge of all staff, adding necessary staff to provide help in critical clinical areas, and developed additional protocols to proactively manage certain high-risk conditions such as ante-partum hemorrhage. In 2007, the position of laborist was created and recruited. In 2009, an oxytocin initiation checklist was developed, a postpartum hemorrhage kit was built, and online training with knowledge tests was implemented. In summary, this program involved multiple interventions like training, addition of personnel, implementation of customized toolkits and safety aids, and use of technology for communication and record-keeping. In terms of impact on clinical and financial outcomes, Grunebaum reported a decline in sentinel events from 1.04 per 1000 births in the year 2000 to zero such events in the years 2008 and 2009; the compensation payments declined from $50 million to less than $5 million. All these elements potentially contributed toward institutionalization of emphasis on patient safety. The progressive implementation of different interventions over time also illustrates the cumulative benefits of the interventions.

Another outcomes study, focused specifically on the effects of the MORE^{OB} program, demonstrated improvements in clinical outcomes as well as reduction in insurance costs (payouts) (Thanh et al., 2010). The goal of the MORE^{OB} program was "to achieve a uniform degree of excellence in all delivery centers" (Thanh et al., 2010). The program consists of three modules (learning together, working together, and changing the safety culture) that include online modules, lectures, simulations, drills and practice sessions (Milne & Lalonde, 2007). The MORE^{OB} implementation process began with a pilot program funded by the Healthcare Insurance Reciprocal of Canada (HIROC) at HIROC's client hospitals (Milne et al., 2013). Thereafter, the program was funded by the Alberta Ministry of Health and Wellness and the program was implemented across the province of Alberta. By 2013, the MORE^{OB} program had demonstrated improvements in clinical outcomes as well as reduction in insurance costs, thereby producing the projected return on SOGC's investment within the first three years instead of the projected five-years (Milne & Lalonde, 2007; Milne et al., 2013). However, there has not been a comprehensive study—beyond the clinical and financial performance outcomes—linking all aspects of a safety culture involving the MORE^{OB} program or a similar training intervention. The study presented in this thesis is substantially different in scope and scale from the Thanh et al. study. While the Thanh et al. study focused narrowly on the clinical and financial outcomes of the MORE^{OB} program within Alberta, this study focuses on the effect of the MORE^{OB} program on the broader safety culture within obstetrics units in Ontario. Also, this study used both qualitative and quantitative methodologies to triangulate the potential impact of the MORE^{OB} program on culture and climate.

1.5 Philosophical Assumptions and Interpretive Frameworks

This study used a post-positivist framework, employing a social science theoretical lens and recognizing that cause-and-effect is a probabilistic relationship that may or may not manifest in every interaction or may not be fully explainable with quantitative data (Denzin & Lincoln, 2005). The researcher's early training has been in physical sciences and technology and later training in education and business. Thus, the researcher's views have evolved from a strictly positivistic perspective to post-positivistic perspective, acknowledging that (a) the researcher's bias influences what is observed, analyzed and reported, (b) the relationship between an intervention and its impact is probabilistic at best, (c) while probabilistic tools and techniques provide a certain degree of objectivity, there is often additional information—in terms of qualitative narratives—that adds context to the phenomenon observed through quantitative analysis, and (d) together, the quantitative and the qualitative analyses provide a more comprehensive understanding of the phenomenon under study.

Ontologically, the researcher recognized reality from multiple perspectives and therefore, used multiple qualitative and quantitative tools to report findings. Epistemologically, the researcher gathered subjective evidence from the participants by engaging in direct observations, interviews, and deep dialog to lessen the distance between himself and his research subjects; however, in order to balance this approach of knowledge generation, the researcher organized the narratives in the form of themes and coded data and used quantitative data collected by third-party agencies.

As an engineer and an educator, the researcher believes that (a) a particular social or socio-technical environment could be engineered—thus a certain type of organizational culture could be produced or changed from one form to another and (b) a properly designed intervention can be effective in changing both individual and communal behavior and thereby result in sustainable changes to focus areas such as safety, productivity, service, or quality.

1.6 Structure of this Thesis

This thesis follows the conventional five-part model in social sciences: introduction, literature review, methodology, results, and discussion and conclusions. A thorough review of relevant literature on culture and climate was used to develop an integrated model of organizational culture and climate. The narrative describing this model forms the overarching theory and provides two fundamental propositions. For the purpose of this study, the MORE^{OB} training was selected as the intervention. Research questions and hypotheses were drawn from the theoretical propositions and in the context of the MORE^{OB} training intervention. Research questions were pursued using qualitative data and corresponding analysis; whereas, hypotheses were tested using quantitative data and corresponding analysis.

The Results section is split into three parts (chapters 4, 5, and 6) and is followed by the Discussion and Conclusions section (chapter 7). In order to help the readers track the various research questions, hypotheses, and the associated findings, the research questions and hypotheses are presented first in Chapter 2 and again in Chapter 7.

1.7 Summary

The healthcare sector in the United States, Canada, and the United Kingdom is faced with the dual mandate to improve quality of care and affordability. It is generally believed by leading researchers and practitioners that this mandate could be addressed by improving the safety culture in healthcare, and training seems to be the most frequent intervention hoped to succeed in bringing about a sustainable, long-term cultural change. However, the enthusiasm for a solution may have raced past the development of a robust theoretical foundation. Thus, this research reviews the current literature on organizational culture, organizational climate, and integrated models of culture and climate. It proposes a new integrative model as the theoretical foundation for a case-study in the obstetrics practice in Ontario, Canada. Training, as a planned intervention, is used to assess the mechanisms by which organizational culture and climate could be influenced.

Chapter 2: Literature Review

2.1 Introduction

Researchers in the fields of organizational studies and management have long been fascinated by the constructs of organizational culture and organizational climate; particularly, there has been tremendous enthusiasm to link organizational culture with organizational performance. However, over the past three decades, several leading researchers have also called for both a more disciplined approach to the study of organizational culture/climate and also to the integration of these two concepts. This chapter seeks to start with a clean slate and progressively construct an integrated model of organizational culture and climate comprised of the key elements of culture and climate as well as their mutual influence. It takes an incremental approach to theory building (cf. Corley & Gioia, 2011; Dubin, 1969). While such an approach may not normally lead to particularly insightful or surprising theoretical contribution (Corley & Gioia, 2011), it could enable extending and connecting previously established constructs (Dubin, 1969), giving rise to potentially insightful propositions regarding the relationship between the various constructs contained in the theory. Also, by way of a fresh start toward the integrated model, this approach seeks to incrementally build on past studies in the form of models 1-7. Thereafter, this chapter extends the integrated model to a more specific focus on safety, thereby bounding the theoretical framework. A training intervention is used as an independent variable in Model 8. In order to test the effectiveness of such a planned intervention on the safety culture and climate at subject hospitals, a brief discussion of key theories regarding training interventions is also presented. Finally, since the case-based approach tends to build an in-depth narrative about each case, the insights derived from one case could be compared with those from another and new conclusions could be drawn (Eisenhardt, 1989). This chapter concludes with a proposed theoretical model, its propositions, and related research questions and hypotheses.

2.2 Organizational Culture

2.2.1 Model 1: Shared Experiences Lead to Shared Values

Schneider and Barbera (2014) present 35 chapters illustrating the latest thoughts of leading researchers studying organizational culture and climate. Schneider and Barbera's definition of culture, which is used as the working definition by others throughout the book, is rooted in shared values within an organization, and it includes mechanisms used to reinforce and revise such values through a broad range of acculturation processes, management decisions, and transmission of legends and stories across the organization.

Ployhart, Hale, and Campion (2014) attribute Schneider and Barbera's definition to the school of thought that regards culture as an *enduring* set of characteristics that guide the routine operation of an organization (DiMaggio, 1997; Sewell, 2005); alternatively, another school of thought uses a toolkit paradigm, wherein culture is temporal, transferable, and a matter of choice (Swindler, 2001). It seems certain practices may emerge indigenously within a group based on their shared experience and consistent with their values—this would be aligned with the former perspective on culture—and another group may borrow certain aspects of another group's culture, artifacts like checklists for example, adapt them for their context and use them to the extent they meet their needs, thereby supporting the toolkit paradigm. However, based on Ployhart et al.'s assessment, the various definitions and perspectives on culture overwhelmingly converge on three dimensions: (a) artifacts, (b) values and beliefs, and (c) underlying assumptions, which have been the foundation of Schein's theory of organizational culture (1988, 2010, 2015). Additionally, Ployhart et al.'s review claims that (a) organizational culture is historically determined and socially constructed, (b) culture is stable, but can be changed under appropriate circumstances, and (c) culture should be studied at a group level, whereby it would acknowledge the heterogeneity observed across groups within the same organization as well as enable comparison across similar groups in different organizations. Schein (1988) defines artifacts as manifestations of the underlying culture and hence they can take the form of language, symbols, stories, as well as implementation mechanisms like policies and procedures. The role of organizational history and social construction of meanings within that historical context is captured by Schein (1988, 2010, 2015) in terms of "shared experience and learning."

Schein (2015) draws upon previous research to offer the description of culture as state of shared beliefs and values as well as a dynamic process of constructing shared meaning (Frost, Moore, Louis, Lundberg, & Martin, 1985) through a shared learning process, wherein this dynamic process is used to regularly reaffirm or revise the state of the extant culture. The balance between the stability of the existing shared beliefs and the influence of new shared experiences and their meaning presents both emotional security or "avoidance of catastrophic anxiety" (Weick, 1995; Weick & Sutcliffe, 2007) as well as opportunities for meaning-driven shifts in shared beliefs (Sahlins, 1985). Thus, Schein (2015) reaffirms that culture is both a state and a process in his definition of culture:

> A pattern of shared basic assumptions that the group has learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (Schein, 2010, p.18).

In effect, Schein's model has two influence vectors: one vector connects shared experience to shared values as a reinforcement mechanism, giving a degree of stability to the shared values; the second vector also connects shared experience to shared values, but it tends to create new meanings and new values and therefore, it tends to revise the state of the extant culture.

Figure 1 illustrates this dual-vector concept as Model 1. The blue arrow represents the reinforcement of existing shared values through routine experiences and learning and the red arrow represents revision of existing values as a result of new shared experiences and learning.

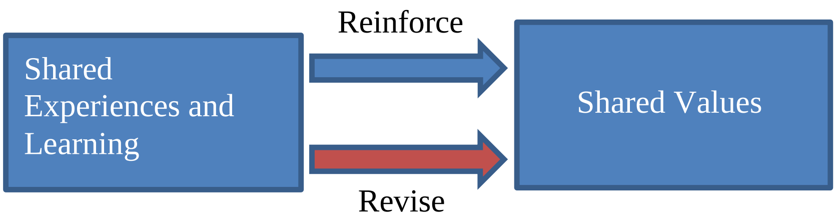


Figure 1. Model 1. Shared experiences and learning reinforce and revise shared values.

<u>2.2.2 Model 2: There are Four Types of Organizational Values</u>

Cultures are often defined solely in terms of a group's shared values, beliefs, and unquestioned assumptions (Helmreich & Merritt, 1998; Hofstede, 1984; Schein, 1988). These groups could be categorized as belonging to a certain profession (professional culture), organization (organizational culture), or nation (national culture). Within each major group, different subgroups are compared with respect to the relative importance they ascribe to a specific value. For example, with respect to national culture, Hofstede discovered that Europeans were more individualistic than Asians (who are more collectivistic). Similarly, Helmreich and Merritt discovered that pilots were more individualistic than surgeons and Patankar and Taylor (2004) discovered that mechanics were more individualistic than pilots.

Schein (1988, 2010, 2015) used the combined term, “beliefs and values,” while Hofstede (1984) used “values” only. The emergent model in this study chose to use “values” rather than “beliefs and values” or “beliefs” because there was more consistent use of the term “values” in culture literature (e.g., Argyris & Schön, 1974, 1978; Bourne & Jenkins, 2013; Hofstede, 1984; Rochon, 1998; Schwartz, 1992). Simplistically, the distinction between beliefs and values seems to be that beliefs are relative to the context in which they are applied and values are more humanistic and absolute. Thus, one could argue that there is a greater likelihood of agreement among people on values rather than beliefs. Bourne and Jenkins (2013) criticized this traditional view of organizational values as “unitary or fully formed and stable entities” and presented an alternate perspective. Accordingly, values can be classified in terms of different levels as well as in terms of present versus future contexts: espoused, attributed, shared, or aspirational with a certain degree of overlap. Espoused values are those that are formally espoused by top management, attributed values are those that the members of the organization readily attribute to their organization, shared values are the aggregate of individual values as rated on a Likert-type scale, and finally aspirational values are the values that the members believe ought to be the organizational values. Dissonance between these values creates three types of gaps: expectation gap, dislocation gap, and leadership gap. Expectation gap arises when attributed and shared values are consistent, but sufficiently separated from espoused and aspirational values; a dislocation gap arises when attributed and espoused values are consistent, but sufficiently separated from shared and aspirational values; and a leadership gap arises when the espoused values are sufficiently separated from the cluster of attributed, shared, and aspirational values. Each form of gap creates its own set of challenges and they have to be resolved differently. (Bourne & Jenkins, 2013). Awareness of such gaps is relevant to the choice of both the intervention strategy as well as rate of adoption of the change program. For example, an expectation gap would indicate the degree to which the organization would be willing to change if the members were made aware of this gap. On the other hand, with a dislocation gap, the internal perception of the organization would be significantly different from the external perception—thus, public acknowledgement of such a gap could be risky for leaders, and bringing about an alignment in these perceptions would be a delicate task. Finally, if there is a leadership gap, it would indicate a significant challenge in building a coalition in support of the espoused values because the leader may be the only one championing the espoused values.

Based on this expanded view of values, Model 1 could be expanded to include all four types of values. Thus, shared experiences and learning would influence espoused values, attributed values, shared values, and aspirational values; however, the degree of influence on a specific type of value would likely depend on the nature of the shared experiences and learning. This expanded view on values leads one to Model 2, as illustrated in Figure 2.

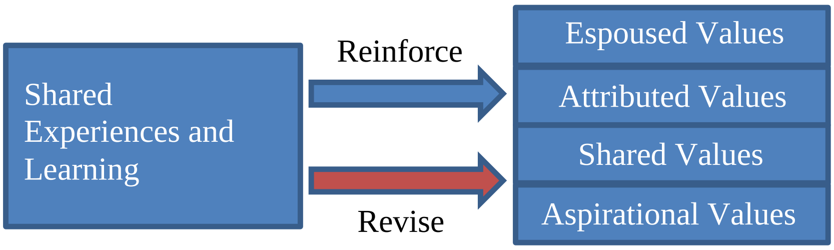


Figure 2. Model 2. Shared experiences influence four types of organizational values.

2.2.3 Model 3: Only Some Shared Experiences Cause Learning

The concepts of shared experience and learning deserve a closer look. Experiential learning is defined as a form of learning in which "a learner is directly in touch with the realities being studied" and distinct from traditional academic learning which takes place detached from the practical, real-world operational setting (Keeton & Tate, 1978). Over the past 50 years, several scholars have contributed to the development of the Experiential Learning Theory; however, the foundation was laid by notable scholars like John Dewey (democratic values, pragmatism, and personal development), Kurt Lewin (T-groups, action research, and democratic values), and Jean Piaget (personal development, dialectics of learning from experience, and epistemology) (Kolb, 2015). Kolb defines experiential learning as, "the process whereby knowledge is created through the transformation of experience" (p.49). This definition and the general approach to understanding human learning is particularly important to cultural development because the emphasis in experiential learning is on the experience of being part of an activity, cognitive reflection, knowledge generation, and adaptation—such that there is individual-level transformation resulting from the experience and it sows seeds for organizational or systemic transformation. Miller, Riley, Davis, and Hansen (2008) discovered that the post-simulation debriefing was most influential in participant-learning and process improvements. Thus, shared experience can lead to learning and this learning can lead to process improvements. Senge (1990) defines organizational learning as an integration of four core disciplines (building a shared vision, fostering consistent mental models, team learning, and achieving personal mastery)—the integration itself, however, is the fifth discipline of systems thinking. Thus, he claims,

> At the heart of a learning organization is a shift of mind—from seeing ourselves as separate from the world to connected to the world, from seeing problems as caused by someone or something "out there" to seeing how our own actions create the problems we experience. (p.12-13)

Model 3, illustrated in Figure 3 splits shared experiences and learning to highlight the learning that may be derived from shared experiences. It is also important to note that, according to Senge (1990), most organizations suffer from at least one of the seven learning disabilities: (a) exclusive focus on one's position and not on one's role in the network of roles played by everyone in the organization; (b) the natural human tendency to blame others for failures; (c) the reactive urge to take on the external enemy; (d) fixation on certain visible events or outcomes rather than the deeper, slow-burning issues; (e) inability to respond to gradual rise of threats; (f) being delusional about learning from experience when one has not fully experienced the consequences of one's actions; and (g) the myth of a cohesive management team. Collectively, these learning disabilities reinforce an organization's resistance to learn. Thus, Model 3 acknowledges that the actual learning from shared experiences is likely to be less than optimal.

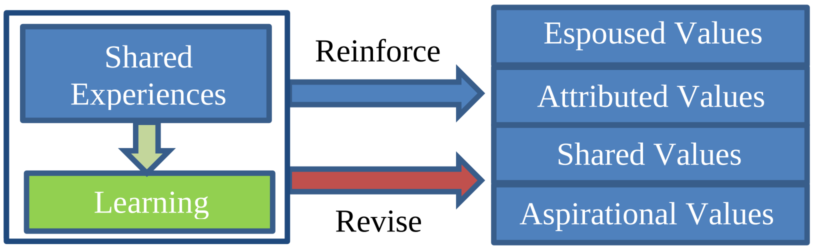


Figure 3. Model 3. Some shared experiences cause learning and influence organizational values.

2.2.4 Model 4: Leaders and Key Influencers Play a Critical Role

While the preceding literature discusses the role of shared experiences and learning on the reinforcement and revision of organizational values, it does not delve into the role of people and the mechanisms that drive, maintain, or influence organizational values. Pettigrew's (1979) study of a founder of a British boarding school has been quoted widely as catalyst in stimulating the study of organizational cultures using qualitative tools that are more commonly used in anthropology (Ehrhart, Schneider, & Macey, 2014; Schneider & Barbera, 2014b; Wright, 1997) as well as noting the influence of leaders, particularly founders, of organizations (Ehrhart et al., 2014; Schneider & Barbera, 2014b; Waterson, 2014). At this point, it would be important to focus on Pettigrew's explanation of how founders inculcate their personal values and beliefs into the organizations they create. Pettigrew defined entrepreneurship as a leader's ability to transform "individual drive into collective purpose and commitment" (p.573). Thus, leaders' efforts to build mission statements, organizational structures, policies, and procedures are essentially implementation mechanisms to achieve their operational objectives (achieving business success) as well as to create a certain organizational culture. Schein (2010, 2015) calls such mechanisms "norms" and the physical evidence of norms, such as the organizational policy document (e.g., a policy on non-punitive self-reporting of errors) a cultural artifact. Although most of the literature on the influence of leadership uses a top-down leadership model, in organizational cultures that rely on highly-trained professional experts who are trained and paid to think or are regarded as "knowledge workers," a progressive view of leadership—in the form of key influencers—might be more appropriate (Davenport, 2005; McDonald, 2005). Figure 4 presents Model 4, which extends Model 3 by adding leaders and key influencers to impact implementation mechanisms like strategies, policies, programs, and processes. The relationship between values and leadership is expressed with a bi-directional arrow to convey that leaders are both influenced by, and influencers of, organizational values. For example, in mature organizations, it is more likely that leaders are selected to fit the organizational values (e.g., Schneider's, 1987, Attraction-Selection-Attrition model), while in the formative stages of organizational development, it is more likely that the founder(s) inculcates their own personal values into their organizations. For example, the influence of founders' values on their organizations have been documented with respect to companies like Southwest Airlines (Freiberg & Freiberg, 1996), Hewlett-Packard (Packard, 1996), the Tata Group (Lala, 2006) and many other high-performing organizations (Collins & Porras, 1997).

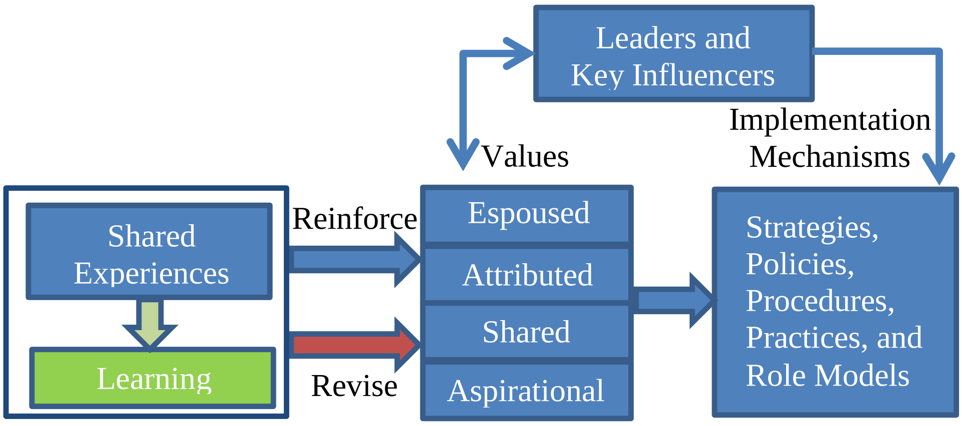


Figure 4. Model 4. Organizational values inform implementation mechanisms

The following two examples illustrate how implementation mechanisms tend to influence individual behaviors and reinforce or revise organizational values.

<u>Human Resources Practices</u>: It is quite common to find a range of policies and practices involving the realm of attraction-selection-attrition (ASA Theory) (Schneider, 1987) of personnel, which starts with attracting potential employees whose personal attributes are compatible with the corporate aspiration, acculturation of the new employees into the organizational culture, and attrition of employees that do not fit within the extant or desired organizational culture. The ASA theory extends Lewin's work on Person-Environment concepts (Lewin, 1935, 1951) and applies it to the specific mechanisms used to attract individuals with certain desired KSAs (knowledge, skills, and attributes) type of individuals into an organization, retaining and rewarding certain behaviors that are consistent with the organizational values, and rejecting or punishing behaviors that are not consistent with the shared or espoused organizational values.

<u>Safety Practices</u>: In high-consequence industries, catastrophic incidents are relatively rare. Thus, it is generally believed in these communities that reduction

of precursor events, such as errors that are caught and adverse outcomes that are averted, will reduce the catastrophic/fatal accidents (Taxis, Gallivan, Barber, & Franklin, 2006). Consistent with this theory, the Threat and Error Management model emphasizes regular peer-observations of operational performance to note threats faced and recognized or not, errors made, and the overall outcome (Helmreich, Klinect, & Wilhelm, 1999). This model uses regular observation and correction of the smallest deviations in order to maximize the overall safety and reliability of the system.

Thus, one could conclude that various implementation mechanisms are designed to influence individual behaviors (minimize at-risk behaviors and errors), which in turn contribute toward a desirable firm performance. It is important to note that (a) the relationships between values, implementation mechanisms, behaviors, and firm performance are probabilistic and not causal and (b) observable individual, group, and firm-level outcomes form a feedback loop that creates new shared experiences, which feed into new learning (Aboumatar et al., 2007; Bagian et al., 2002; Battles, Dixon, Bortkanics, Rabin-Fastment, & Kaplan, 2006; Berenholtz, Hartsell, & Pronovost, 2009; Carroll, Rudolph, & Hatakenaka, 2002; Deis et al., 2008; Latino & Latino, 2006; Rex, Turnbull, Allen, Vande Voorde, & Luther, 2000; Vincent, Taylor-Adams, & Stanhope, 1998; Wald & Shojania, 2001; Wilson, Dell, & Anderson, 1993; Woolf, Kuzel, Dovey, & Phillips, 2004; Wu, Lishutz, & Pronovost, 2008).

2.2.5 Model 5: Feedback Loops Influence Shared Experiences and Learning

In Model 5, Figure 5, the emergent model of organizational culture includes both the outcomes as well as the feedback loop.

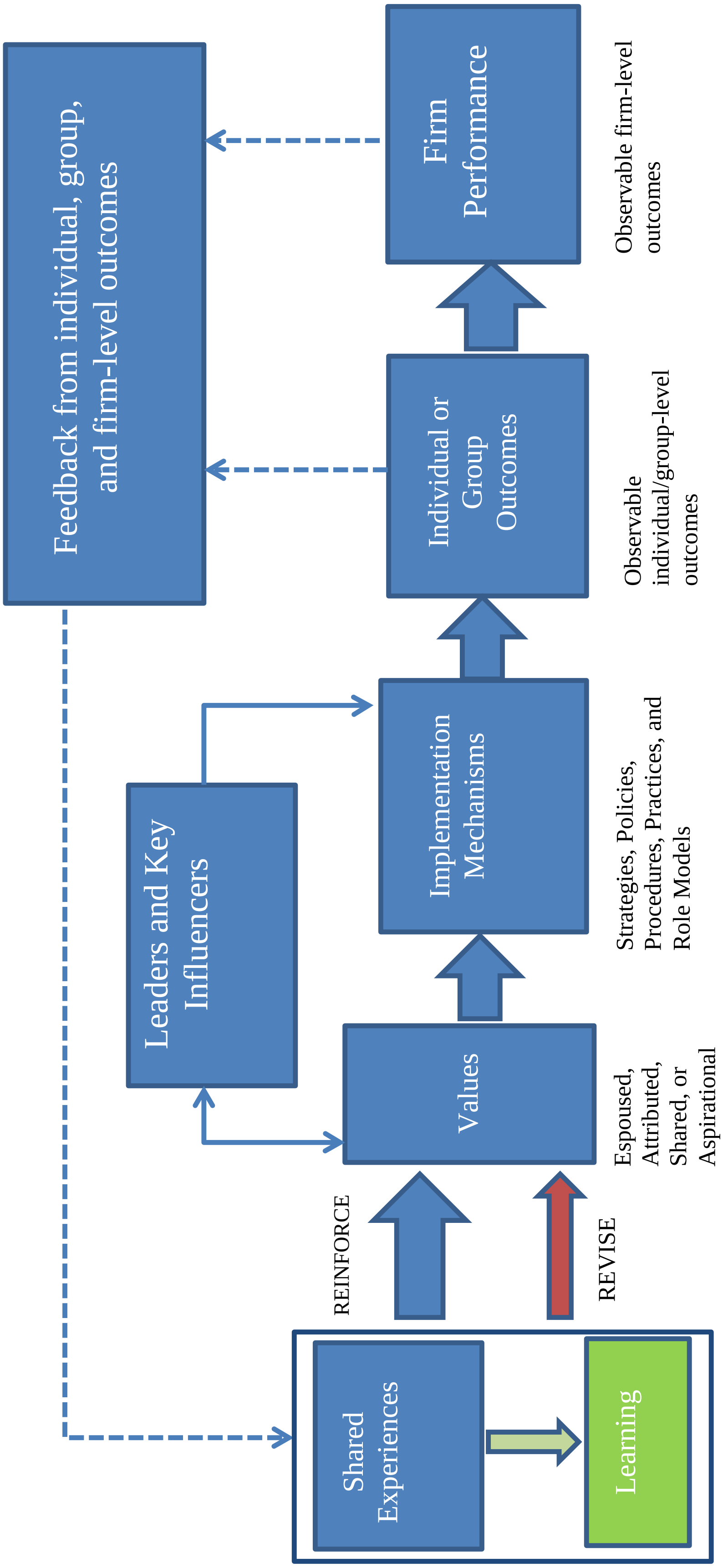


Figure 5. Model 5. Structure of organizational culture

Table 2 summarizes the key structural elements comprised in the construct of organizational culture as follows:

a) Shared Experience
b) Learning
c) Organizational Values
d) Implementation Mechanisms
e) Leaders and Key Influencers (Heroes)
f) Individual, Group, and Firm-level Outcomes
g) Feedback Loop

Table 2. Key elements of organizational culture

Key Cultural Element	Context/Key Findings	Source
Shared experiences and learning	Shared history of experiences result in identification of patterns of success of a group's response to challenges. These patterns are reinforced and automated with practice and lead to shared values and unquestioned assumptions.	Schein (1988, 2010, 2015)
Experiential learning and organizational learning	People learn through experience (outcomes of their actions) and reflection on those experiences; organizations learn from experience of success/failure and adaptation of strategies.	Kolb (2015); Senge (1990)
Organizational Values: shared beliefs and unquestioned assumptions	Cultures can be defined in terms of values and beliefs shared by a group of people: national, organizational and professional cultures.	Hofstede (1984); Helmreich & Merritt (1998); Schein (1988)
Four types of organizational values	Organizational values can be classified into four types: espoused, attributed, shared, and aspirational.	Bourne & Jenkins (2013)
	For organizations to be transformed, there must be a value-level change.	Rochon (1998)
Implementation Mechanisms: processes used to implement and reinforce or renew organizational values	Processes used to attract, select, and attrition (ASA model) employees that might fit (or not fit) with the organizational culture tend to reinforce values held by existing employees.	Schneider (1987)
Leaders and key Influencers	Anthropological perspective on study of how leaders inculcate their personal values into their organizations	Pettigrew (1979)
Implementation Mechanisms: Structures, Policies, Procedures	Leaders institutionalize their values through formal structures, processes, and procedures in the organization	Schein (2010, 2015)
Individual, group, and firm-level performance	The just culture focuses minimizing at-risk behaviors; debriefings are routinely used as learning opportunities.	Dismukes & Smith (2000); Marx (2001); Reason, 1997)
Feedback in response to Individual Behaviors/ Performance and Group or Firm-level Performance	Knowledge of individual and organizational factors that may have led to performance lapses serves as a feedback loop and can result in changes in policies, procedures, and practices—a measure of organizational learning	Reason (1997); Clarke (2006); Putter (2010); Senge (1990)

2.2.6 The Role of Artifacts

One aspect that is notably absent from the list of key structural elements of culture is the role of artifacts. Many scholars, particularly Schein (1988, 2010, 2015) and Rousseau (1990), have noted the value of artifacts. Schein's model considers artifacts as a part of the organizational culture construct and Rousseau's model views artifacts as the most visible aspect of an organization's culture. However, since artifacts are *products* of culture, the emergent structure of organizational culture proposes to study artifacts as outcomes or manifestations of culture rather than the culture itself. Vilnai-Yavetz and Rafaeli (2012) argue that artifacts are much more than evidence of organizational culture. They incorporate relevant literature and provide an expansive definition of artifacts:

> Artificial products, something made by human beings and thus any element of a work environment…perceived by senses and that they have certain intentions, aiming to satisfy a need or a goal…include intangible notions such as names, language, and contracts, as well as tangible notions such as inanimate objects introduced by organizational members into their organizations. (p.10).

Considering the broad range of tangible and intangible notions that could be included within the scope of an artifact, Vilnai-Yavetz and Rafaeli present three dimensions from which artifacts should be analyzed: instrumentality, aesthetics, and symbolism. Instrumentality refers to the utility (or lack thereof) of the artifact—many physical artifacts such as tools, checklists, policies and procedures would have a positive influence on the outcomes and hence would be considered to have positive instrumentality. The degree to which such an artifact is useful or effective in accomplishing the intended goal and minimizing mistakes could be further evaluated with an evaluation rubric and a corresponding numeric rating. Aesthetics refers to the sensory reaction to the artifact—is it pleasing, is it appropriately used (graphic or symbolism in the context of local customs and traditions), or does it evoke generally positive emotional reactions? Symbolism refers to the meaning of the artifact—it could mean something entirely different to the ones that create the artifact versus those that see it or observe it. Thus, “artifacts can have both intended and unintended symbolic consequences” (p.14).

Once the scope and nature of an artifact is defined, the next question is about its role in organizational culture. As products of organizational culture, one must consider the various structural elements of an organizational culture as presented in Table 2 and consider their corresponding artifacts. Table 3 presents examples of such artifacts and the context in which such artifacts have been studied and/or key findings relating to these artifacts. This is neither exhaustive nor exclusive list of artifacts and their corresponding studies; it is a list of examples to illustrate the concept that each cultural element could have a corresponding artifact and that artifacts include tangible and non-tangible items.

Table 3. Artifacts of organizational culture

Cultural Element	Sample Artifact	Context/Key Findings
Shared experiences and learning	Organizational history; stories; legends and heroes	Stories of the circumstances under which the firm was founded, the challenges it faced as it grew, the factors that led to its success, and the qualities of individuals that made the firm successful in the past and are therefore likely to make the firm succeed in the future—all serve to transfer core values and vision from the founders, leaders, and key influencers to the next generation of leaders and new employees. Vivid examples are noted by several researchers (Collins & Porras, 1997; Freiberg & Freiberg, 1996; Lala, 2006; Schein, 2010)

Table 3 (Continued). Artifacts of organizational culture

Cultural Element	Sample Artifact	Context/Key Findings
Experiential learning and organizational learning	Uniforms, checklists, kits/bundles, manuals, etc. to institutionalize learning from past experience	Uniforms provide legitimacy and status and they paradoxically make the individuals distinctive or unapproachable (Fiol & O'Connor, 2012); learning from previous errors, checklists are used to institutionalize practice of key behaviors and minimize recurrence of same/similar errors (Gawande, 2009); bundles or kits developed by the clinical teams were used to consistently improve clinical outcomes across multiple specialties (Hendrich et al., 2007)
Organizational Values: shared beliefs and unquestioned assumptions	Value or Belief Statements; potential evidence of change or stability over the long-term	Clearly articulated and well-publicized organizational values or belief statements can help “preserve the core and stimulate progress” or “maintain ideological control and provide operational autonomy” (Collins & Porras, 1997, p. 137-139, 236-239); evidence of long-term (over 150 years) stability in core values and adaptation to changing business , political, and socio-economic environment led the Tata Group from centralized control to decentralization, and globalization (Sarkar-Barney, 2014)
Four types of organizational values: espoused, attributed, shared, and aspirational	Stories of how dissonance in values is handled	When there is a dissonance between what is espoused versus what is experienced, it is not unusual to discover this gap in the stories told by the management (more closely aligned with the espoused values) versus those told by the frontline personnel (more closely aligned with the shared or attributed values). Replaying the stories from the frontline to the executive team could trigger acknowledgment of the value gap and provision of resources and support needed to bridge the gap (Patankar, Brown, Sabin, & Bigda-Peyton, 2012, p. 162-166).

Table 3 (Continued). Artifacts of organizational culture

Cultural Element	Sample Artifact	Context/Key Findings
Implementation Mechanisms: processes used to implement and reinforce or renew organizational values	Group/team-level symbols and rituals; new employee orientation programs	"Routinized behaviors reflect the common sense understandings about the meaning and use of artifacts;" artifacts from the old culture can remain in the residual institutional memory (old processes, policies, tools, etc.) and resist the adoption of new practices demanded by the new culture (Kaghan, 2012)
		Logos as symbols: "logos are to companies what flags are to countries" (Baruch, 2012)
		Employee socialization rituals as well as corresponding artifacts such as training materials, evaluation tools, incentive mechanisms, and performance standards form a system of artifacts that collectively shape the individual behaviors to fit with the organizational cultural expectations (Ehrhart et al., 2014, p.153-160). Culture survives through teaching of shared assumptions to newcomers (Schein, 1990).
Individual, group, and firm-level performance	Performance dashboards, award programs, error investigation reports, briefing and debriefing tools	Focused dashboards, proactive use of accident investigation reports to identify latent errors in the system, and well-managed pre- and post-event briefing/debriefing can lead to improved quality of care (Kroch et al., 2006; Lindberg, Hansson, & Rollenhagen, 2010; Papaspyros, Javangula, Adluri, & O'Regan, 2010)
Leaders and key Influencers	Stories about legends and heroes; criteria for award programs	What leaders pay attention to, how they react to positive and negative incidents (particularly crises), how they allocate resources and rewards, what is their evidence of selecting, promoting and coaching, and how do they recruit, select, promote, as well as excommunicate or terminate other leaders (Schein, 2010). Stories themselves are powerful enough to institutionalize values in the psyche of the employees because they "give concrete context to abstract values" (Wilkins, 1984, p.59)

Table 3 (Continued). Artifacts of organizational culture

Cultural Element	Sample Artifact	Context/Key Findings
Feedback from Individual Behaviors/ Performance and Group or Firm-level Performance	Annual reports; use of performance dashboards; incentives to drive key performance indicators; stories of how mistakes and under-performance are handled; changes in the environment within which a firm operates	Well-aligned electronic dashboards can become living artifacts that increase transparency, improve goal and incentive alignment, and give a sense of ownership and control to the employees at large (Dover, 2004); ethical dilemmas arise when a particular experience places individual values in conflict with organizational values—the role of professional societies, labor unions, and regulators could be leveraged to influence organizational practices and bring them in alignment with values of the profession (Patankar, Brown, & Treadwell, 2005); reflection on stories about practices within one's own discipline against the stories of practices from other disciplines could lead to self-realization and borrowing of tools across disciplines—a checklist is such an example in healthcare (Gawande, 2009); at DuPont Chemicals, a combination of regulatory and community pressures led to transparent, community-company partnership to address environmental issues (Knowles, 2002)
	Communication materials (internal as well as external)—print, online, and in-person communication	Creators of communication artifacts tend to be more focused on the knowledge; whereas, the observers or readers tend to focus more on knowing—the socially constructed meaning of the artifact; thus, they may give similar or contrasting meaning, depending on how they feel about the creator(s) of the artifact or their past experience with similar symbolism (Cunliffe & Shotter, 2012)

Freiberg and Freiberg (1996) tell the classic story of Southwest Airlines: "It is virtually impossible to understand the people, the culture, and the inner workings of Southwest Airlines without first understanding its past" (p.14). Rooted in this history are values of hard work, individuality, ownership, and fun (p. 147 lists 13 such dominant values), as well as numerous stories of legal battles to survive in an industry dominated by legacy carriers. The napkin on which the first three service airports were drawn by the founders—Dallas, San Antonio, and Houston—serves as the foundational artifact symbolizing both humble beginnings as well as entrepreneurial spirit and the personal struggle that the founders and the early employees endured to start the airline. One of the lessons learned in the early days of the airline was to capitalize on the secondary airports serving major cities—for example, Houston's Hobby Airport instead of the Houston Intercontinental Airport—and that learning was repeated across the nation to develop a highly successful strategy for Southwest's financial success as well as regional economic development. Herb Kelleher, now retired, has become the living legend and he has epitomized the Southwest spirit symbolizing freedom, loyalty, passion, and the unquestioned assumption: "never give up" (p. 36). These personal values of the leader were modeled, customized, and re-told through numerous stories across the airline—ranging from opening of services to new cities to handling of passenger complaints. With each legal battle and operational challenge to survive came new lessons that were implemented primarily through inspiration rather than dogmatic policies and procedures, yet core practices survived and many—like the 10-minute turnaround from arrival to pushback—became the "signature moves" or culture defining practices (p. 34). Limited resources led to creativity, making every employee the brand ambassador, particularly the flight attendants and anyone who came in direct contact with the customers. Employees were hired for their attitude and trained for the required skills. Also, the traditional Human Resources Department was called, "the People Department" and placed its employees at a higher priority than its customers, engendering the belief that if one takes care of the employees, then, the employees will take care of the customers. Thus, the new employee attraction, selection, and attrition processes were all focused on personal attitude and fit with the corporate personality. Southwest also uses firm performance as a mechanism to employee performance: “When you talk to a ramper or a flight attendant, they’ll tell you what the stock price is that day” (p. 97). Such dedication and intense focus on firm performance is not just a result of employee ownership (since 1973), but the core value of encouraging every employee to act like an owner so they take more responsibility for the success of the airline. This focus on employees is a daily task and not just during award ceremonies or union contract negotiations. The leaders’ commitment to employee job security and profitability is also a non-negotiable assumption—employees know and sincerely believed that Herb Kelleher’s word was good enough; his commitment did not have to be on paper. Southwest Airlines is arguably one of the select companies to deliver on consistency in its espoused, attributed, shared, and aspirational values—it has won the “Triple Crown” demonstrating its excellence in operational performance (most flights with on-time performance, fewest customer complaints, and smallest number of missed bags), no fatal accidents, celebration of its people—both employees and customers—as evidence of its commitment to service to its customers through its employees, and firmly rooting its organizational values in the hearts of its employees.

2.2.7 Role of External Environment

Model 5, representing the structural elements of organizational culture, is consistent with three of the five elements of culture developed by Deal and Kennedy (1982): values, heroes (leaders and key influencers), and rites and rituals (norms or implementation mechanisms). Deal and Kennedy’s fourth element is environment: “the environment in which a company operates determines what it must do to be a success" (p.13). This element is similar to Schein's concept of "shared experience and learning," which is presented in Model 5. However, in order to fully incorporate Deal and Kennedy's model, the shared experience in Model 5 must consider the experience of operating the business in its environment—the external influence of social, economic, and political factors (among others) on the success of the firm—and not just the internal experience of employees within the firm or just in the context of actual versus desired outcomes. This aspect is incorporated in the integrated model of culture and climate (Model 6, Figure 6). By including the influence of external, environmental factors on culture, the organization—as a system—becomes an open system and acknowledges that factors external to the organization will influence the values held by the individuals within the organization. Such influence of environmental factors has been studied extensively under Hofstede's (1984) model of the influence of national affiliation on the individually-held beliefs and values—called the national culture. The emergent model, however, goes beyond the influence of national environment on individually-held values. It is open to a broader range of environmental factors and is concerned with their influence on the shared values of the organization. Thus, factors that threaten the survival of the organization or provide unique opportunities to thrive are likely to have significant influence on the internal culture of the organization.

Deal and Kennedy's fifth element is "cultural network" (p.15). It is a network of people who are responsible for communicating the corporate message and hence (a) the message is subject to their interpretation and (b) the recipients of the message may react differently to different messengers—or even sabotage or contaminate the message to the extent that the intended change program fails. In order to accommodate this perspective, Model 5's "Leaders and Key Influencers" must consider both positive and negative influencers—one cannot assume that all key influencers are positively disposed toward the organizational values and goals.

2.2.8 A Reflection on the Emergent Model of Organizational Culture

The emergent structure of organizational culture is an illustration of both what culture is, as well as how it is manifested or influenced. It is integrative of most other models of culture, but it also extends and connects other models in a unique way. For example, Schein's (1988, 2010, 2015) model of culture is focused on the influence of shared experience on organizational values, but it does not further classify values as shared, aspirational, and attributed. Thus, issues related to gaps in alignment between the various types of values and various groups of people in an organization cannot be explored within Schein's model. Also, while Schein incorporates the construct of learning in the form of "internalization" of values, Senge (1990) provides a more helpful description of organizational learning through experience; yet, these two constructs—organizational learning and organizational culture—have remained largely unconnected in culture studies; instead, "learning culture " (Reason, 1997; Senge, 1990) has emerged as yet another descriptor of organizational culture without formal linkage with traditional culture studies. Similarly, the role of implementation mechanisms is addressed in different ways. For example, Westrum (1995) uses information flow characteristics to classify organizations as pathological, bureaucratic, or generative. This approach focuses on how organizations transmit and receive information to accomplish their operational objectives, which could be interpreted as nature of the mechanism used to implement its shared values and accomplish the operational objectives. Leadership, on the other hand, is arguably the most studied construct. There are numerous studies about how leaders influence organizational culture (e.g., Hendrich et al., 2007; Knowles, 2002; Pettigrew, 1979; Schein, 1988, 2010; Zohar, 2002b). Most of these studies, however, perceive formal leaders (founders or managerial title holders) as primary drivers of organizational values and culture, while missing the role of informal leaders and key influencers in shaping and maintaining organizational culture. The studies on individual-, group-, and firm-level outcomes are scattered across different academic siloes. Individual-level performance outcomes are typically addressed in human resources literature (e.g., Schneider, 1987) or training literature (e.g., Kirkpatrick & Kirkpatrick, 2006); group-level outcomes are typically addressed in organizational climate (Ehrhart et al., 2014) or broader social behavioral literature (Ployhart et al., 2014); and firm-level outcomes are addressed with respect to financial performance or brand/reputational value (Sarkar-Barney, 2014; West, Topakas, & Dawson, 2014; Wiley & Brooks, 2000). While some models of culture mention the influence of performance outcomes on organizational climate (Putter, 2010; Wiley & Brooks, 2000), rarely are these outcomes connected with structural elements of culture. Feedback is also covered extensively in experiential and organizational learning, but it is mostly in the context of *learning* as an organizational value and whether or not an organization has a *learning* culture (Kolb, 2015; Senge, 1990).

In conclusion, Model 5 presents a positivist perspective using a mechanistic “input-output” paradigm to represent a “technical” or hardware-like system consisting of inter-dependent components that have achieved convergent consensus among leading researchers. Therefore, these components form the units (the *what* component) of the overall theory, and the relationship between them seeks to explain the rationale, the conditions, and the nature of their interactions (the *why*, *when*, and *how* aspects of the theory) (c.f., (Bacharach, 1989). For one to fully grasp the notion of culture, however, the entire system needs to be understood as a holistic construct arising out of not only the constituent elements, but also from the unique interactions among those elements. The next two sections use a similar approach to develop the current understanding of organizational climate and the integration of culture and climate.

2.3 Organizational Climate

Ehrhart, Schneider, and Macey (2014) present an exhaustive review of over 50 years of research studies on organizational climate. This review provides a strong historical background, areas of conflicts among the various researchers, the different disciplinary and philosophical perspectives, the disagreements, and the gradual convergence on key concepts related to organizational climate. Ultimately, these converging concepts are listed in the form of five themes that collectively provide both a working definition of organizational climate as well as opportunities to explore the structure of this complex construct from multiple focus areas:

1. Organizational climate emerges through various mechanisms, including leadership, communication, training, and so forth;
2. Mechanisms themselves are not climate, but the experiences they produce and the meaning attached to them creates climate;

3. Organizational climate is not an individual property, but a property of workgroups or organizations; it is based on shared experiences and shared meaning within that workgroup or organization;
4. Shared experiences, and meanings attached to them, emerge from natural interactions in workgroups or organizations; climate is shared in the natural course of work and the interactions happen at and surrounding work;
5. Organizational climate is not an affective evaluation of the work environment in its existential form—it is not mere satisfaction with what exists—but rather a descriptive abstraction of people's experiences at work and the meaning attached to them. (p. 64). Thus, the emphasis is on the people's *experience* resulting from their interaction with their environment and the *meaning attached* to that experience.

Synthesis of these five themes leads Ehrhart et al. to offer the following concise definition of organizational climate:

> Organizational climate is the shared meaning organizational members attach to the events, policies, practices, and procedures they experience and the behaviors they see being rewarded, supported, and expected. (p. 69).

This definition of organizational climate is not without its challenges. For example, some authors argue that climate is an individual-level construct (Rousseau, 1990; Virtanen, 2000) and refer to it as "psychological climate" (Ehrhart et al., 2014; Parker et al., 2003); others argue that it is the attitude/affect of the employees (Ashkanasy, Wilderom, & Peterson, 2000; Michela & Burke, 2000; Wiley & Brooks, 2000). Nonetheless, Ehrhart et al.'s emphasis on climate as the *meaning* assigned by a group of people (unit of assessment) to the events and procedures that they have experienced, has sustained the test of a broad range of studies as reported by Schneider and Barbera (2014). Further, Schneider and Barbera classify climate studies at two levels: molar and focused. Molar studies refer to organizational climate, not specific to a particular performance outcome such as safety, quality, or service. Five studies are considered key in mapping the evolution of the structure of molar climate studies: Campbell, Dunnette, Lawler, and Weick, 1970; James and James, 1989; Jones and James, 1979; Litwin and Stringer, 1968; and Schneider and Bartlett, 1968. Of these, the study by James and James (1989) presents six components that were supported in most of the preceding studies, and they further aggregated those components into four major dimensions of climate: "role stress and lack of harmony; job challenge and autonomy; leadership support and facilitation; and work group cooperation, friendliness, and warmth" (Ehrhart et al., 2014, p.81). In a subsequent study, Ostroff (1993) reviewed the preceding literature and organized the molar climate components into three categories: affective, cognitive, and instrumental. The affective aspects included issues of harmony, group cooperation, friendliness and warmth; the cognitive aspects included job challenge and autonomy, innovation and intrinsic rewards; and the instrumental aspects included involvement in actual tasks, effectiveness of work processes, and extrinsic rewards (Ehrhart et al., 2014, p.81-82). According to James et al. (James et al., 2008), the various dimensions of molar climate collectively measure "the degree to which the [organizational] environment is personally beneficial or detrimental to one's [personal] sense of well-being." Thus, there is evidence to support that the molar climate provides a foundation on which strategic, focused climate could be built in support of safety, quality, service, etc. (Ehrhart et al., 2014): "At its core, the focused climate concept is about alignment" (p.86). Thus, focused climate studies are generally geared toward the performance outcomes such as quality, safety, innovation, service, etc. The underlying assumption in such studies is that if the policies, procedures, practices, as well as leadership support and behaviors are aligned, they project a consistent message regarding what is important to the organization (elements of organizational culture, as discussed in the previous section).

In the context of safety, many of the safety climate survey instruments can be linked with the works in High Reliability Organizations (La Porte & Consolini, 1991; Roberts, 1993), influence of national cultural differences on safety climate (Hofstede, 1984), the influence of national, professional and organizational cultural differences on safety climate (Helmreich & Merritt, 1998), climate studies in industrial safety (Zohar, 2002a, 2002b); impact of information flow on safety climate (Westrum, 1995), and the characteristics of learning organizations (Senge, 1990).

Safety climate is also described as a snapshot of the extant state of employee attitudes and perceptions about safety policies, procedures, and practices (Denison, 1996; Guldenmund, 2000; Harvey et al., 2002; Mearns & Flin, 1999; Mearns, Whitaker, & Flin, 2001; O'Conner, O'Dea, Kennedy, & Buttrey, 2011; Wiegmann, Zhang, von Thaden, Sharma, & Mitchell, 2004). By extension, climate regarding another focus area such as service, quality or innovation could also be described as a snapshot of the extant state of employee attitudes and perceptions about that focus area.

Thus, organizational climate is a psychological response or an outcome measure (manifestation) of the underlying organizational culture, and it refers to member attitudes and perceptions about shared experiences, organizational values, and implementation mechanisms, as well as reactions to observed behaviors of fellow-employees, leaders and key influencers.

Tables 4 summarize the structural elements of organizational climate from a molar perspective, which are generic and applicable at the organizational level and across industry sectors.

Table 4. Elements of molar organizational climate

Climate Element	Key Indicators	Source
Molar:		
Affective	Participation (perceived influence in the joint decision-making process, participation in setting goals and policies), cooperation (perceived helpfulness of supervisors and co-workers, emphasis on mutual support), warmth (perceived feeling of good fellowship, prevalence friendly workgroups), and social rewards (praise and informal recognition by peers and workgroups)	Ostroff (1993) synthesized preceding literature on molar analysis of organizational climate and developed these three categories. The subsequent theoretical implication is that molar climate influences the focused climate and thereby impacts the success of strategic objectives like safety. Also Ostroff's research supports the notion that molar climate (as a whole) has a stronger influence on organizational (firm) performance than individual-level perceptions of the affective, cognitive, and instrumental aspects.
Cognitive	Growth (perceived emphasis on personal growth and development on job, emphasis on skill development), innovation (perceived emphasis on innovation and creativity, acceptance of change), autonomy (perceived freedom to be own boss, plan and control over own work), intrinsic rewards (formal recognition and awards based on ability and effort)	
Instrumental	Achievement (perception of challenge, demand for work, and continuous improvement of performance), hierarchy (perceived emphasis on going through channels, locus of authority in supervisory personnel), structure (perception of formality and constraint in the organization, emphasis on adherence to rules), extrinsic rewards (rewards of pay, assignments, and advancement based on ability and time spent on work)	

So far, organizational culture and organizational climate have been discussed as separate constructs. Per Model 5 discussed previously, organizational culture could be presented as a system consisting of shared experiences and learning which lead to revision and reinforcement of organizational values; leaders and key influencers who institutionalize their values through formal implementation mechanisms; and performance outcomes that are experienced at the individual, group, and firm levels enable a feedback loop that tends to modulate the voracity of the implementation mechanisms in order to achieve the desired performance outcomes. Thus, the cultural elements seem to be primarily concerned about how an organization achieves its functional objectives and tend to explain why certain functional objectives may be important to the organization. Organizational climate, on the other hand, focuses on the meaning attached to the underlying cultural framework and the collective feeling arising out of shared experiences of the people in the organization. Typically, climate is assessed using survey instruments that seek to determine the degree to which the people in a particular group agree that certain values are shared, there is a consistent commitment by the leadership, there is interpersonal trust between employees and management, communication is open and two-way, there is good teamwork among people from different disciplines, individuals are respected, people are encouraged to learn from their experience (evidence-based practice), and adverse events are viewed as genuine learning and systemic improvement opportunities.

Acknowledging that culture and climate are derived from different intellectual traditions, they have been analyzed with different tools and techniques; however, there has been a tendency to employ climate methodology (survey questionnaires) for culture studies. There are many persuasive arguments to integrate the constructs of culture and climate and conduct a more holistic analysis of organizations. Thus, the next section presents the key arguments in support of an integrated model of organizational culture and climate.

2.4 Integration of Organizational Culture and Climate

The roots of "climate" versus "culture" debate could be traced back to the seemingly independent emergence of these two terms, one from Gestalt psychology (climate) and the other from anthropology and sociology (culture); cross-utilization of the two terms in the organizational context; overuse of the term "culture" ahead of the science; and the quest to link culture with performance (Schneider & Barbera, 2014a). While many scholars have differed in their definitions of climate and culture, there seems to be a general agreement that (a) climate refers to surface level or temporal phenomenon while culture refers to a deeper, longer-term phenomenon, and (b) due to the etymological and epistemological differences between the two terms, the methods to study climate tend to be dominated by quantitative means such as survey instruments and the methods to study culture tend to be dominated by qualitative means such as ethnographic observations, interviews, stories, and artifact analysis (Denison, 1996; Ostroff, Kinicki, & Tamkins, 2003; Rousseau, 1990; Scott, Mannion, Davies, & Marshall, 2003). Thus, studies that focus on organizational culture tend to be "narrow and deep" while those that focus on organizational climate tend to be "broad and shallow." More recently, there has been an increasing interest in integrating the two approaches and applying mixed-methods techniques to (a) study both the short- and the long-term aspects of culture and (b) gain a more complete understanding of how both climate and culture could be influenced to improve organizational performance (Braithwaite, Paula, & Pope, 2010; Driscoll, Appiah-Yeboah, Salib, & Rupert, 2007; Ehrhart et al., 2014; Patankar et al., 2012; Rousseau, 1990; Schneider & Barbera, 2014a; Waterson, 2014). Such an approach could serve as the starting point for new studies that seek broader and deeper analysis of organizational culture and climate.

An integrated model of organizational culture and climate would provide a broad framework which could be applied to a particular focus area such as safety, quality, or service. In such a focused context, the interpretive lens would consider the various elements of culture and climate from the perspective of that particular focus area. This study focused on the patient safety aspect of organizational culture and climate. As previously noted, (a) the healthcare industry in the United States, Canada, and the United Kingdom is challenged to address the dual mandate of quality and affordability; (b) a growing number of studies assert that a long-term cultural change is required; and (c) most of the change programs tend to focus on assessment of organizational climate. Thus, this section attempts to first integrate the separate constructs of organizational culture and climate and present an integrated perspective. Table 5 presents the two separate definitions of culture and climate, and summarizes five integrative models.

Table 5: Integration of culture and climate

Culture	Climate
A pattern of shared basic assumptions that the group has learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (Schein, 2010, p.18).	Organizational climate is the shared meaning organizational members attach to the events, policies, practices, and procedures they experience and the behaviors they see being rewarded, supported, and expected. (Ehrhart et al., 2014, p. 69).
Integrative Models	
A competing values framework (CVF) could be used as the underlying or foundational organizational orientation (a measure of culture) upon which climate dimensions could be mapped. Such a cross-mapping results in the placement of employee welfare, autonomy, participation, communication, emphasis on training, integration, and supervisory support (as climate dimensions) within the human relations quadrant (internal focus, flexible orientation per the CVF model of culture); formalization and tradition dimensions could be mapped within the internal process quadrant (internal focus and control orientation per the CVF model); flexibility, innovation, outward focus and reflexivity could be mapped within the open systems quadrant (external focus and flexible orientation); and clarity of organizational goals, effort, efficiency, quality, pressure to produce, and performance feedback could be mapped within the rational goal quadrant (external focus and control orientation). (Patterson et al., 2005).	
Culture and climate follow parallel paths with leadership and organizational effectiveness forming the two bookends of this model while culture influences the climate. At the one end of this model, leadership is tasked with simultaneously valuing people (culture) and promoting a specific operational strategy (climate). At the other end, organizational effectiveness measures the success in attracting and retaining talent (culture) and success in the competitive marketplace (climate). (Schneider, Ehrhart, & Macey, 2011, p.405).	
Organizational culture and climate both focus on the shared meanings of the organizational context: climate focuses on the perceptions of what happens in the organizations (behaviors, support, and expectations) and culture focuses on why those things happen (basic assumptions, values and beliefs). This model takes into account the influence of external business (Barney, 1986) and national environments and how they might influence both individual-level and organization-level values, assumptions, and social cognitive processes.(Ostroff, Kinicki, & Muhammad, 2012).	
A multi-layered approach can be used to integrate the concepts of culture and climate. Accordingly basic assumptions and core values form the deep layer of culture, which gives rise to espoused values, priorities, policies, practices, norms and artifacts—which is essentially organizational culture. The interpretation of the consistencies/gaps, and the consequential internalization of meaning of the current environment from an individual employee perspective and from a strategic context such as safety, quality, innovation, etc. give rise to the extant climate. (Zohar & Hoffman, 2012)	
Another multi-layered perspective is the Safety Culture Pyramid (SCP) model, which places values and unquestioned assumptions at the base, followed by strategies, policies and practices. These two layers are consistent with the preceding definitions and models of organizational culture. The next layer in the SCP model is climate, an employee perception of the underlying cultural elements, and the final layer represents the performance outcomes at individual, group, and firm levels. (Patankar et al., 2012)	

Reflecting on the structure of organizational culture presented in Model 5 (Figure 5) and the five integrative models of culture and climate presented in Table 5, brings to light the following differences between the five integrated models and the emergent model:

1. The Competing Values Framework (CVF), as the name specifies, is limited to *values*; however, the emergent integrated model of culture and climate contains more than just values. The use of CVF as the foundational model of culture would necessarily eliminate the consideration of shared experiences, leadership, implementation mechanisms, outcomes, and feedback mechanisms. Therefore, although Patterson et al.'s model is psychometrically robust and paves the way for comparative studies of organizational culture and climate across multiple organizations and industries it seems limited by its grounding exclusively with the underlying organizational values. Also, methodologically, it relies exclusively on self-administered survey data rather than a combination of externally collected outcomes data, ethnographic observations, artifact analysis, and narrative analysis of stories embedded in the organizations.
2. Schneider et al.'s model presents climate as a reflection or result of the underlying culture; however, it seems incomplete if it is limited to the role of leadership (in valuing people and promoting strategy) on one end and organizational effectiveness (in retaining talent and achieving market success) on the other end (Ehrhart et al., 2014, p.220). This model does not consider the influence of shared experiences in shaping culture; neither does it explain how or why new values are formed and how an

organization learns from its different types of shared experiences. Methodologically, this model is limited to survey questionnaires.

3. The strength of the Ostroff et al. model is that it takes into account external influences on culture: national and business contexts (Barney, 1986). It also incorporates the notion of "sensemaking" (cf. Weick, 1995) as a pathway to influencing individual values through learning. However, it continues to use artifacts as part of culture rather than products of culture, and it clusters organizational culture, structure and practices, and climate under the meta-category of leadership. While it could argued that leadership has influence over shared organizational values and assumptions, as well as organizational structures and practices, the almost exclusive focus on leadership discounts the role of shared experiences of the frontline personnel. The emergent model of culture and climate proposes that there is a causal link between structures and practices and behaviors, which in turn tend to influence climate. Also, Ostroff et al. mix elements that are external (such as industry and business environment and national culture) with those that are internal (such as vision, strategy, and organizational goals) to the organizational system; they also mix structural elements of organizational culture (such as values and organizational structures and practices) with psychological response (organizational climate) in the construct of culture. Again, the role of shared experiences in shaping organizational values gets lost in the final model, while leadership assumes the primary responsibility for building, maintaining, and changing organizational culture and climate.

4. Zohar and Hoffman revive the early notions of culture as a multilayered construct with artifacts being the most visible layer and the unquestioned assumptions being in the deepest layer. However, their model focuses almost exclusively on the gap between espoused versus enacted values as the defining characteristic of organizational culture. In this model, there is no mention of *how* and *why* organizational values are shaped. Thus, shared experiences, leadership, performance outcomes and feedback mechanisms yield to the focus on the nature of the gap between espoused and enacted values.
5. Patankar et al.'s pyramid model is an integrative, multi-method model that is consistent with the structure of organizational culture presented in Model 5: values form the base of the pyramid and implementation mechanisms form the next layer; and the individual, group, and firm-level outcomes form the top layer of the pyramid model. However, in the pyramid model, climate is presented as a mediating element between implementation mechanisms and performance outcomes. Based on the latest literature, discussed previously, climate is now seen as a psychological response to the underlying culture, and behaviors and performance outcomes are part of culture; thus, climate must be an outcome of the total culture and not just a response to the implementation mechanisms. Also, like most other integrative models, the pyramid model does not consider the role of feedback mechanisms, learning resulting from shared experiences, and the role of external environmental influences.

An enhanced, integrative model of organizational culture and climate is presented in Figure 6. This model fills the deficiencies noted in the earlier version by incorporating the influence of the external environment within which a firm operates, the role of shared experiences and learning in forming the core organizational values and unquestioned assumptions, and the role of feedback mechanisms that are used to interpret performance outcomes and create new meanings of shared experiences. It also acknowledges the bi-directional influence between values and practices and it highlights the role of leaders and key influencers in both influencing organizational values and being influenced by them, as well as in influencing various implementation mechanisms.

So far, the literature review has focused on the broad concepts of organizational culture and climate and their integrated models. Next, literature that is more specific to the safety aspects of culture and climate—hence, called safety culture and climate—is presented. A review of this literature will further inform the development of the emergent model.

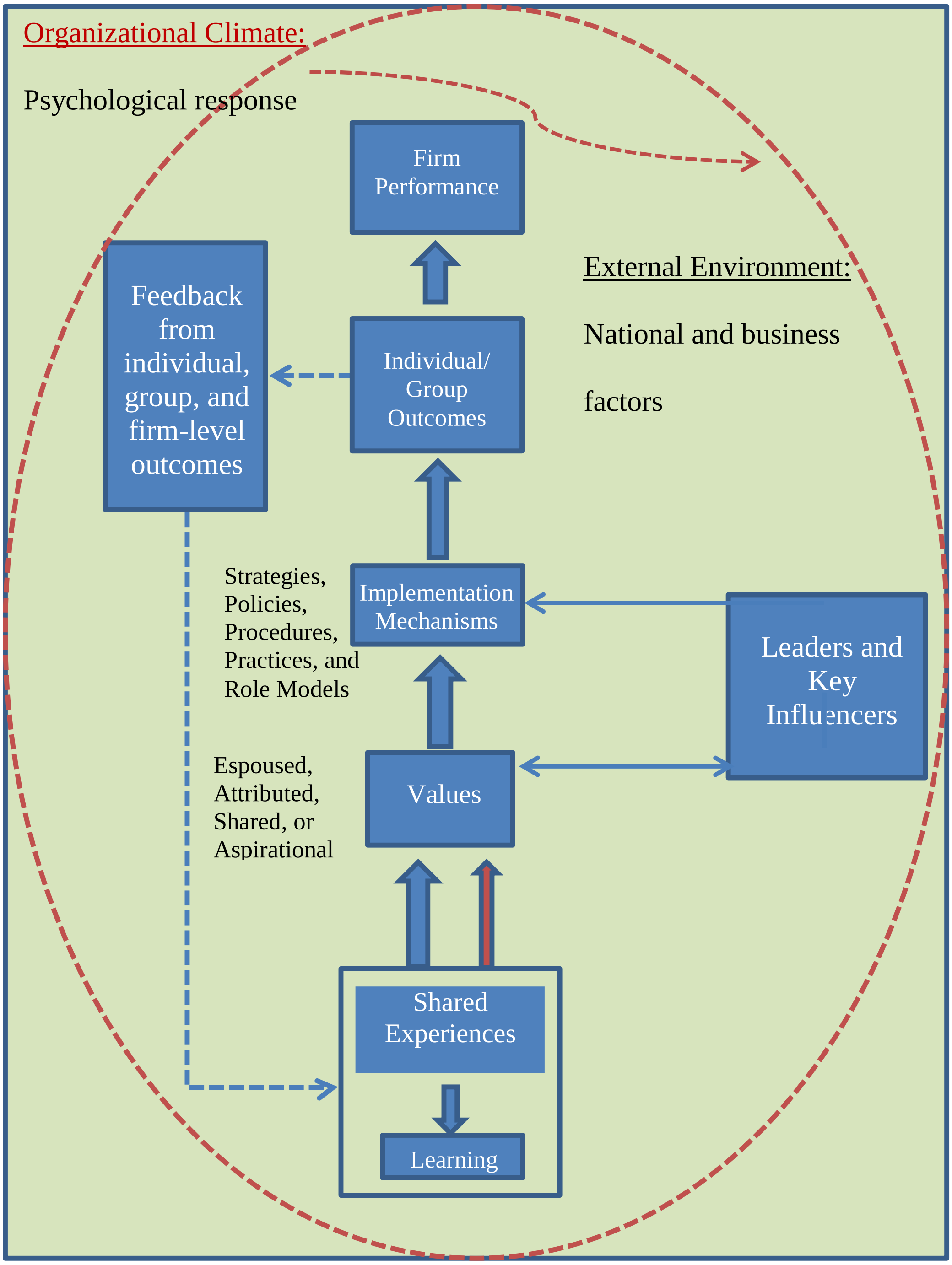


Figure 6. Model 6. Integrative approach to organizational culture and climate

2.5 Safety Culture and Climate

It is generally agreed that safety culture or safety climate are focused studies of organizational culture or organizational climate, respectively, in the context of safety (Clarke, 1999; Cooper, 2000; Glendon, Clarke, & McKenna, 2006; Griffin & Neal, 2000; Guldenmund, 2000). Cooper (2000) adds one exception to this notion: in high-consequence industries, safety should be the dominating characteristic and therefore, there should not be much distinction between organizational culture and safety culture. Although numerous definitions of safety culture have emerged over the past decades, they appear to be characterized as either an interpretive perspective that seeks to characterize "the way people think and/or behave in relation to safety" or a functionalist perspective that seeks to characterize safety culture as a "product" intended to serve a specific purpose (Cooper, 2000, p.114). Nonetheless, five models or categories of models, as characterized by Glendon, Clarke and McKenna (2006), are presented for comparative discussion: (a) Reciprocal Safety Culture Model; (b) Multi-layered Models of Safety Culture; (c) Behavioral Safety Culture Models; (d) Information Flow Models of Safety Culture; and (e) Work Climate Model

<u>Reciprocal Safety Culture Model</u>: Cooper (2000) argued that the functionalist perspective of characterizing safety culture provides an opportunity to link personal (e.g., values and beliefs), behavioral (e.g., competencies and patterns of behavior), and situational (e.g., organizational systems and subsystems) aspects of safety culture. Thus, he proposed the Reciprocal Safety Culture Model. This model is rooted in Bandura's Social Learning Theory and Social Cognition

Theory, which assert that an individual's psychological state, external environmental conditions within which the individual operates, and the behaviors that the individual exhibits are bi-directionally interacting. While this model enables one to collect empirical data from three measures, psychological, behavioral, and situational, and also accounts for the dynamic relationship between various cultural elements, it would be difficult to link the three measures at the individual level and further difficult to develop valid aggregation of those measures at the group level.

In comparison, the emergent model offers some similarities and extends the viability for validation. For example, the core theory underpinning the reciprocal safety culture model is the interactivity among three elements: psychological, behavioral, and environmental. The emergent model is consistent with this theory. The shared experience and learning among individuals and groups is in the context of their external environment as well as feedback received from past performance outcomes and the internal implementation mechanisms. However, the emergent model adds the role of leaders and influencers and incorporates the influence of performance outcomes. The role of leaders and key influencers is consistent with the overall organizational culture models discussed previously; moreover, the incorporation of performance outcomes enables the assessment of relative importance placed on business performance goals versus safety performance goals, sometimes referred to as the "speed-or-accuracy trade-off (SATO)"(Drury & Gramopadhye, 1991). Methodologically, psychological responses to values, implementation mechanisms, outcomes, and leadership could be assessed through safety climate surveys; performance outcomes could be assessed through incident/accident data associated with the specific workgroup, and individual-level outcomes could be assessed via peer observations of work performance; and the influence of external environmental factors could be assessed through focus groups and interviews. Together, these methods would enable a triangulated assessment of organizational culture and climate.

Multi-layered Models of Safety Culture: Similar to safety culture being regarded as a subset of organizational culture, many researchers tend to view safety culture as a multi-layered construct. Typically, three layers are considered: unquestioned assumptions as the core, beliefs and values as the intermediate, and norms and artifacts as the most visible layer (Rousseau, 1990; Schein, 1988; Zohar & Hoffman, 2012). This approach is generally rooted in the theoretical assumption that an organization's safety culture is primarily, if not exclusively, represented by its relative valuation of safety. Thus, the greater the value placed on safety (as compared to the value placed on profit maximization, for example), the stronger the safety culture at that organization. While this approach is not in conflict with the emergent model, it does not help explain when and under what conditions the core assumptions, values, and beliefs could be changed; how some of these assumptions, values, and beliefs are reinforced; and due to its emphasis on the interpretive view, it falls short of providing practical guidance as to how one could improve the extant safety culture.

If one were to frame the emergent model from a multi-layered perspective, it would be skewed toward a functionalist view, describing how values and beliefs are formed, reinforced, and revised. Thus, the shared experiences and learning derived from those experiences would form the core, which would inform and influence the formation of assumptions, beliefs, and values—the second layer. These assumptions, beliefs, and values would be enacted through implementation mechanisms—the third layer—and generate the corresponding individual, group, and firm-level performance outcomes—the fourth layer. Both implementation mechanisms and the performance outcomes would generate artifacts, which are commonly viewed as the outermost layer of a multi-layered model. Three elements that are typically absent from multi-layered models are the role of leaders and key influencers, feedback mechanisms, and external influences. By incorporating these elements, and enabling triangulation of analytical methods, data sources, and longitudinal measurements, the emergent model extends the traditional multi-layered models as well as responds to the call for holistic triangulation by (Cooper, 2000; Jick, 1979; Rousseau, 1990), among others.

Behavioral Safety Culture Models: Behavior-based safety culture models are rooted in the antecedents-behavior-consequences model with feedback loops designed to trigger positive reinforcement for desirable behaviors and negative reinforcements for undesirable behaviors (Komaki, Barwick, & Scott, 1978; Krause, 1997; Zohar & Fussfeld, 2008). Over a period of time, the participants learn to perform in accordance with the desirable behaviors, and the consistency as well as longevity of such behaviors is a function of feedback loops acting as consequences rather than antecedents of behavior (Grindle, Dickinson, & Boettcher, 2000). Geller (1994) calls it the "total safety culture," presumably because its disciplined approach is somewhat similar to a Total Quality Management approach. These models have been successful in a number of industries such as food manufacturing (Komaki et al., 1978), construction (Krause, 1997), mining (Qing-gui, Kai, Ye-jiao, Qi-hua, & Jian, 2012), trucking (Hickman et al., 2007), and manufacturing (Grindle et al., 2000); however, most of the empirical evidence is from top-down implementation of safety programs and the desire for safe operation is linked with financial outcomes (worker injuries lead to loss of productivity and compensatory expenses). Nonetheless, there are some examples where behavior-based programs have achieved success through employee ownership of the program (Geller, 2005). While these models acknowledge the interactivity between the individual worker, the work environment, and the worker behavior, they do not explicitly consider conflicting incentives. For example, if there is an incentive for overtime or longer work hours, but a disincentive for working under fatigue, how would a behavioral safety culture program help manage such a dissonance? Issues with variations in implementation processes and uncertainty about the influence of internal organizational as well as external factors have also been noted (Wirth & Sigurdsson, 2008).

The emergent model of culture and climate did not specifically focus on participant behaviors; instead, it relied on the feedback from performance outcomes to moderate participant behaviors as a function of learning and internalization of their work experience. Thus, although the emergent model is consistent with behavioral safety culture models in the sense that it also relies on feedback loops to reinforce or penalize individual behaviors, it could be strengthened by explicitly including individual behaviors prior to the performance outcomes state. See Figure 7 for the updated model. This addition enables the emergent model to include the assessment of underlying behaviors regardless of the outcomes. Also, since the emergent model claims that learning derived from shared experiences influences values and these values influence future behaviors, mediated by various implementation mechanisms and leadership influence, the role of feedback mechanisms is to appeal to a deeper, internal value-system within the individual rather than just the reward/penalty mechanism. While some behavioral safety programs emphasize the role managers play in engineering the environment for safe operations, most programs focus on *worker* behaviors.

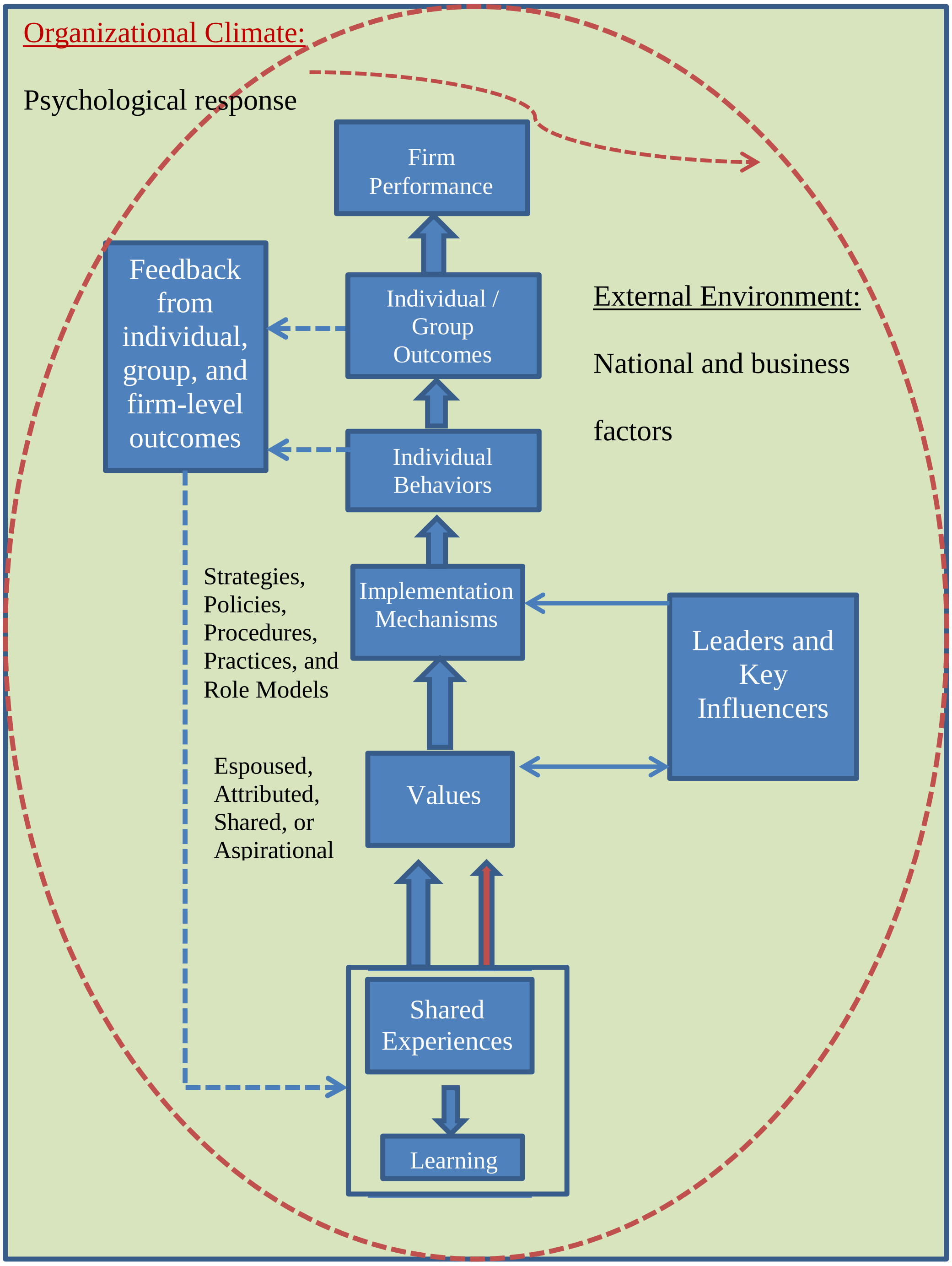


Figure 7. Model 7. Integrative model with individual behaviors

The emergent model, on the other hand, explicitly incorporates the influence of leadership and external factors. Also, per the behavioral safety culture model, a person is likely to be discouraged from violating any rule even if that rule happens to be detrimental in a particularly unique circumstance, thereby leaving the opportunity for accidents resulting from a unique combination of rare circumstances or latent failures. Thus, it seems that the behavioral safety culture model is more suited to address "individual accidents" rather than "organizational accidents" (Reason, 1998, p.295); while the emergent model can handle both types of accidents.

<u>Information Flow and Learning Models of Safety Culture</u>: Information flow within an organization could be regarded as its lifeblood, and thus, the culture of an organization has been classified according to the patterns of information flow: pathological, bureaucratic, and generative (Westrum, 1995). In the context of safety culture, the information being processed by the organization is about safety. For example, in a pathological safety culture, safety-critical information is likely to be guarded and people who report safety issues are likely to face some type of punitive action.

In a bureaucratic safety culture, safety-critical information is available, but may not be utilized due to internal siloes and lack of communication pathways between departments. In a generative safety culture, safety-critical information is openly shared, people who report safety issues are recognized, and past failures are used as learning opportunities. Such classification of safety cultures paved the way for a state function or a maturity model: safety culture could now be viewed as not only an inherent quality of an organization, especially in high-consequence industries, but also a quality that could be improved from one state to another.

Subsequently, Lawrie, Parker, and Hudson (2006) conducted studies in the oil and gas industry and discovered five levels of cultural maturity: pathological, reactive, calculative, proactive, and generative. Reason (1997) used a variant of this approach based on how errors are reported and managed: blame culture, reporting culture, and just culture. Patankar et al. (2012) called this classification an accountability scale and noted the existence of a fourth category: secretive culture. Overall, in a secretive culture, errors remain hidden out of fear of reprisal; in a blame culture, people who commit errors face punitive actions; in a reporting culture, people are encouraged to report their errors under a non-punitive error reporting program; and in a just culture, there is a clear distinction between unintentional errors, which are forgiven, and intentional acts with disregard for safety, for which people are punished (Marx, 2001; Patankar et al., 2012; Reason, 1997). Another variant of information flow model is the learning model. In such a model, the emphasis is placed on how information is used to prevent future failures. Thus, there are four states of a learning culture: failure to learn, episodic learning, continuous learning, and transformative learning (Senge, 1990). At the low end of maturity on this scale, organizations fail to learn from their mistakes (or mistakes of their employees)—they tend to blame individual employees and terminate their employment with the hope that the accident would not occur again. Thus, as an organization, they fail to learn. At the far end of this scale, organizations not only take failures very seriously and seek systemic solutions, but they actively investigate the potential for other, latent failures in the system and strive to address them before they manifest themselves into accidents.(Patankar et al., 2012; Reason, 1997; Senge, 1990).

The emergent model of culture and climate incorporates the notion of information flow both as implementations mechanisms (policies, procedures, practices, and role models) as well as feedback mechanisms (how outcomes are used to derive learning from shared experiences). Thus, the implementation pathway could be studied in terms of information flow or accountability based models and the feedback pathway could be studied in terms of learning models. The emergent model is not inconsistent with the information flow or the learning models; however, it focuses on the holistic aspects of culture and climate and the dynamic relationship among the various elements, which has been long sought by both organizational culture and safety culture researchers because most of them have observed that organizational culture or safety culture is more than sum of the various parts like leadership, shared values, environmental factors, etc. and risks exist throughout the organization, as well as from external influences, not just within a particular element of culture (e.g., Clarke, 2000; Pidgeon, 1998; Reason, 1997, 1998).

<u>Work Climate Model</u>: The work climate model proposed by Clarke (2000) suggests that safety behaviors are influenced by safety climate at the workplace, which in turn is influenced by the underlying safety culture. Specifically, Clarke presents two mechanism of influence: (a) safety culture affects behaviors directly through latent failures and (b) safety culture affects behaviors indirectly through safety climate. Further, this model presents three stations at which work climate could be assessed: perceptions of management commitment, perceptions of workplace risk, and perceptions of the safety management systems. While safety climate survey instruments could be structured to assess the worker perceptions at these three stations, the relationship between their perceptions and their behaviors

or performance outcomes is still correlational and not causal. The emergent model can certainly accommodate a three-station structure of the safety climate survey, but it retains the following antecedent-behavior-consequence pathway: shared experiences and learning → shared values→ implementation mechanisms →individual behaviors→performance outcomes→feedback to shared experiences and learning. Thus, the elements of safety management systems described in Clarke's model are represented in the emergent model as implementation mechanisms, managers and supervisors are represented as leaders and key influencers, and organizational context is represented in environmental factors. Two elements of safety culture that are notably absent, or at least underspecified, in Clarke's model are the role of shared experiences and the role of shared values and beliefs. On the other hand, the emergent model is not explicit about personal beliefs regarding risk and safety, personality variables, and the notion of individual responsibility because these aspects are presumed to be handled under Schneider's ASA theory (Schneider, 1987), at least in high-consequence industries. The assumption is that individuals who do not fit the norm in terms of their personality or individual motivation are not likely to be recruited, retained, or promoted within the organization.

Zohar (2014) presents a conceptual model of safety climate with antecedents and consequences. In this model, there are seven antecedent variables: structural attributes, symbolic interaction, group/organizational leadership, psychological work ownership, organizational commitment, job stress and burnout, and personality. Of these, the first three are well-aligned with the implementation mechanisms, shared experiences and learning, and leaders and key influencers in the emergent model. However, the latter seven are not explicitly included in the emergent model. While Zohar provided both theoretical and empirical support to include these antecedents in the overall safety climate model, the relative significance of these variables has not been established. Zohar's model also seeks to explain the safety climate-behavior relationship in terms of expectancy theory: individuals are likely to align their behaviors toward maximizing the payoff associated with recognition for safety performance. Similarly, there are other individual-level psychological constructs such as knowledge, motivation, and engagement that are included in Zohar's model, but not in the emergent model. The emergent model seeks to explain the relationship between various cultural and climatic elements at a macro level; wherein, all the cultural elements essentially serve as antecedents to the climatic elements. Zohar also points to the continued need for research focused on the operationalization of safety culture and safety climate in order to gather empirical evidence to explain their relationship. It seems that the emergent model of culture and climate is well positioned to contribute toward the operationalization of the constructs of culture and climate as well as their inter-relationship.

<u>Recent Safety Climate Studies in Healthcare</u>: Over the past three decades, some studies have periodically reviewed the extant literature on safety climate/culture and presented meta-analysis of the consistent themes. Six such studies (Flin, 2007a, 2007b; Flin et al., 2000; Guldenmund, 2000, 2007; Jackson & Kline, 2014; Sammer, Lykens, Singh, Mains, & Lackan, 2010) are used to present an overview of the key safety climate elements that have been retained through multiple studies and some from across domains. Table 6 presents these themes as key elements of safety climate.

Table 6: Elements of safety climate

Key Element	The degree to which the employees perceive that …	Synthesis Studies
Safety as an organizational value	… the organization considers patient safety as an organizational value; there is visible and authentic engagement of all stakeholders; changes in policies and practices are consistent with this core value.	Guldenmund (2000); Sammer et al. (2010)
Leadership or Senior Management Commitment	…their leaders and immediate supervisors to be committed to safety programs as experienced in terms of accountability, change management, provision of resources, role-modeling, clarity of vision, and building of open relationships.	Guldenmund (2000); Flin et al. (2000); Singer et al. (2007); Sammer et al. (2010); Jackson & Kline (2014);
Mutual Trust	…their work environment is just; everyone is held accountable for the group's values and commitment; at-risk behaviors are not tolerated	Sammer et al. (2010)
Communication	…communication is both top-down and bottom-up; there is openness, structure, and follow-up	Guldenmund (2000); Flin (2007); Sammer et al. (2010); Jackson & Kline (2014)
Teamwork	…there is alignment between values and action, there is deference to expertise, autonomy, mutual respect for individuals, willingness to adapt, and generally supportive (warmth) relationships	Singer et al. (2007); Sammer et al. (2010); Jackson & Kline (2014)
Respect for Individuals	…there is investment in individual competency; there is engagement of employees in improving safety	Flin et al. (2000)
Support for Team/Firm-level Goals (Resources)	…there are sufficient, competent resources to handle the workload (inverse of work pressure); work conditions are generally supportive of safe practices	Guldenmund (2000); Flin et al. (2000); Singer et al. (2007); Sammer et al. (2010);
Emphasis on Learning from Experience (Evidence-based practice)	…the organization is committed to risk management, evidence-based improvement, use of best practices from other organizations/industries, and places emphasis on overall performance improvement	Guldenmund (2000); Flin et al. (2000); Sammer et al. (2010)
Response to Unintentional Errors	…the organization is committed to learning from errors	Guldenmund (2000); Singer et al. (2007); Sammer et al. (2010); Jackson & Kline (2014)

Flin et al. (2000) reviewed 18 survey instruments used in the energy sector in the United Kingdom and revealed 18 scales corresponding to three key dimensions: management, system safety, and risk. Also, secondary dimensions of work pressure and individual competence were noted. Subsequently, Flin (2007b) reviewed safety climate studies from industrial safety and healthcare and concluded that (a) there was a general lack of psychometric validation of safety climate questionnaires used in healthcare and (b) there were four core dimensions that could be mapped from industrial safety to healthcare: management commitment to safety, supervisor commitment to safety, safety system, and work pressure. Flin’s (2007a) first conclusion stratifies the need for leadership commitment at two levels: senior management and immediate supervisor. The senior management commitment is typically equated with provision of resources, anchoring with organizational values, and handling of errors. The immediate supervisor commitment is typically associated with role modeling, employee-management trust, willingness to change established practices, and warmth or care for the individual practitioners.

Guldenmund (2000) reviewed studies in safety culture/climate up to 1997 and argued that safety climate could be considered an alternative safety performance indicator. Furthermore, he concluded that, “climate follows naturally from culture or, put another way, organizational culture expresses itself through organizational climate” (p.221). His meta-analysis of ten safety climate instruments that had been subjected to exploratory factor analysis yields the following common themes: generally, the work environment is safe; individuals are free from blame/punishment for inadvertent errors; management and immediate supervisors show concern for their employees and are effective in providing a safe work environment; technical and safety training is adequate; there are established rules, mechanisms and protocols to address safety concerns; safety is regarded as an organizational value at par with productivity; and communication involves promotion of safe practices, lessons learned, and proactive identification of hazards.

Guldenmund (2007) set out to review the existing safety climate survey questionnaires to determine "the common basis that might explain the patterns of shared attitudes found in safety climate research' (p. 724). First, Guldenmund argues that there has been some confusion in safety climate research as a result of distinction made between perceptions and attitudes, wherein perception refers to description of the external objects and attitudes refer to evaluation of those objects. However, he also argues that perceptions are not entirely separate from attitudes; thus, in the context of safety climate, he concludes that "safety climate research is basically attitude research" (p.726). In comparison, Ehrhart et al. (2014) have also focused on climate as an attitudinal measure, but emphasized the role of experience with the environment rather than the environment itself. Second, Guldenmund concludes that organizations are influenced by national and regional conditions as well as educational, socio-economic, and religious characteristics of its workforce.

Sammer et al. (2010) used the Agency for Healthcare Research and Quality (AHRQ-USA) definition of safety culture, which is borrowed from the Health and Safety Advisory Commission of Great Britain:

> The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to and the style and proficiency of an organization's health and safety management. (p.156).

This definition integrates the notions of safety culture and climate; therefore, when interpreting their findings in terms of safety climate (rather than culture), it is essential to restate their findings in terms of employee perceptions of the cultural elements in order to consider them as the safety climate elements. Nonetheless, Sammer et al. reviewed 38 generic patient safety studies (not including medical specialties or interventions) conducted at hospitals in the United States from 1999 through 2007 to make an important contribution to the assessment of extant literature. They discovered the following seven key elements: (a) leadership, (b) teamwork, (c) evidence-based practice (use of feedback loops to reduce variation and improve reliability), (d) communication, (e) learning, (f) accountability, and (g) patient-centered focus.

Jackson and Kline (2014) found consensus around four themes: (a) management commitment, (b) teamwork, (c) communication, and (d) incident reporting. The Hospital Survey of Patient Safety Culture (HSOPSC), which was originally developed by the Agency for Healthcare Research and Quality and implemented across 1,128 hospitals in the United States, was adopted for the U.K. environment and implemented across three large hospitals in the East Midlands. The exploratory factor analysis of this instrument yields the following unit-level scales: supervisor expectations; organizational learning; teamwork; communication; feedback and communication about errors; non-punitive response to errors; and staffing resources.

While the above studies present multiple synthesized elements of safety climate, they do not provide a conceptual model of how these elements may be associated with each other. For example, should one consider a hierarchical model of molar and focused climate elements or should one consider a functional model that illustrates the influence of various factors on each other.

Studies based on the emergent, integrated model of culture and climate should strive to explore the role of seven general cultural elements and appropriately focused climatic elements. For example, keeping the cultural elements as listed below, the corresponding climate elements focused on safety are also listed. Both cultural and climatic elements are considered in formulating the specific research questions and hypotheses.

<u>Cultural Elements</u>:

1. Shared Experiences and Learning
2. Organizational Values
3. Implementation Mechanisms
4. Leaders and Key Influencers
5. Individual Behaviors
6. Performance Outcomes
7. Feedback

<u>Climatic Elements</u>:

1. Leadership
2. Teamwork
3. Evidence-based Practice
4. Communication
5. Learning
6. Accountability
7. Safety-centered Focus (for safety climate assessment)

2.6 Narrative for the Integrated Model of Organizational Culture and Climate

So far, an incremental approach to theory building has resulted in Model 7, the integrated model of culture and climate, and enhancements based on the literature on safety culture and climate. Since a theory is a "statement of relationships between units observed or approximated in the empirical world" and it addresses how these units interact, when or under what conditions, as well as the rationale for their interactions (Bacharach, 1989, p. 498), the narrative presented this section serves as the proposed theory. Thus, in accordance with the integrated model of culture and climate illustrated in Figure 7, the theoretical units approximated are all the elements contained within the complex constructs of culture and climate as well as those contained in the construct of external environment. First, considering the three constructs involved (environment, culture, and climate), two broad propositions are presented:

1. External factors influence organizational culture and
2. Organizational culture influences organizational climate.

The narrative describing this proposed model could be termed as a cultural transformation theory, and it could be stated as follows:

> When external factors create conditions that threaten an organization's continued survival or market leadership position, the organization tends to undergo a cultural transformation. Such a transformation is initiated by two types of shared experiences: (a) organic shared experiences by virtue of the members of the organization being aware or directly influenced by the external factors and (b) planned shared experiences that are intentionally

designed and implemented by leaders and key influencers. Both types of shared experiences have the potential to influence organizational values, which in turn result in changes in operational processes, individual behaviors, and changes in corresponding performance outcomes. Feedback from changes in performance influences learning derived from shared experiences and the effectiveness of subsequent operational actions. Organizational climate is a psychological response to the underlying culture and hence could serve as a symptomatic measure of the underlying culture.

At the heart of an organization's culture, however, are its values, which are formed, reinforced, or revised through shared experiences of its members. While reinforcement of organizational values takes place on a routine basis, revision takes place under extraordinary circumstances such as threats to its survival, leadership, or well-being. The quest to institutionalize the group's values leads to implementation mechanisms like strategies, policies, procedures, and practices. Leaders and key influencers have a significant impact on which values are modeled and how they are reinforced through the various implementation mechanisms. Organizational climate, on the other hand, is the group's psychological response to the shared experiences, values, and implementation mechanism, experience with behaviors in the workplace, as well as reactions to individual-, group- and firm-level outcomes. Group performance includes behaviors that influence specific safety, quality, or innovation outcomes, and firm performance includes broader outcomes like financial outcomes or major accidents. Thus, organizational climate includes its members' psychological response to how different outcomes are treated, how the members feel about the underlying behaviors that are rewarded/ penalized, and what is valued by the management or the group.

When the desired performance outcomes are achieved, the experience of such success drives the change in shared values. Patankar, et al. (2012, p.167) illustrate three models adapted from the original works of Argyris (1977), Bierly, Kessler, and Christensen (2000), and Wang and Ahmed (2003). In accordance with this perspective, an organization tends to progressively become more collaborative, community-spirited, and innovative, thus opening up a broader array of learning mechanisms and improved employee engagement. In the context of safety, when an airline or a hospital specifically articulates safety as its organizational value, rather than limiting the list of values to business success (e.g., profitability, customer satisfaction, and industry-leading performance), there have been many instances of collateral changes in implementation mechanisms such as the launch of an error reporting system. Specifically, Patankar et al. (2012, p.173) report a case from healthcare where the values shifted from defensive to collaborative, and finally to innovative, achieving a transformational impact on the subject hospital.

Since the constructs of culture, climate, and external environment are complex by themselves, a second tier of propositions is presented as follows:

1. Environmental factors provide the context for organizational culture;
2. Leaders and key influencers influence organizational values;
3. Shared experiences influence organizational values;
4. Performance feedback influences learning derived from shared experiences; and

5. Multiple mechanisms, including planned interventions, influence a cultural transformation.

These propositions are used to develop the relevant research questions and hypotheses.

2.7 Learning in the Context of the Emergent Model

Organizational studies have often used a learning perspective to explain a particular phenomenon, particularly issues related to strategic choice, mergers and acquisitions, and performance differences (Bapuji & Crossan, 2004). In the development of the emergent model, learning has emerged as an element of organizational climate, and it is structurally represented within the shared experience block as well as through the overall feedback and implementation mechanisms that are used to reinforce or revise organizational values. Thus, learning is an integral aspect of the emergent model. This section presents categories of learning outcomes and levels of analysis in the context of the emergent, integrated model of organizational culture and climate.

Kraiger, Ford, and Salas (1993) classify learning outcomes into three categories: cognitive, skill-based, and affective. In the context of the emergent, integrative model of organizational culture and climate, a participant's (individual level) learning in all three categories could be assessed: cognitive learning could be assessed with knowledge exams, skill-based learning could be assessed with practical tests or field observations, and affective learning could be assessed with climate surveys. The individual-level data could then be aggregated to group-level, as long as there is psychometric support for such aggregation, and group-level conclusions could be drawn. For the purpose of this thesis, cognitive learning outcomes will be obtained through scores on knowledge exams that were administered prior to the beginning of the $MORE^{OB}$ training and at the end of each module. Similarly, affective outcomes will be obtained through scores on safety climate surveys, which are essentially attitudinal measures, also administered prior to the beginning of the $MORE^{OB}$ training and at the end of each module. In accordance with Kraiger et al.'s (1993) model of learning outcomes, qualitative data that indicate deep, value-level change at individual, group, or organization-level would be considered an affective learning outcome, rather than a cognitive or skill-based outcome. While the use of skill-based outcomes is consistent with the emergent theoretical model, the use of such outcomes was beyond the scope of this study.

Since the emergent model of culture and climate takes a group-level perspective as the unit of analysis, assessment of learning can also be accomplished at the group level. Edmondson (2002) focused on the role of team or group-level learning in influencing organizational learning. Edmondson proposed two competencies to be integral to group-level learning: reflection and action. She further claimed that a team member's perception of psychological safety is critical to moving a team from reflection to action. In the context of the emergent model, shared experience, by definition is a group-level phenomenon and therefore, one could argue that the learning derived from such experience is group-level learning; however, in accordance with Edmondson's observation, in order for shared experiences to translate into learning, the group must engage in deliberate reflection practices. When, the reflective practices are appropriately structured and managed, they have the potential to cause deep, value-level impact that would either reinforce the extant values ("an incremental change" according to Edmondson) or revise the extant values ("a radical change" according to Edmondson). The feedback loops, as well as the role of leaders and key influencers, identified in the emergent model specifically aims at addressing the barriers to convert reflection into action and to move from group-level learning to organization-level learning. Thus, the emergent model is complementary to Edmondson's perspective on group-level learning. The qualitative analysis conducted in this study explores how group-level learning translates into cultural change. Although this study is limited to the study of group-level changes, it can be extended to organization –level changes without changing the core model.

Easterby-Smith, Crossan, and Nicolini (2000) examine the rise and fall of specific debates in the field of organizational learning. Of particular significance is the debate regarding levels of analysis: is organizational learning a simple aggregation of individual-level learning or is it much more and truly a property of the group? While there are arguments on both sides of this debate, Hedberg (1981) argues that organizational learning is more than the sum of individual learning because "members come and go, and leadership changes, but organizations' memories preserve certain behaviors, mental maps, norms, and values over time" (p.6). The literature reviewed thus far regarding what constitutes an organizational transformation would suggest that the application of Hedberg's definition of organizational learning is essential for any change program or intervention to effect a deep, transformational cultural change. In other words, organizational learning is a prerequisite to cultural change. Consistent with the current thinking regarding the appropriateness of the level of analysis, as noted by Easterby-Smith et al., it seems fitting to consider both the individual level analysis to quantitatively determine the effectiveness of a training intervention at the individual level and supplement it with qualitative field observations and/or interviews to determine group-level learning. Also, artifacts of learning such as new organizational values, procedures, posters, or task kits would serve as tangible evidence of group-level learning that has transcended beyond individual-level learning and is likely to survive personnel transitions. Considering that the MORE^{OB} training intervention is a team-based training program aimed at a particular community of practice—the obstetrics team consisting of physicians, nurses, midwives, and administrators—the notion of "collective or social learning" or learning as a result of meaningful interactions among different individuals and professional groups both within the training sessions as well as in actual practice (Bruner & Haste, 1987; Cook & Brown, 1999; Edmondson, 1999; Engestrom & Middleton, 1996; Lave & Wenger, 1991; March, 1991), is more relevant. Furthermore, Easterby-Smith et al. note that the most current thinking on level of analysis for learning has shifted toward "learning-in-working" or organizational learning as a social phenomenon. Thus, it makes sense to collect individual-level knowledge exam data to quantitatively measure cognitive learning, conduct field observations and interviews to collect qualitative data regarding group-level learning, and seek artifacts that support individual-independent, group-level learning and collectively provide evidence of lasting, change in the organizational culture.

Bapuji and Crossan (2004) reviewed 123 articles that were published between 1990-2002 to take stock of the state of empirical research in organizational learning. Their findings conclude that there was a "growing consensus in the literature that learning can be behavioral and cognitive, exogenous and endogenous, methodical and emergent, incremental and radical, and it can occur at various levels in an organization" (p.400). Furthermore, Bapuji and Crossan claim that about 65 per cent of the empirical studies employed a learning perspective to organizational research and offer another classification of organizational learning based on the source of the underlying experience: internal experience or endogenous learning, or external experience or exogenous learning. While the internal experience as a source of learning appears to be self-explanatory, the external experience could be further categorized into congenital learning, vicarious learning, and inter-organizational learning. Congenital learning occurs when a firm is new and needs to learn from other established firms in the industry or from other industries. Vicarious learning occurs when a firm is fairly established, but learns from other firms within the industry or from other industries—possibly through benchmarking of outcomes. Inter-organizational learning occurs among firms that are formally affiliated with each other through coalitions or associations and regularly share certain data or experiences. These overall findings and definitions of internal versus external learning complement the emergent model very well. For example, applying a learning orientation to the emergent model, one could argue that (a) shared experiences are essentially group-level phenomenon and so learning occurring through such experiences could be assessed at that level; (b) knowledge imparted through a training intervention could be assessed through tests at an individual level and then aggregated to determine the group-level change in knowledge levels; (c) the effect of knowledge improvement on behavioral changes could be assessed through practical tests or field observations; (d) changes in individual or group behaviors are both a function of individual-level learning as well as social learning resulting from immersion in the work environment and interacting with other members of the obstetrics practice; (e) both methodological and emergent, as well as incremental and radical, changes are possible through the operationalization of the emergent model; (f) the notion of external factors could be framed in the learning context as external or exogenous learning.

Table 7 presents a summary of different learning perspectives, their classification, definition, and contextual fit.

Table 7: Learning perspectives and contextual fit

Learning Perspective	Classifications	Definition	Contextual Fit
Individual Learning	Cognitive	Includes verbal knowledge, organization of the domain knowledge, and cognitive strategies employed to access and apply the knowledge (Kraiger, Ford, & Salas, 1993)	The MORE^{OB} program is a training intervention aimed at raising the domain knowledge of all participants. Thus, the pre- and post-intervention knowledge exams assess cognitive learning.
	Skill-based	Includes practical demonstration of the use of procedures, composition of tasks, and a certain degree of automaticity in executing the procedures (Kraiger, Ford, & Salas, 1993).	The emergent model offers opportunities to include skills assessment data through the use of practical tests and field observations. However, this study did not include such data.
	Affective	Includes assessment of attitudinal changes as a result of the learning intervention, a as well as motivational aspects like disposition, self-efficacy, and goal-setting (Kraiger, Ford, & Salas, 1993).	The safety climate measures used in this study are essentially attitudinal measures seeking to determine changes in psychological responses to the underlying cultural elements. However, this study did not include measurement of motivational aspects.

Table 7 (Continued): Learning perspectives and contextual fit

Learning Perspective	Classification	Definition	Contextual Fit
Levels of Learning or Unit of Analysis	Individual	Purists believe that organizational learning should be analyzed at the individual level because learning is a human quality and it should not be attributed to inanimate entities like an organization. Also, since senior managers have the most impact on strategic directions of an organization, understanding learning at their individual level would provide adequate approximation of organizational learning. (Easterby-Smith, Crossan, & Nicolini, 2000)	The emergent model allows for a broad, and more current, perspective on level of analysis. For example, individual-level knowledge improvements resulting from the MORE^{OB} training intervention are measured by the pre- and post-intervention knowledge exams. These changes can be aggregated to group-level. Also, qualitative data collected through interviews and field observations could be used to determine group- and organization-level learning.
	Group-Level	Group-level learning seeks to focus on the social aspects of learning or the learning that takes place as a result of social interactions among the individual participants (Bruner & Haste, 1987; Edmondson, 1999; March, 1991)	In the emergent model, it is theorized that feedback resulting from the observation of individual behaviors and outcomes of both individual and group-level actions will influence the shared experiences and consequently impact the shared values.
	Communities-of-Practice	Communities-of-practice are essentially multidisciplinary teams focused on a particular common problem or task (Lave & Wenger, 1991)	This level of analysis is well-suited for the emergent model because obstetrics teams are essentially communities of practice.
	Organization-Level	Edmondson (2002) argues that learning occurs in small group collectives and for it to extend to a broader community such as the entire organization, there must be effective mechanisms for reflection and action beyond the small group level.	In the context of this study, there must be mechanisms for reflection and action to specifically take the leaning from obstetrics to hospital level. These mechanisms could be examined from the perspective of implementation mechanisms included in the emergent model.

Table 7 (Continued): Learning perspectives and contextual fit

Learning Perspective	Classification	Definition	Contextual Fit
Sources of Learning	Internal	Learning that occurs from a firm's own experience. (Bapuji & Crossan, 2004)	The emergent model depicts how intrinsic shared experiences as well as strategic interventions aimed at creating new shared experiences influence the overall organizational culture; thus, this model could be presented from a learning perspective as an illustration of how an organization may learn and transforms itself through internal and external sources of learning.
	External • Congenital • Vicarious • Inter-organizational	Learning that occurs from another firm's experience: (a) Congenital learning occurs at the launch of a new firm and it is in the form of borrowed expertise from another firm or industry's experience; (b) Vicarious learning occurs while a firm is operating under steady state conditions, but learns from other firms or industries that are not formally affiliated with it; and (c) Inter-organizational learning occurs when a firm learns from another firm that is somehow affiliated with it. This affiliation could be through an industry-level organization or a coalition. (Bapuji & Crossan, 2004)	In accordance with the emergent model, the external environment would play a significant role in influencing the transfer of knowledge at congenital, vicarious, and inter-organizational levels.

2.8 Training as a Culture-change Intervention

Now that an integrated model of culture and climate has been developed, it is worthwhile to consider where a typical intervention program would fit within this model. Training is arguably the most common intervention aimed at shaping individual behaviors at the workplace. Orientation and basic skills programs are commonly used to train newly hired workers to be productive at their job and also learn the norms of the organization. Similarly, changes in organizational performance outcomes are attempted through changes in workplace behaviors that rely on transfer of knowledge from training programs to individual behaviors. For example, in healthcare, training programs have been used to enhance individual-level clinical knowledge and skills as well as team-oriented competencies, particularly with the use of simulation and drills (Aggarwal et al., 2010; Miller et al., 2008; Pratt et al., 2007; Thomas, Sexton, & Helmreich, 2004; Weaver et al., 2014). Such programs have also been known to influence organizational culture and climate (Patankar & Taylor, 2004; Pratt et al., 2007). There is also support for organizational climate to be linked with improvement in personal injury rate (Beus, Payne, Bergmann, & Arthur, 2010), which in turn, is a result of certain at-risk individual behaviors. Clarke (2006) also proposes a link between safety climate and employee safety performance: “Organizational safety climate has an important influence in ensuring adherence to procedures, but, in particular, plays a significant role in the promotion of employee commitment and involvement in safety” (p.324). Thus, it follows that if a training program is developed as an intervention strategy aimed at providing a specific shared experience aimed at enhancing knowledge, it could influence organizational climate, group performance outcomes, and firm performance. However, it is not clear as to how such programs would influence individually-held and shared organizational values. Yet for an intervention program to effect a cultural transformation at the organization, it must either create new values, change old values, or connect new values with old values (Rochon, 1998). Thus, it is essential to investigate the effectiveness of training programs in improving individual-level knowledge, group-level climate, and group-level peroformance outcomes, as well as the impact on the shared organizational values.

Over the past 50 years, much research has been done in the areas of training evaluation, including transfer of training to workplace behaviors and organizational outcomes. For example, Kirkpatrick's four-level model of training evaluation consists of reaction, learning, behavior and results (Kirkpatrick, 1979, 1998; Kirkpatrick & Kirkpatrick, 2006). The first level of evaluation is generally affective: the participants' feelings about the training, perceived relevance and practicality of the training, and the overall effort required to engage in the training. Essentially, it assessed whether or not the participants were pleased about the training. This assessment is short and prompt, and can be done immediately after the training. The next level of evaluation is the assessment of actual change in knowledge or cognitive capabilities as a result of the training. This assessment involves a pre-post training assessment of knowledge via written tests or interviews. Attitudes and opinions surveys are also used to assess the effectiveness of learning. The third level of assessment is typically conducted some months (12-18 months) after training to find out whether the participants changed any of their own behaviors as a result of their training. This assessment can be done through observations, self-assessment, survey questionnaires, or interviews. Finally, the fourth level of assessment seeks to determine if the training could have resulted in any changes in organization-level performance outcomes. From the context of safety, the goal of a training program could be to reduce workplace injuries. The series of underlying assumptions running across these four levels of assessment would be as follows:

- The participants liked the safety training and they were generally pleased;
- The participants’ knowledge about key safety issues improved after training;
- The participants used their new knowledge to change their behaviors at the workplace; and
- As a result of the changed behaviors, the workplace injuries declined.

Since its introduction, Kirkpatrick’s model has been used, criticized, expanded, and contracted; nonetheless, most researchers in the field agree that it has spurred both extensive field-testing as well as new theoretical development in the field of training evaluation (Salas & Cannon-Bowers, 2001). Alliger, Tannenbaum, Bennett, Traver, and Shotland (1997) expanded Kirkpatrick’s level one evaluation beyond affective reaction and discovered a stronger link between usability of the training and transfer of training to work performance. Tannenbaum et al. (1993) expanded the behavior level into two outcomes: training performance and transfer performance. In their model, learning (level two) is related to training performance (which includes academic performance on post-training tests), and the pathway to results (level four) is mediated by training performance and transfer performance. Warr, Allan and Birdi (1999) discovered that the correlation between reaction (level one) and job behavior (level three) were non-significant and correlations between learning (level two) and job behavior (level three) were low. Thus, they concluded that transfer of training to work performance must be related to other factors. Holton (2005) criticized Kirkpatrick's model because it seemed like per Kirkpatrick's model failure to achieve the set training goals, particularly transfer of training to work performance was blamed entirely on the training itself. Instead, Holton proposed a three-level model that focused on two trainee-level factors (learning and individual behavior) and one organizational factor (organizational performance). The challenges associated with transfer of learning to work performance are largely related to organizational culture (management support, peer support, feedback, etc.)(Holton, 2005). Similarly, Birdi (2007) discovered that while most training programs regarding innovation focus on idea creation, they tend to have much less success in idea implementation because the latter requires a different skillset and it also relies on support from the organization (i.e., a supportive organizational culture).

In an attempt to bridge prevailing theories and models, Alvarez, Salas, and Garfano (2004) developed one of the most comprehensive models integrating training evaluation (a measure of how well the training program achieves its goals) and training effectiveness (why the training program is effective in achieving its goals). Dealing with transfer performance, they attribute it to individual characteristics (mostly motivation to learn and transfer), training characteristics (content and delivery mechanisms most likely to support transfer), and organizational characteristics (generally termed as organizational climate conducive to transfer of training). Spitzer's Learning Effectiveness Measurement (LEM) methodology takes a more active stance on training as well as transfer of training to work performance (Spitzer, 2005). Essentially, the LEM seeks to proactively identify the barriers to transfer before designing the training, persuade the management to address these barriers, and use longitudinal, continuous measurements to determine whether the barriers have been effectively removed or mitigated as well as the level of success of the training program in effecting the change at individual and organizational levels. Sitzman and Weinhardt's (2015) training engagement theory takes a holistic view about what it takes to achieve successful training outcomes, including transfer of training and organizational performance improvements. Essentially, it advocates for continuous assessment of engagement and commitment from multiple levels of the organization so that there is an ongoing attention to the training and multi-level vested interest in the training program's success. Birdi and Reid (2013) take another multi-level perspective and propose that training can impact at not only individual and group levels, but also at organizational and societal levels. Finally, Blume et al. (2010) also acknowledge the vital role played by the work environment (organizational culture) in successful transfer of training to workplace behaviors and organization-level performance outcomes.

In the light of this growing body of literature that points to the significance of organizational culture in transfer of training as well as the potential for a training intervention to impact societal norms, Model 8 (Figure 8) includes a mediated pathway between learning (arising out of planned training intervention) and changes in individual behaviors. Cases of training programs that may have resulted in changes in organizational culture need to be studied more carefully to determine the mechanisms by which training can influence shared organizational values, as well as consider the influence of other concurrent mechanisms of influence. Table 8 summarizes the above models and their features.

In the light of the training research discussed above, the role of training intervention in shaping organizational culture and climate is illustrated in the updated model in Figure 8. Training creates new shared experiences, which result in individual-level learning and can influence individually held vales. Alternately, training may directly influence individual behaviors, even though they may be mediated by individual characteristics, training characteristics, and organizational culture. Regardless of the pathway, changes in individual behaviors are theorized to produce improvements in group and firm-level outcomes.

Table 8: Key models and features of training evaluation and transfer

Theory/Model	Features	Publications
Four Levels of Training Evaluation	Training should be evaluated at four levels: Reaction, Learning, Behavior, and Results	Kirkpatrick (1979, 1998)
Three Levels of Training Outcomes	There are three broad levels of training outcomes: Learning, Individual Performance, and Organizational Performance	Holton (2005)
Integrated Model of Training Evaluation and Effectiveness	Most comprehensive model: It takes into consideration needs analysis, individual trainee characteristics, training characteristics, organizational characteristics, post-training attitudes, reactions, cognitive learning, training performance, transfer performance, and results.	Alvarez et al. (2004)
Learning Effectiveness Measurement	Proactive and continuous assessment of learning effectiveness; consists of five phases: Predictive Measurement; Baseline Measurement; Formative Measurement; In-process Measurement; and Retrospective Measurement	Spitzer (2005)
Training Engagement Theory	A temporal, concurrent set of sequences taking place at various levels of an organization affects the ultimate effectiveness of training programs.	Sitzman & Weinhardt (2015)
Transfer of training from knowledge/skills to workplace behaviors	It is a function of motivation- and ability-related factors	Elangovan & Karakowsky (1999)
	Work environment also plays a critical role in transfer of training	Birdi (2007); Blume et al. (2010)
Taxonomy of Training and Development Outcomes	Training can be designed to achieve multiple levels of outcomes: individual, workgroup, organizational, and societal	Birdi & Reid (2013)

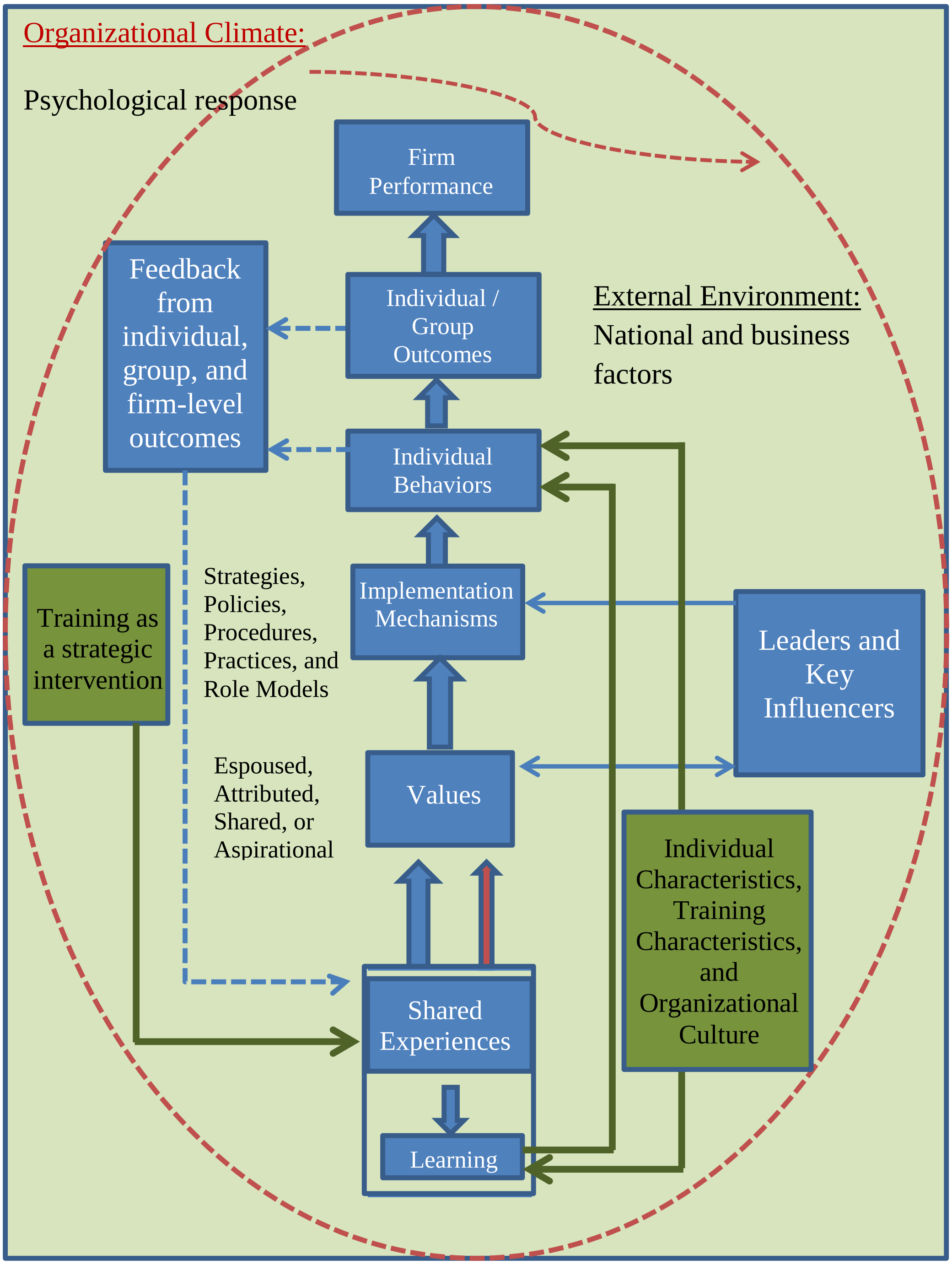


Figure 8. Model 8. Influence of training on culture, climate, and performance

2.9 Research Questions and Hypotheses

The overarching research question of this study was whether an intervention, such as training, alone would be sufficient to produce a cultural change. The review of literature presented in this chapter demonstrates that although culture and climate have emerged and developed as separate constructs, it is time to consider an integrated model of culture and climate, which in turn, necessitates a mixed-methods approach to test the model (cultural studies tend to be qualitative and climatic studies tend to be quantitative). Thus, in the context of the selected domain (obstetrics practice in Ontario, Canada), it is essential to develop the second-tier theoretical propositions into specific research questions and use one of the propositions (the fifth proposition was selected based on availability of quantitative data) to derive corresponding hypotheses. The purpose of these research questions and hypotheses is to empirically-test the validity of the integrated model of culture and climate and revise it, as necessary.

2.9.1 Research Question #1

In accordance with the integrated model of culture and climate, and supported by the literature, broad environmental factors tend to influence organizational culture (proposition #1). For example, in Deal and Kennedy’s (1982) five elements of culture, one element is environment, which constitutes business, political, and social considerations. Similarly, Barney’s (1986) model places emphasis on external business environment and Ostroff et al.’s (2012) integrative model of organizational culture and climate takes into account two external factors: business factors and national factors. Empirically, Hofstede (1984) is renowned for his study on the influence of the national environment within which personnel are raised on their individual and group-level values, which in turn are aggregated as characteristics of national cultures. Additionally, three key examples of environmental factors shaping organizational culture were reported by Wilkins (1984), Freiberg and Freiberg (1996), and Knowles (2002). Wilkins reported the importance of stories in building and sustaining organizational cultures. Most of these stories relate shared experiences of certain individuals or groups (heroes) within given environmental conditions (challenges) and their triumph over those conditions, which eventually help communicate and germinate the desired organizational values across generations of employees. Freiberg and Freiberg told the story of Southwest Airlines narrating their triumphs over unprecedented environmental challenges and how these shared experiences formed their distinctive culture. Also, Knowles reported in great detail how a combination of community outrage and regulatory pressures led to DuPont Chemicals' transparent and engaged approach to chemical safety. Thus, there is sufficient theoretical support, reinforced by empirical findings, to pursue the research question as to how specific environmental factors might have influenced the patient safety culture in the obstetrics practice in Ontario.

RQ_1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

2.9.2 Research Question #2

The role of leaders and influencers in shaping organizational cultures in general, and values in specific, has been studied by numerous scholars over the past decades (proposition #2). In particular, the works of Pettigrew, Schneider, and Schein are salient. Pettigrew (1979) promulgated an anthropological perspective on how leaders, particularly founders, infuse their personal values into their organizations. He defined entrepreneurship as the leader’s ability to transform “individual drive into collective purpose and commitment” (p.573)—this definition necessitates leaders to reflect on their personal values and habits and not only imprint them on the organization, but also to institutionalize them through robust mechanisms such that these values and habits will be continually reinforced. Schneider’s attraction-selection-attrition (ASA) theory (1987), which is an extension of Lewin’s person-environment concepts (1935, 1951), focuses on the role of traditional human resources function in an organization. It asserts that an organization will tend to attract and retain individuals—including leaders—who manifest values that are consistent with those of the organization (and by extension, those of the founders of the organization). Schein’s (2010, 2015) notion of norms institutionalizing organizational values comes from a combination of human relations perspective and organizational behavioral perspective of neoclassical approach to management (Sarkar & Khan, 2013). Schein builds on the human relations perspective that social context plays a key role in individual employee behavior as well as the organizational behavioral perspective in that individuals within an organization will respond to incentives that reinforce specific behaviors. Many consultant accounts and biographies of prominent leaders/founders give vivid examples of how leaders instilled their personal values in their respective organizations. For example, Freiberg and Freiberg (1996) tell the Southwest Airlines story and the influence of their founder Herb Kelleher, Packard (1996) tells the story of Hewlett-Packard (HP) and the influence of its co-founders Bill Hewlett and David Packard on the organizational values and culture of HP. Additionally, Lala (2006) documented the multi-generational influence of the Tata family on the multi-national conglomerate, the Tata Group. Throughout these accounts, it is clear that corporate founders seek to build companies that are "like them." Schneider (1987) and Schein (2010, 2015), on the other hand have studied publicly-traded corporations (which were not founded by the current leaders) and documented the leadership's profound impact on a wide range of strategic and operational decisions which include, but are not limited to, attraction, selection and attrition of employees, development of formal structures and process to develop and maintain certain organizational values, and reward and recognition mechanisms that celebrate the desired behaviors. Thus, there is sufficient theoretical support, reinforced by empirical accounts, for proposition #2 and to pursue the research question as to how leaders and influencers at the subject organizations might have shaped the shared organizational values.

RQ_2: How did leaders and influencers shape shared organizational values at the subject organizations?

2.9.3 Research Question #3

Shared experiences form the core of Schein's theory on organizational culture and leadership (2010, 2015). While different organizations in the same business, national, and legal environment may be presented with the same set of challenges, how they specifically choose to address their challenges, and ultimately triumph, distinguishes them from their competitors. The lessons learned through such trials are distilled into organizational values and serve as the foundation to address future challenges (proposition #3). Schein addresses the notions of both revision and reinforcement: challenges that require new solutions tend to revise previously held organizational values and those that continue to be overcome with previously proven solutions tend to reinforce the existing values. The implementation mechanisms used to institutionalize organizational values include organizational structures, policies, and procedures. Since Schein's work has been the foundation of many applied studies in organizational culture, there is support for proposition #3, and therefore, the corresponding research question would be to determine how specific shared experiences, through implementation mechanisms, might have helped revise and reinforce organizational values at the subject organizations.

RQ_3: How did shared experiences, through implementation mechanisms, help revise and reinforce organizational values at the subject organizations?

2.9.4 Research Question #4

Feedback is one specific element or action that distinguishes the relationship between teaching and learning from being a simple transmission and reception of information to a dynamic, multi-loop system of transmitting, receiving, questioning, sense-making, building, and assimilating toward enhancement of core knowledge within the learner (Askew, 2000). In the context of organizational learning, knowledge of factors leading to certain positive or negative performance outcomes can result in commitment to certain policies, processes, standards, or practices (Clarke, 2006; Putter, 2010; Reason, 1997; Senge, 1990). It is also possible that there are two types of feedback: formal and informal. Formal feedback is often reported in human resources literature or education literature as a means to enhance individual performance (Askew, 2000; Balcazar, Hopkins, & Suarez, 2014); however, informal feedback is generally implied in the social learning context, particularly in response to how new-hires might learn about the prevailing norms at an organization or a specific workgroup (Louis, 1980). Thus, at an organizational level, it is likely that both types of feedback are present and hence there is support for proposition #4. The corresponding research question needs to determine more specifically how feedback from group-level performance might have influenced learning derived from shared experiences:

RQ_4: How did feedback from group-level performance influence learning derived from shared experiences at the subject organizations?

2.9.5 Research Question #5

Several studies noted in the literature review point toward the relationship between organizational climate and performance (Beus et al., 2010; Clarke, 2006; Zohar, 2002a; Zohar & Hoffman, 2012). However, the link between climate and performance is correlational rather than causal. Thus, it makes sense to investigate the relationship between the key cultural elements and the performance outcomes while organizational climate continues to serve as a temporal measure of the underlying cultural elements. Furthermore, the training transfer literature claims that the effectiveness of transfer is at least partially mediated by organizational culture (Alvarez et al., 2004; Birdi, 2007; Blume et al., 2010; Sitzman & Weinhardt, 2015; Spitzer, 2005). Therefore, the final research question, derived from proposition #5, seeks to determine how inherent cultural elements tend to influence the effectiveness of a planned culture-change intervention.

RQ_5: How do inherent cultural elements influence the effectiveness of a planned culture-change intervention?

2.9.6 Hypothesis #1

Building on the last proposition (#5), planned interventions like training could be targeted toward increasing awareness, providing a new set of shared experiences, and thereby resulting in improved organizational climate. Similarly, training could also be targeted toward changing individual and group behaviors and thereby impacting individual- and group-level performance (Patankar & Taylor, 2004). For example, just culture training focuses on reducing at-risk behaviors at the individual level, but uses a community standard to set the threshold for such behaviors (Dismukes & Smith, 2000; Marx, 2001; Reason, 1997). In the healthcare domain, Milne, Walker, and Vlahiki (2013) have demonstrated that focus on improving clinical knowledge across a team can improve their performance and thereby influence group-level clinical outcomes. Patankar and Taylor (2004) have illustrated that just as a well-designed safety program could result in a positive return on investment at the firm level, poorly designed programs could result in a negative return on investment. Thus, there is sufficient evidence to support a more specific hypothesis that the $MORE^{OB}$ training, as an implementation mechanism, improves group-level performance. Thus, this analysis will have to be at the group-level.

H_1: The $MORE^{OB}$ training, as a planned intervention, improves group-level outcomes.

2.9.7 Hypothesis #2

Fundamentally, training not only seeks to provide a certain necessary skillset for the employees, it also symbolizes the value attributed to its employees. Hence, Patterson et al. (2005) map emphasis on training with the human relations quadrant of the Competing Values Framework. Singer et al. (2007) studied organizational climate across 105 hospitals in the United States and concluded not only that patient safety training programs influence organizational safety climate, but also that for training to have the greatest impact on climate, the training programs should target three levels: organization, group, and individual. In the aviation industry, Patankar and Taylor (2008) reviewed four generations of maintenance resource management training and concluded that as a safety training program, it raised awareness among the participants and improved organizational safety climate, which in some cases lasted up to two years after the end of the training program. Thus, there is sufficient evidence to support the more specific hypothesis that the $MORE^{OB}$ training, as a planned intervention, improves group-level patient safety climate. Thus, this analysis will have to be at the group-level.

H_2: The $MORE^{OB}$ training, as a planned intervention, improves group-level patient safety climate.

2.10 Summary

The healthcare system, particularly in Canada, must improve both quality and affordability. One key element in addressing this need is the ability to develop and sustain a strong culture of patient safety. Building on past studies on organizational culture and climate, this study seeks to develop and validate an integrated model of culture and climate using a mixed-methods approach. In the emergent integrated model of organizational culture and climate, Schein's original model of organizational culture was expanded to explicitly include the concepts of environmental influence on culture, organizational learning, four types of organizational values, implementation and feedback mechanisms, and the role of leaders and key influencers. Artifacts were acknowledged as physical objects as well as embedded stories—but they served as evidence of culture rather than the culture itself. Thus, culture was proposed to comprise of shared experiences and learning, values, implementation and feedback mechanisms, individual behaviors, individual and group outcomes, and firm outcomes, as well as reinforcement and revision mechanisms that enabled the balance between stability and responsiveness inherent to a culture. Climate was viewed as a psychological response to the underlying culture and thus comprised of the group members' perceptions of the degree to which the extant work environment is conducive to their well-being. In order to change organizational safety culture, one would have to influence one or more of its shared core values; training could provide an intentional shared experience aimed at influencing organizational values. Five research questions and two hypotheses were presented to determine the viability of this integrated model.

The five research questions focused on the structural aspects of the model, while the two hypotheses focused on the operational aspects. Specifically, the research questions sought to determine the role of environmental factors in influencing organizational culture (RQ_1), the role of leaders and key influencers in shaping organizational culture (RQ_2), the role of implementation mechanisms in engineering specific shared experiences that sought to reinforce or revise organizational values (RQ_3), the role of feedback mechanisms in shaping learning derived from shared experiences (RQ_4), and the role of inherent cultural elements in influencing the effectiveness of planned culture-change interventions (RQ_5). The two hypotheses, on the other hand, sought to test the influence of the $MORE^{OB}$ training (as a planned intervention) on group-level outcomes (H_1) and on group-level patient safety climate (H_2). Collectively, responses to these research questions and hypotheses sought to validate the integrated model of culture and climate, consider revisions to the model, and ultimately answer the overarching research question as to whether a training intervention alone could result in a cultural change.

Chapter 3: Methodology

3.1 Introduction

Culture studies, rooted in the tradition of anthropology, tend to be qualitative studies involving ethnographic observations, narrative analysis of interviews, and/or artifact analysis. Climate studies, on the other hand, are rooted in the tradition of psychology and tend to be dominated by quantitative methods like survey instruments. Both these approaches have their relative strengths and weaknesses. For example, cultural studies tend to be deep but narrow and hence difficult to compare across multiple groups; whereas, climate studies tend to be broad but shallow and hence making it difficult to get an in-depth understanding of the phenomenon being measured. In order to leverage the strengths of both these methods, several leading authors have recommended a mixed-methods approach. There are many ways of structuring such an approach. For example, one could conduct a qualitative study to generate research hypothesis and then follow-up with a quantitative study to test the hypothesis. Alternatively, one could conduct a quantitative study to get a broad understanding of the phenomenon being studied and then follow-up with complementary qualitative study to build a deeper understanding of the phenomenon.

For the purpose of this study, the preceding literature review has led to an integrated model of culture and climate. Thus, it follows that both qualitative and quantitative methods should be used to test this model. Since the focus of this study was not on the development of individual analytical tools (like survey instruments or knowledge exams), but rather on the overall dynamics of the integrated nature of culture and climate in the narrow context of patient safety, the overall architecture of the methods used in this study would be best described as a retrospective, quasi-experimental, mixed-methods approach. It was retrospective because the intervention for cultural change, the MORE^{OB} program, was developed and implemented by the Salus Global Corporation and pre- and post-implementation data were made available to the researcher. The researcher was not involved in the design or implementation of the intervention, nor was the researcher involved in the design of the various quantitative data collection tools. Also, since the earliest intervention had been applied over ten years ago, there were no opportunities to make changes to the intervention based on the findings of this study. Nonetheless, the extensive datasets available through the Salus Global Corporation provided a unique opportunity to study safety culture from the perspective of a specific intervention on a longitudinal basis. This study was quasi-experimental because the human subjects participating in the safety climate survey, the MORE^{OB} intervention, and the knowledge exam were not selected randomly—they represented a convenience sample of those who volunteered for the intervention and associated surveys and outcome measures (cf. Reichardt & Mark, 1997). From an analytical perspective, this research employed qualitative techniques to explore the research questions and quantitative techniques to test the hypotheses. Results from both methods were triangulated using a convergence model. Thus, this study used a mixed-methods approach.

Figure 9 has been adapted from Creswell and Clark's (2007) convergence model. In accordance with this model, quantitative and qualitative data collection and analysis may proceed along parallel paths, producing their independent results (the row of red boxes and the row of blue boxes). In order to maximize the benefits of the two types of datasets and the associated methodologies, the convergence approach uses a comparison-and-contrast step, which involves identification of unique, complementary, or conflicting learning arising out of the two analyses. Finally, in the interpretation phase, the researcher must present the holistic learning arising out of the two analyses.

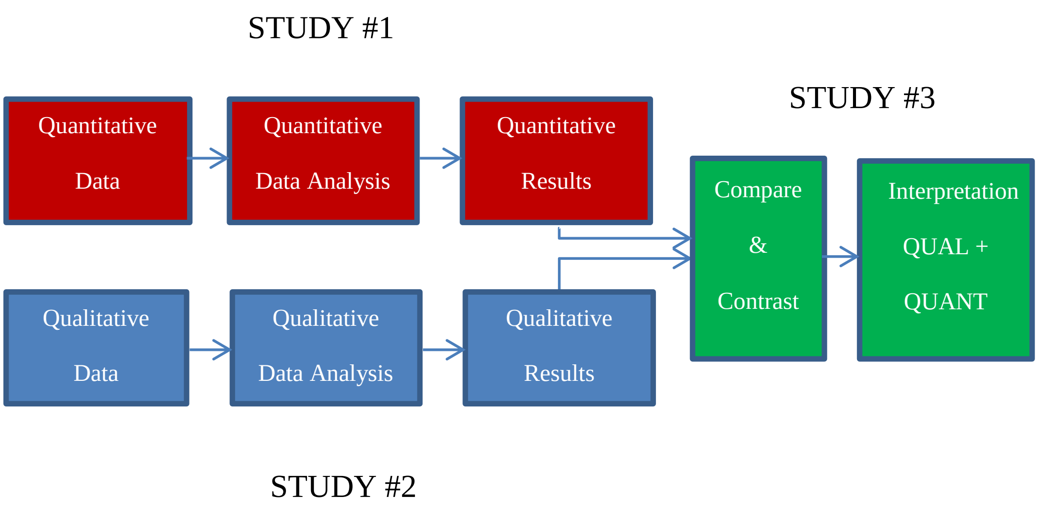


Figure 9: Creswell's convergence model for mixed-methods research

In accordance with Creswell's convergence model for mixed-methods research, this study was divided into three studies. The MORE^{OB} program, as an intervention strategy, served as the independent variable or treatment across all three studies. Study #1 was a quantitative study of the impact of the MORE^{OB} program on (a) knowledge, (b) clinical outcomes, and (c) patient safety climate. This study tested the two hypotheses: impact of training on group-level outcomes (H_1) and impact of training on group-level patient safety climate (H_2). Study #2 was a qualitative study of (a) environmental factors, (b) role of leaders and key influencers, (c) role of shared experiences, and (d) the role of feedback mechanisms in reinforcing or revising organizational values. This study developed a richer understanding of the impact of the MORE^{OB} program on the patient safety culture of a narrow sample of obstetric units. It addressed four research questions. Finally, Study # 3 followed the integrated model of culture and climate to compare and contrast the analyses of qualitative and quantitative data in accordance with the theoretical model and in the context of two subject hospitals. This study responded to the final research question (RQ_5).

3.2 Description of the Study Sample

The unit of analysis in this study was the obstetrics team. Since organizational climate and culture are experienced and lived at a group-level rather than an individual-level, the smallest measurable unit for organizational climate and culture within obstetrics is the multidisciplinary obstetrics team. Thus, consistent with the recommendations in the literature (Bhattacherjee, 2012; Ehrhart et al., 2014; Schneider & Barbera, 2014b; Waterson, 2014), the researcher believes that culture, as a group-level construct, should be studied and reported as such, and not at the individual or at the institutional level (higher than group level).

This study was based on data from 68 hospitals (represented by one obstetric team per hospital) in Ontario, Canada, out of 103 hospitals that provide birthing facilities. Of these 68 facilities, 39 are considered "early adopters" because they implemented their training program between 2006 and 2008, and the remaining 29 facilities are considered "late adopters" because they implemented their training program between 2009 and 2011. The early adopter group of hospitals served as the experimental group and the late adopters served as the control group when comparing the effects of the MORE^{OB} program on clinical outcomes.

A typical obstetrics team in Canadian hospitals consists of obstetricians (10%), family physicians (9%), nurses (70%), and midwives (11%). In some cases, the obstetrics team may include residents and administrators of the obstetrics program. The average total size of an obstetrics team per hospital is 70. This team forms the unit of analysis for all the studies. Thus, any assertions made about the safety culture are limited to the obstetrics team at the hospital and not generalized to the broader enterprise. Since not all team members participated in every study, the specific number of participants in each study varies; a description of sample participating in each study is presented in the corresponding section.

3.3 Description of the Training Intervention

The MORE^{OB} training, as a planned intervention, was implemented in three modules: Learning Together (Module 1), Working Together (Module 2), and Changing the Safety Culture (Module 3). Table 8 presents the key steps involved prior to each module, during the module, and after the module. Table 9 presents the measurement timeline for the patient safety climate survey measurement, knowledge exam administration, training module administration, and interview and artifact data collection. Clinical outcomes data were available from three to five years before the start of the MORE^{OB} training, during the training, and up to five years after the training. The topical content of the training modules matched the 16 competencies developed by a group of subject matter experts. A list of these competencies is presented in Section 4.2.1 (p.137). As the participants progressed from Module 1 to Module 2, the emphasis shifted from acquiring foundational knowledge to learning to work together in real-world setting through drills and emergency exercises; and in Module 3, the emphasis was on proactively identifying and changing individual and team behaviors, as well as past practices and policies to be consistent with those expected from high-reliability organizations (e.g., hierarchy is flattened in an emergency situation).

Table 9: Key steps before, during, and after the training intervention for each module

Pre-Training
Hospital appoints a multidisciplinary Core Team consisting of physicians, nurses, and administrators to manage the overall implementation of the MORE^{OB} program
Consulting Company assigns a dedicated Program Consultant to work with the Hospital Core Team
Core Team receives a Program Manual and access to the online platform which has all the clinical and non-clinical content, workshop materials, and materials to conduct group activities including skills drills and emergency drills
Core Team conducts an environmental scan of clinical outcomes and other concurrent initiatives in session
Pre-Module Climate Survey (For Module 1)
Pre-Module Knowledge Exam (For Module 1)
Selection of Emphasis Areas for Training, Workshops, Skills Drills, and Emergency Drills based on team-level weaknesses identified in the Knowledge Exam
Program Consultant trained the Core Team using the “Train the Trainer” model
During Training
Program Consultant worked with the Core Team to provide technical support, monitor overall progress, and address emerging issues
The Hospital Core Team was responsible for conducting the training—multidisciplinary local trainers trained multidisciplinary teams.
Post Training
Post Module Climate Survey (For All Modules)
Post Module Knowledge Exam (For All Modules)
Review of Clinical Outcomes, Climate Survey, and Knowledge Exam with the Core Team and Hospital Management

Table 10: Training and data collection timeline

Year 1	Year 2	Year 3	Interviews and Artifact Collection
Pre-Module 1 Climate Survey Pre-Module 1 Knowledge Exam			All interviews and artifact collections were conducted in 2016
Module 1 **(8-12 months)**	**Module 2** **(8-12 months)**	**Module 3** **(8-12 months)**	
Early Adopters: 2006	Early Adopters: 2007	Early Adopters: 2008	
Late Adopters: 2009	Late Adopters: 2010	Late Adopters: 2011	
Post-Module 1 Climate Survey	Post-Module 2 Climate Survey	Post-Module 2 Climate Survey	
Post-Module 1 Knowledge Exam	Post-Module 2 Knowledge Exam	Post-Module 2 Knowledge Exam	
Post-Module 1 Clinical Outcomes Data	Post-Module 2 Clinical Outcomes Data	Post-Module 3 Clinical Outcomes Data	

3.4 Measures Used in the Study

This section presents an overview of the measures used across the three studies. Study #1 has three sections: (a) knowledge exam analysis, (b) clinical outcomes analysis, and (c) patient safety climate analysis. The knowledge exam analysis was used to determine the knowledge gained about clinical topic areas (listed in Section 4.2.1, p.137) and about how to work in multidisciplinary teams that was gained through the MORE^{OB} program. Since exam scores were not available at question level, it was not possible to provide Chronbach's alpha for the exam; however, the Kuder-Richardson formula 21 (KR-21) was used to determine the reliability of the exam and then the scores were categorized by the exam topics (e.g, communication, postpartum hemorrhage, management of labor, etc.). Next, in the clinical outcomes analysis, outcome data were categorized in terms of dichotomous values on whether a particular condition exists (e.g., Cesarean section birth) and the frequency of these conditions existing over a period of time before and after the MORE^{OB} training program modules. Finally, patient safety climate analysis focused on the effects of the MORE^{OB} program on the safety climate at the participating obstetrics units. Since the survey instrument which was used to collect the safety climate data was not designed by the researcher and was not tested for psychometric properties, Exploratory Factor Analysis was conducted to discover the underlying pattern of connections between the responses to survey items. This discovery led to the development of a factor structure. This factor structure was then tested using Confirmatory Factor Analysis to determine its validity. The confirmed factor structure was used for the analysis of the effects of the MORE^{OB} training on patient safety climate in obstetrics.

Study #2 was a qualitative study. As such, it used semi-structured interviews and artifact analysis to identify key themes that could be used to explain how the organizational culture was created, maintained and changed at the subject organizations. Emphasis was placed on identifying and differentiating between espoused, attributed, shared, and aspired values, as well as the reinforcement and revision processes used to maintain/revise the organizational values. The role of formal leadership and key influencers at the group level and the effects of group-level performance outcomes were also explored.

Study #3 was a mixed-methods, longitudinal study of two subject hospitals. It leveraged the data and findings from the preceding two studies but focused on the two subject hospitals and their respective peer groups (Early Adopters or Late Adopters). The goal of this study was to respond to the fifth research question: How do inherent cultural elements influence the effectiveness of a planned culture-change intervention?

3.5 Study #1: Quantitative Analysis of the Impact of the MORE^{OB} Program on Knowledge, Clinical Outcomes, and Patient Safety Climate

3.5.1 Hypotheses and Measures

In Study #1, two hypotheses were tested.

H_1: The MORE^{OB} training, as a planned intervention, improves group-level outcomes.

Two performance measures were used to test this hypothesis: knowledge examination scores and clinical outcomes.

H_2: The MORE^{OB} training, as a planned intervention, improves group-level patient safety climate.

Safety climate survey scores were used to test this hypothesis.

3.5.2 The Knowledge Examination

The objective of the knowledge exam analysis was to determine the extent to which the MORE^{OB} program was effective in raising the knowledge level of participating clinicians. Traditionally, healthcare professionals have been trained in accordance with their respective professional discipline and tested for their individual knowledge and skill; yet, in practice, they have been expected to work together, across multiple disciplines and achieve the collective goal of health and safety of their patient. In the case of the MORE^{OB} program, the premise was that if the entire obstetrics team was trained together, with appropriate emphasis on discipline-specific knowledge and skills training, as well as mutual roles and responsibilities, they would have a stronger core knowledge base in the field of obstetrics, build respect for each other's professional competency, trust each other, and improve interpersonal communication (Milne et al., 2013). The MORE^{OB} knowledge assessment examination was developed by a diverse team of subject matter experts with due consideration to the core knowledge that each obstetrics team member should demonstrate. The assessment tool itself consisted of a criterion-referenced multiple-choice exam (75 questions), which was reviewed and updated periodically. Thus, although the competencies remained the same, the specific exam questions changed over time, thereby ensuring that any gains in scores were most likely to be due to knowledge gained from the MORE^{OB} program and subsequent implementation, rather than chance or memorization of answers from the preceding round of testing.

3.5.2.1 Description of the Sample and Analysis of the Exam

The Salus Global Corporation provided the researcher with exam scores associated with each administration of the knowledge examination for each participant in the MORE^{OB} program. The sample for this analysis consisted of participants from 68 hospitals (n=4,157). It was a representative sample of obstetricians, family physicians, nurses, and midwives.

A validity and reliability analysis of the exam was conducted. The validity analysis was based on the process used to construct the exam and its conformity with the learning outcomes of the course. Since item-level student performance scores were not available, Chronbach's Alpha could not be calculated. Thus, only Kuder-Richardson formula 21 (KR-21) was used to determine the reliability of this exam (Gay, 1996), which is a conservative estimate of reliability and is popularly used in educational testing.

$$r_{total\,test} = \frac{(K)(SD^2) - \bar{X}(K - \bar{X})}{(SD^2)(K-1)}$$

Where K= the number of items in the test
SD= the standard deviation of the scores
$\bar{X}$ = the mean of the scores

Generally, a reliability score of .90 is expected for established achievement tests; however, a score in the range of .70 to .80 is more common for classroom-based educational programs and associated tests.

In order to establish the content validity of the exam, the researcher reviewed the process used to construct the exam and compared its structural blueprint with learning outcomes of the MORE^{OB} program. Each exam question was analyzed (Item Analysis) to determine the difficulty level of each item, the discriminating power of the item, and the effectiveness of each alternative (McCowan & McCowan, 1999).

This analysis tested the overall reliability and validity of the knowledge exam before its scores were used to determine whether or not the MORE^{OB} training program was effective in improving the core knowledge.

3.5.2.2 Measure 1: Knowledge Exam Scores

In response to the MORE^{OB} training, the participants' clinical and non-clinical (about communication and teamwork) knowledge was expected to improve. Data were collected at the individual level and aggregated at the obstetrics group level. Changes in clinical and non-clinical knowledge levels of the group were tested using repeated measures ANOVA on the pretest/post-test scores on knowledge exams. Improvement in knowledge scores would mean that the MORE^{OB} training was effective in improving the clinical and team-performance knowledge of the participants. The context in which such knowledge was obtained forms a new shared experience and the knowledge gained serves as learning derived from this shared experience. Thus, per the integrated model of organizational culture and climate, there would be partial support for the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1). In order to fully support this hypothesis, the improvement in knowledge needs to transfer to an associated improvement in work performance outcomes (such as clinical outcomes).

3.5.3 The Clinical Outcomes

The objective of the clinical outcomes analysis was to determine the extent to which the MORE^{OB} program was effective in improving the clinical outcomes. The Canadian Institute for Health Information (CIHI) collects clinical outcomes data from all Canadian healthcare facilities. The Salus Global Corporation requested maternal and neonatal linked health records for all acute care separations where the patient presented for labor and delivery. CIHI provided these data on a secure platform for access and analysis only at the Salus Global facility in London, Ontario.

3.5.3.1 Description of the Sample

The sample for this analysis was divided into two groups: Experimental Groups (I & II) and Control Group. The Experimental Group I comprised of the 39 early adopting obstetrics groups and Experimental Group II comprised of 29 late adopting obstetrics groups, as described in Section 3.3. The Control Group comprised of all the other healthcare facilities in Ontario. Since there were 103 total obstetrics groups in Ontario, for Experimental Group I, the corresponding Control Group I consisted of 64 obstetrics groups and for Experimental Group II, the corresponding Control Group II consisted of the remaining 35 obstetrics groups.

Data from the Canadian Institute for Healthcare Information (CIHI) were used for the analysis of clinical outcomes. CIHI uses ICD-10-CA (CIHI, 2009b) as the coding scheme for diagnosis and CCI (CIHI, 2012) as the coding scheme for interventions. Since case-level linked data were made available, it was possible to consider each maternal case and its linked neonatal case and decode the associated diagnosis and intervention. For example, if a woman was admitted for pre-term labor and she delivered a set of twins with low birth weights, and suffered postpartum hemorrhage, stayed in the hospital for five days and the babies stayed in the hospital for two weeks, it was possible to decipher all this information from the dataset. It is important to note that although the maternal and neonatal cases were linked, there were no names or other identifiable information associated with these cases. Also, in accordance with Salus Global's agreement with CIHI, the researcher had signed a non-disclosure agreement with the Salus Global Corporation.

3.5.3.2 Analysis of the Clinical Outcomes

The maternal clinical outcome variables of interest were as follows:

1. Caesarean Section,
2. Postpartum Hemorrhage,
3. Shoulder Dystocia, and
4. Length of Stay.

The data for both experimental groups (those participating in the MORE^{OB} program) and the control group (all other facilities) were mapped against the MORE^{OB} training dates and analyzed to determine if the difference in the clinical outcomes achieved by the experimental groups versus the control group was significant. Also, the longitudinal trend of the clinical outcomes was mapped to determine whether the clinical impact of the MORE^{OB} program was significant.

3.5.3.3 Measure 2: Clinical Outcomes

Since the MORE^{OB} program was aimed at reducing undesirable clinical outcomes, it was logical to expect a decline in such outcomes after the MORE^{OB} training. If the clinical outcomes of the obstetrics units improved after the MORE^{OB} training, it would mean that the MORE^{OB} training was effective in improving the clinical performance outcomes at the participating obstetric units. An improvement in these outcomes would support the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1).

3.5.4 The Patient Safety Climate Assessment

The objective of the patient safety climate analysis was to test the second hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level patient safety climate (H_2). Before this objective could be addressed, it was essential to analyze the safety climate survey instrument. This instrument was developed by the Salus Global Corporation and administered prior to the initiation of the MORE^{OB} program as well as after each of the three modules. It consisted of 54 items that were rated on a Likert-type scale of 1-5 (strongly disagree, disagree, neutral, agree, and strongly agree). The goal of this instrument was to determine the effectiveness of the MORE^{OB} training program in changing the safety climate at hospitals participating in the MORE^{OB} program. The survey instrument is provided in Appendix B.

The underlying model of safety climate survey was derived from High Reliability Organizations and Communities of Practice literature (Thanh et al., 2010). The survey instrument corresponded with the instructional goals of the MORE^{OB} program and included six dimensions:

1. Patient Safety is Everyone's Priority
2. Teamwork
3. Valuing Individuals
4. Open Communication
5. Learning
6. Empowering People

The MORE^{OB} program required that each implementing hospital form a multidisciplinary core team, including senior management and clinical practitioners, who signed a commitment agreement to implement the MORE^{OB} program. Such a commitment most likely included assignment of the necessary organizational resources to ensure that all members of the obstetrics unit were available for training and any barriers to their training or practices resulting from their training were at least addressed if not removed. The majority of the cost of training itself, however, was provided by an external entity—either the insurance provider or the provincial Ministry of Health. The goal of the MORE^{OB} program was "to change the culture of blame to a focused and sustained patient safety culture, where patient safety is everyone's responsibility, with observed reductions in events and improved quality of care" (Milne & Lalonde, 2007) p.565). Thus, the MORE^{OB} program placed a clear overall emphasis on safety.

3.5.4.1 Description of the Sample

The MORE^{OB} Safety Climate Assessment Survey was administered by the Salus Global Corporation at 68 obstetrics groups across Ontario between 2006 and

2011, both pre- and post-MORE^{OB} training. On an average, each obstetrics group consisted of 70 personnel (49 nurses, 7 obstetricians, 6 family physicians, and 8 midwives). Although the actual number of members attending any particular delivery ranged from 5-7, since the entire pool of 70 personnel underwent the MORE^{OB} training together and there was considerable shift-based rotation in allocation of a specific member to a specific delivery, the entire group of 70 personnel was considered a *functional unit* of measurement for safety culture assessment. Rousseau (1990) emphasized the importance of choice of the "unit of measurement" and cautioned against generalizing the conclusions beyond the unit of measurement. According to Schein (1988), "culture is the organization's response to the problems that it has confronted" (p.5). Schein's definition of culture involves contributory relationships: common experiences of a group lead to a shared view of the world by that group, which in turn leads to shared methods of problem solving, and repeated success of certain methods results in basic assumptions about the world in which this group operates. Since the MORE^{OB} training, operational challenges, and the routine practice of newly acquired knowledge and skills take place as a shared experience within various combination of personnel involving the obstetrics team, it makes sense to define and measure culture at this level.

In accordance with the approach used by Singer et al. (Singer et al., 2007) to validate Patient Safety Climate in Healthcare Organizations Survey, the MORE^{OB} Safety Climate Survey data were sorted as follows:

- Group 1A (50 Percent Random Sample of the Early Adopters): Includes 39 obstetrics groups that underwent the MORE^{OB} training between 2006 and 2008. A 50 percent random sample of all the pre-training responses from the total Group 1 respondents (n=2,198) formed the derivation sample.

- Group 1B (50 Percent Random Sample of the Early Adopters): Includes 39 obstetrics groups that underwent the MORE^{OB} training between 2006 and 2008. A 50 percent random sample of all the pre-training responses from the total Group 1 respondents (n=2,198) formed the validation sample.
- Group 1C (50 Percent Random Sample of Early Adopters): Includes 39 obstetrics groups that underwent the MORE^{OB} training between 2006 and 2008.This third 50 percent random sample of all the pre-training responses from the total Group 1 respondents (n=2,198) formed confirmation sample (used in Confirmatory Factory Analysis).

3.5.4.2 Factor Analysis

An Exploratory Factor Analysis (EFA) was conducted on all the pre-training responses in the derivation sample (from Group 1) with extraction of factors using Principal Axis Factoring, followed by Direct Oblimin Rotation with Kaiser Normalization, to identify a simplistic structure of relatively independent groups of items (factors) as suggested by Tabachnick and Fidell (2012). The factor groupings were verified by referencing the inflection points on the Scree plot.

Next, the EFA results were compared with the intended six dimensions of the Safety Climate Assessment Survey:

1. Patient safety is everyone's priority
2. Teamwork
3. Valuing individuals

4. Open communication
5. Learning
6. Empowering people

A Multi-Trait Analysis (MTA) was conducted on all the responses in the validation sample (from Group 1B). Item-to-scale correlations were examined to determine the extent to which the item measured the hypothesized dimension or factor of safety climate rather than any other dimension. For construct validity to be high, the item-to-scale correlation should be above .40 (Tabachnick & Fidell, 2012). Together, EFA and MTA tested for the reliability and validity of the survey instrument.

The emergent model of safety climate was compared with Singer et al’s (2007) nine-dimensional model: three organization-level factors, two unit-level factors, three individual-level factors, and one additional factor.

Finally, another sample of survey responses (Group 1C) was used to conduct a Confirmatory Factor Analysis on the factors previously identified and validated by MTA. The results of MTA were presented as a hypothetical factor structure for patient safety climate in obstetrics. In accordance with contemporary recommendations for the assessment of model fit (Hu & Bentler, 1999; Tabachnick & Fidell, 2012) the following criteria were used:

- $\chi^2/df < 5.00$ is acceptable; <3.00 is good (Kline, 1998)
- NFI > .90 is good (Bentler & Bonett, 1980)
- CFI > .90 is acceptable; >.95 is good (Bentler, 1990)
- TLI > .90 is acceptable; >.95 is good (Hu & Bentler, 1999)
- RMSEA < .10 is acceptable; <.06 is good (Hu & Bentler, 1999)

The resultant, well-supported, factor structure was used to test the impact of MORE^{OB} training on safety climate.

3.5.4.3 Impact of the MORE^{OB} Training on Safety Climate

An assessment of changes in safety climate pre-/post-MORE^{OB} training was conducted at the obstetrics group level at each healthcare facility to identify statistically significant differences in the safety climate that may be attributed to the MORE^{OB} training.

3.5.4.4 Measure

Patient safety climate scores served as the measure for the second hypothesis.

H_2: The MORE^{OB} training, as a planned intervention, improves group-level patient safety climate.

This hypothesis was tested using a Latent Growth Modeling (LGM) framework, which allowed for assessment of change over periodic treatments along a longitudinal timeline (Duncan & Ducan, 2009). Pre-training, post-Module 1, post-Module 2, and post-Module 3 formed the four measurements used to determine both the *amount* of change and the *shape* of change. An improvement in patient safety climate scores would mean that the MORE^{OB} training was effective in improving the safety climate at the participating obstetric units, supporting the second hypothesis, as stated above. An improvement in patient safety climate signals an improvement in the participants' attitudes toward the underlying culture. Climate scores alone are not capable of identifying all the underlying cultural changes, but they would be indicative of potential cultural shifts.

3.6 Study #2: Qualitative Analysis of Environmental Factors, Leadership, Shared Experiences, and Feedback Mechanisms

Study #2 was a qualitative study and addressed four research questions:

RQ_1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

RQ_2: How did leaders and influencers shape shared organizational values at the subject organizations?

RQ_3: How did shared experiences, through implementation mechanisms, help revise and reinforce organizational values at the subject organizations?

RQ_4: How did feedback from group-level performance influence learning derived from shared experiences at the subject organizations?

This study developed a richer understanding of the key cultural elements within the narrow sample of obstetric units at two subject hospitals.

The researcher conducted interviews with key informants from a convenience sample of two hospitals with comparable attributes like level of care, number of births per year, and availability of key informants for the interviews. With the average functional unit size of 70 and two facilities, as many as 140 interview candidates were identified; however, it was not practically feasible to conduct as many individual interviews. Therefore, a combination of individual and team interviews was used. Forty-one individuals, representing senior management, obstetricians, nurses, and midwives, from two hospitals participated in the interviews.

3.6.1 The Interview Instrument

A semi-structured interview approach was used to collect narrative data regarding the experience prior to implementing the MORE^{OB} program, during the implementation, and post-implementation. The general themes explored during these interviews included the following (the interview schedule, with specific questions, is included in Appendix A):

1. Rationale for the choice of the MORE^{OB} program as a strategic intervention—consider environmental factors, compatibility with existing organizational values and goals of the MORE^{OB} program, and specific desired clinical or financial outcomes;
2. The role of leaders and key influencers in facilitating the adoption of new practices in response to the MORE^{OB} program, challenges in implementing the program, and use of feedback mechanisms to sustain the momentum of change; and
3. Evidence of institutionalization in terms of artifacts, stories, awards, and general recognition of best practices and heroes, as well as transfer of best practices beyond obstetrics.

Follow-up questions varied slightly, depending on the candidates. For example, some nurses commented on examples of how their practice had changed. Senior management, on the other hand, commented on broad changes in the healthcare sector and how such changes influenced changes in practice. In response, they were asked to give specific examples. The narratives generated from these interviews were first assigned attributes such as participant type (e.g., nurse, physician, senior manager, etc.) as well as employer (e.g., hospital A or hospital

B). Next, the content was coded at three levels: (a) as individual-level answers to specific questions from the interview instrument; (b) as common themes emerging across all the answers, (c) whether they were related to specific cultural elements (e.g., values, leadership, implementation mechanism, etc.), and (d) in accordance with the five research questions. These narratives were also used to identify underlying assumptions, shared values, and key shared experiences (defining moments).

3.6.2 Artifact Analysis

Artifacts are symbolic representations of culture (Rousseau, 1990). They are unique to each functional unit and they represent that unit's values. Some examples of such artifacts include mission and vision statements, goals and priorities, logos, awards, commonly told stories, and local heroes and legends.

In addition to the on-site interviews at the two healthcare facilities, as described in Section 3.6.1, the researcher collected examples of the following artifacts:

1. Mission/Vision Statement
2. Goals and Priorities
3. Annual Reports
4. Strategic Plan
5. Awards/Recognition
6. Notes from Field Visit

A content analysis of these items, together with the themes extracted from the interviews, served as manifestation of enacted values and unquestioned assumptions. Overall, the above types of artifacts served as tangible evidence of institutionalization of organizational culture.

3.7 Study #3: Integration of Quantitative and Qualitative Studies.

The objective of this study was to integrate the data and findings from the preceding studies, in the context of longitudinal assessments of two subject hospitals, and develop a comprehensive response to the integrated model of culture and climate. Both qualitative and quantitative methods were inadequate on their own in fully describing or analyzing culture and hence a mixed-methods approach was used to leverage the benefits of each and produce a more meaningful and substantive analysis (cf. Rousseau, 1990). Generally, a mixed-methods approach in research design refers to all procedures involved in collecting and analyzing research data in the context of a single research project (Creswell & Clark, 2007; Currall, Helland Hammer, Baggett, & Doniger, 1999; Driscoll et al., 2007). In the case of this study, the quantitative data were collected independently and at different times; however, the MORE^{OB} program served as the common shared experience and enabled temporal anchoring of the data to investigate the influence of various factors on each other.

3.7.1 Quantitative Data

The quantitative data collected in the context of this research project included the following:

1. MORE^{OB} Knowledge Exam Data
2. CIHI Clinical Outcomes Data
3. Patient Safety Climate Survey Data

While these three types of quantitative data could not be linked at the individual level, the functional unit (the unit of analysis) contributing to the three datasets were known to be the same. Thus, at the functional unit level, two hospitals were selected for focused, longitudinal reviews.

3.7.2 Qualitative Data

Qualitative data collected included the following:

1. Interview Data
2. Artifact Data

Both these types of data were collected from three healthcare facilities, as described in Section 3.6.2. These data were coded using QSR NVivo 10.0, a qualitative data coding software, so that the themes emerging from the qualitative data could be analyzed (cf. Driscoll et al., 2007).

3.7.3 Anchoring Scheme

The quantitative and qualitative data were collected in different timeframes and by different entities; thus, the researcher had to develop an anchoring scheme to enable effective merging of the datasets. It was possible to link the quantitative datasets based on a timeline starting with one year prior to the beginning of the first module of the MORE^{OB} training at one of the 39 early-adopter facilities and continuing on through three years after the completion of the last MORE^{OB} module at the last of the 39 early-adopter facilities. With this approach, pre- and post-training data were analyzed to determine the degree to which the MORE^{OB} training could have influenced the safety climate and clinical outcomes.

3.7.4 Test of the Integrated Model of Culture and Climate

The emergent model, as presented in this study, integrated the constructs of organizational culture and climate. Culture, as a group-level construct, is a shared set of values that manifest themselves in distinctive artifacts and behaviors of that group, giving that group a specific identity. At the heart of a group's culture are its values, which are reinforced or revised through shared experiences of its members. While reinforcement of the group's values takes place on a routine basis, revision takes place under extraordinary circumstances such as internal or external threats to its survival or well-being. Values lead to implementation mechanisms like strategies, policies, procedures, and practices. Leaders and key influencers impact how values are reinforced through the various implementation mechanisms. Group performance includes individual and group behaviors that influence performance on focused metrics like safety, innovation, and quality. Climate, as a psychological response, includes perceptions by members of the group with respect to how individual, group, and firm-level outcomes are treated—what is deemed important and what underlying behaviors are rewarded. Finally, a transformational change can be claimed when there has been a "value-level" impact.

In order to validate the above model, this section considered the MORE^{OB} program as an independent variable and knowledge, clinical outcomes, and patient safety climate as dependent variables. Since all the hospitals in this study were located in the same province, they were all assumed to be subjected to the same four environmental factors. However, it was noted in Study #2 that Hospital A was particularly impacted by a sudden growth in population and ethnic diversity—this was noted as a defining moment or a systemic shock. Similarly, Hospital B was impacted by the appointment of the external supervisor, another example of a defining moment. Thus, it was reasonable to expect that the organizational cultures at these two hospitals would be different from those at other hospitals in their respective peer groups. Therefore, these two hospitals were selected for longitudinal analysis to determine how prior shared experiences, shared values and assumptions, leaders and key influencers, implementation mechanisms, and post-intervention experiences and performance outcomes might have influenced the effectiveness of the MORE^{OB} training, as a planned intervention, on their respective organizational culture and climate. Analysis of artifacts was expected to be representative of the extant cultural attributes and the evolutionary path taken by the organization. The theoretical influence trajectory was postulated to be as follows:

> Shared Experiences →Defining Moment→Values and Assumptions, as well as Leadership→Implementation Mechanisms→New Shared Experience→New Individual Behaviors→New Performance Outcomes→Feedback Mechanisms →New Shared Experience→Revision of Values and Assumptions.

This study discussed findings related to all five research questions and two hypotheses, but the findings were in the limited context of the two subject hospitals. In particular, this study focused on the fifth research question because it was not addressed in the preceding two studies.

RQ_5: How do inherent cultural elements influence the effectiveness of planned culture-change interventions?

3.8 Ethical Considerations

The researcher was a nine-month, fulltime tenured faculty member of Saint Louis University. Part of his employment expectations included research; therefore, there was no conflict of interest in the researcher pursuing this project concurrent with his employment, especially on a part-time basis from a distance. In fact, the University of Sheffield's research degree structure (part-time, remote location) was particularly suitable for this project. The researcher committed to spending 20 per cent of his time during the academic year and 100 per cent of his time during the summer and winter breaks (off-contract periods) to concurrently fulfill all the necessary obligations toward his employer and toward the research Ph.D. program at the University of Sheffield.

3.8.1 The Salus Global Corporation Fellowship

The researcher was a U.S. citizen conducting research on Canadian data, and pursuing doctoral degree from the United Kingdom. This was a unique, international research partnership. In order to facilitate the research while respecting Canada's Export Control laws, the Salus Global Corporation served as the agent between the researcher and Canadian agencies. Also, Salus Global provided a Visiting Research Fellowship to the researcher. In order to manage the conflict of interest arising out of such funding, the researcher exercised a three-level conflict management plan: one, the funding for this fellowship was *not* contingent upon any specific research outcomes; two, the Salus Global Fellowship stipend was restricted to less than 25 per cent of the total cost of the research so that Salus Global was not the majority stakeholder in the outcomes of this research; and three, the University of Sheffield, which had no financial interest in the Salus Global Corporation, retained full supervisory and approval authority for the project.

3.8.2 Access to Archival Data

The Salus Global Corporation provided access to the following three sets of archival data:

1. MORE^{OB} Knowledge Exam Scores
2. Patient Safety Climate Survey Data
3. CIHI Clinical Outcomes Data

The first two sets of data were collected by Salus Global and were proprietary; however, the researcher was granted full access to these data through a non-disclosure agreement. The researcher had no reason to believe that these data may not be genuine and therefore assumed to be truthful and provided in good faith. The clinical outcomes dataset had been collected by Canadian Institute for Health Information (CIHI) directly from the individual healthcare facilities and provided to Salus Global. However, given the fact that the dataset contained some institution-level identifying information, the researcher signed a non-disclosure agreement with Salus Global that enabled him to access the data, de-identify it, and run the necessary statistical analyses.

3.8.3 CIHI Protocol

The Canadian Institute for Health Information (CIHI) provided Salus Global with maternal and neonatal health abstracts from all healthcare facilities in Ontario for fiscal years 2001 through 2011. Salus Global made these abstracts available to the researcher, but the data did not leave the Salus Global property. Therefore, the researcher installed a separate computer (non-networked) on Salus Global's property so that the CIHI data in both SAS and Excel formats could be loaded on this separate computer. This computer remained within full control of Salus Global until the end of this project; thereafter, its hard-drive was reformatted and it was returned to the researcher.

3.8.4 Protection of Human Subjects

Prior to beginning Study #2, which involved interviews and artifact collection, it was necessary to secure appropriate Human Subjects approval. A proposal for Human Subjects study was developed, which was subsequently approved by the University of Sheffield. In accordance with the protocol, an approved informed consent form was used to secure every participant's consent prior to enrolling them in the study. In order to minimize the risk of breach of confidentiality for the participants, the researchers did not use any identifying information on the interview transcripts. The participating subjects were made aware of this risk and only those volunteering to continue with the interview were included in the study. Every reasonable precaution was taken to secure confidential data.

The CEOs of all 68 hospitals with MORE^{OB} programs were invited to participate in interviews of themselves as well as members familiar with the implementation of the MORE^{OB} program (specifically, the obstetrics team). Each prospective participant was made aware of the purpose of the research, the benefits and risks associated with participating and not participating, confidentiality of their identity and affiliation, and their right to terminate the interviews at any time. This project received Ethics Approval on June 1, 2015. The Approval Letter, Research Information Sheet, and the Consent Form are attached in Appendix A.

Chapter 4: Results of Study #1

4.1 Introduction

Overall, five research questions and two hypotheses were addressed across three studies. Appropriate quantitative and qualitative analysis techniques were used to test the hypotheses and respond to the research questions. Study #1 was a quantitative study of knowledge exams, clinical performance improvements, and safety climate outcomes. This study addressed the following two hypotheses:

H_1: The MORE^{OB} training, as a planned intervention, improves group-level performance.

H_2: The MORE^{OB} training, as a planned intervention, improves organizational climate.

The first hypothesis was tested with two measures: knowledge examination scores and clinical outcomes. Knowledge examinations were administered by the Salus Global Corporation prior to the first MORE^{OB} training module and at the end of each subsequent module. Data from three modules were used in the analysis. Since the exams were developed by Salus Global and results of reliability and validity analysis were not available, this study started with a validity analysis of the examination and proceeded with item analysis as well as reliability analysis. Once the reliability and validity of the examinations were established, participant scores before and after the MORE^{OB} training modules were compared between two groups of hospitals (Early Adopters and Late Adopters, as described in Section 3.2). Results of these analyses are reported in the Section 4.2.1.

Next, four clinical outcomes were analyzed: (a) Cesarean section rates, (b) postpartum hemorrhage rates, (c) handling of shoulder dystocia, and (d) overall length of stay. The rationale for choosing these outcomes is discussed later in this chapter. The original data were provided by the Canadian Institute for Healthcare Information (CIHI) to the Salus Global Corporation. The researcher accessed these data under the terms of the agreement between CIHI and Salus Global. In addition to the obstetrics groups classified as Early Adopters or Late Adopters, a third group of obstetrics groups —Non-Adopters—was also included in the analysis. The Non-Adopters consisted of obstetrics groups that had not adopted the MORE^{OB} program. Thus, the total sample consisted of data from 103 obstetrics groups across Ontario (35 Non-Adopters, 39 Early Adopters, and 29 Late Adopters). Results of these analyses are reported in Section 4.2.2.

The second hypothesis was tested using a validated multi-factor safety climate structure. The exploratory factor analysis process followed by confirmatory factor analysis processed used to test the psychometric properties of the survey instrument resulted in six factors: (a) Patient safety is everyone's priority; (b) Learning, (c) Valuing individuals, (d) Empowering people, (e) Open communication, and (f) Teamwork. Results of these analyses are reported in Section 4.2.3.

4.2 Results of Study #1: Quantitative Analysis

4.2.1 MORE^{OB} Knowledge Examination Data Analysis

4.2.1.1 Validity Analysis

The Salus Global Corporation followed a DACUM-like process (Norton, 1997), which started with the identification of key tasks performed by the obstetrics team and followed by the identification of the underpinning knowledge required to perform those tasks. This approach is different from the traditional DACUM process, which focuses on tasks performed by an individual because the process is intended to produce certification criteria for the individual. Nonetheless, the process could be used to develop team-level knowledge requirements. The following sixteen competencies were identified by a group of subject matter experts:

1. Communication (Interpersonal)
2. Patient Safety (As a philosophical and practical priority)
3. Management of Labor
4. Induction of Labor
5. Assisted Vaginal and Breech Births
6. Hypertensive Disorders in Pregnancy
7. Antepartum and Intrapartum Hemorrhage
8. Postpartum Hemorrhage
9. Preterm Labor and Birth
10. Prelabor Rupture of Membranes
11. Fetal Well-being
12. Vaginal Birth After Cesarean Section

13. Group II Streptococcus Infection
14. Deep Vein Thrombosis
15. Twins
16. Shoulder Dystocia and Cord Prolapse

Subject Matter Experts (SMEs) developed learning objectives for each knowledge domain to be taught and tested, a separate Obstetrical Care Review Committee reviewed all relevant literature to ensure that the core content was current and supported the prevailing best practices. Then, a modular curriculum was developed to progressively address both knowledge and skill aspects of the above sixteen areas of competencies. There were three training modules, each approximately 8-12 months in length: Learning Together, Working Together, and Changing the Safety Culture. All three modules covered the same sixteen topics (listed above), but the pedagogy transitioned from purely didactic to clinical. Each module started with an overview of subject matter to be covered and the expected student learning outcomes. In the first module, the emphasis was on acquiring clinical knowledge. The second module started by reinforcing previously learned clinical knowledge and emphasized the application of that knowledge while working as an obstetrics team. The third module reinforced both didactic and clinical aspects of previously acquired knowledge and emphasized the roles and responsibility that each member of the obstetrics team has in influencing the culture of their unit. As the modules progressed from didactic to clinical setting, they incorporated high-reliability concepts like interpersonal communication, teamwork, and prioritization of patient safety. (Milne et al., 2013).

Another group of SMEs, who were specialists in writing exam questions, developed a bank of over 400 multiple choice questions to match with each learning objective. These questions were aimed at criterion-referenced testing, meaning each candidate had to demonstrate a certain level of proficiency or pass rate rather than a norm-based testing wherein the score required for a particular candidate to pass the exam is relative to the scores attained by a group of candidates taking the exam. Further, each question was structured with its stem as a vignette and three answer options. The correct answer was marked in the master document and content from the corresponding learning module was linked with the answer. Also, each question was evaluated for importance of the knowledge (KI) and cognitive level (CL) in accordance with the Bloom's Taxonomy. Table 11 presents the categories and explanations associated with each cognitive level.

The SMEs evaluating the exam for content validity included members consistent with the intended audience of the training and testing: an obstetrician, a family physician, a registered nurse, and a registered midwife. The role of the SMEs was to regularly review the exam questions, establish cut-off scores using an Angoff evaluation approach (Shrock & Coscarelli, 2007). Additionally, the SMEs assigned a difficulty index (a rating on a five-point scale that represents the estimate of difficulty) and knowledge importance index (a rating on a five-point scale that represents the level of criticality of the knowledge to practice) to each question. Questions that were too easy, or under a "3" on the difficulty index, were eliminated. Questions that received a score of "5" on the knowledge importance index were deemed "mandatory" or could not be substituted and had to be answered correctly because that knowledge was critical to practice; a score of "4" indicated that the knowledge was important but not critical; and a score of

“3” indicated that the knowledge was important. Questions that scored less than “3” were eliminated from the pool. Ultimately, the exam had 60 per cent of the questions at a cognitive level of “3” or “4” and 26 per cent of the questions were at a knowledge importance index of “5.” Exam covering the same topics was administered prior to starting Module 1 (to establish the baseline), and after each module.

Table 11: Cognitive levels and characteristics

Cognitive Level Number	Level of Sophistication	Cognitive Level Category	Characteristics of the Level
1	Lowest	Knowledge	Requires direct recall of fact, number or content exactly as it was presented
2	Intermediate	Comprehension	Requires understanding of a guideline or a formula, which are given in order to answer the question. May involve paraphrasing or giving an example (not previously used in teaching).
3	Higher	Application	Requires application of information. The principle or guideline which must be known to solve the problem is not provided.
4	Highest for Multiple-Choice Question	Analysis	Requires analysis and breaking apart of a problem. There may be extraneous or distracting information. More complex than straight application questions

Table 12 presents an exam blueprint with knowledge area, the corresponding number of questions assigned to the area, and their respective Knowledge Importance and Cognitive Levels (Walker, 2015).

Table 12: Typical exam blueprint

Knowledge Area	Number of Questions	Knowledge Importance (KI) Level			Cognitive Level (CL)		
		5	4	3	4	3	1 or 2
Communication	2		1	1		2	
Patient Safety	2	1	1			1	1
Management of Labor	5	1	2	2	1	3	1
Induction of Labor	5	2	1	2		3	2
Assisted Vaginal and Breach Births	8	3	2	3	2	2	4
Hypertensive Disorders in Pregnancy	5	2	1	2	3		2
Antepartum and Intrapartum Hemorrhage	5	2	2	1	2	2	1
Postpartum Hemorrhage	5	2	2	1	3	1	1
Preterm Labor and Birth	4	1	2	1		3	1
Prelabor Rupture of Membranes	2	1	1		1		1
Fetal Well-being	12	3	6	3	5	4	3
Vaginal Birth After Cesarean	3	1	1	1		1	2
Group II Streptococcus	5	1	2	2	1	3	1
Deep Vein Thrombosis	5	2	1	2	1	1	3
Twins	2		1	1			2
Shoulder Dystocia and Cord Prolapse	5	2	2	1	1	3	1
Total	75	24	28	23	20	29	26
			75			75	

Thus, a typical 75-question exam will consist of question distribution as follows: KI Level 5 (n=24), KI Level 4 (n=28), KI Level 3 (n=23); CL Level 4 (n=20), CL Level 3 (n=29), and CL Level 1 or 2 (n=26). Overall, the exam development process and the resultant structure is consistent with the guidelines of the Royal College of Physicians and Surgeons of Canada (Sherbino & Frank, 2011) and the U.S. National Board of Medical Examiners (NBME, 2002).

4.2.1.2 Item Analysis

The Salus Global Corporation provided all the examination data for this analysis. Over the 10-year implementation period, there were seven versions of the exam. Item analyses of the earliest available version (Version 6) and the latest available version (version 12) are reported. Table 13 presents the item analysis of Exam Version 6. The first column is the item (question number), next is the topic (e.g., APH refers to Antepartum Hemorrhage), and next are the four answer options (the correct option is underscored and the number in the each cell indicates percentage of respondents that chose that option). Under "Test Item Analysis," there are two columns: difficulty and discrimination. The difficulty index is essentially the percentage of the candidates who got that answer correct. Thus, the higher the difficulty index, the easier the question. The discrimination index is the difference between the percentage of high-scoring candidates who got this answer correct and the percentage of low-scoring candidates who got this answer correct. In this sample, the obstetricians scored higher than all other professional groups (which included nurses, midwives, general practitioners, other—anesthesiologists, residents, and administrators) and the "other" professionals scored the lowest. So, the discrimination index is the difference between the scores of the obstetricians and the others. This index is between -1 and +1; the higher the number, the greater the item discriminates between the high performer and the low performer. Thus, it is much more likely that the person who got question 3 in subject area AVB (assisted vaginal birth) correct, also earned a high overall score because the discrimination index is fairly high (.27). Overall, the average difficulty index is .75 (the test is moderately easy; *SD*=.17)) and the average discrimination index is .12 indicating that performance on a particular question is not a strong indicator of the overall performance. Also, 33 items have discrimination index under 0.10; these items could be strengthened in the future.

The subject area or topical abbreviations used in tables 12 and 13 are as follows:

1. APH: Antepartum Hemorrhage
2. AVB: Assisted Vaginal Birth
3. COMM: Communication
4. DVT: Deep Vein Thrombosis
5. FWB: Fetal Well-being
6. GBS: Group B Streptococcus
7. HDP: Hypertensive Disorders of Pregnancy
8. IOL: Induction of Labor
9. MOL: Management of Labor
10. PS: Patient Safety
11. PPH: Postpartum Hemorrhage
12. PLROM: Pre Labor Rupture of Membranes
13. PTL: Preterm Labor
14. TWINS: Twins
15. VBAC: Vaginal Birth After Cesarean Section

Shoulder dystocia was covered in multiple subject areas: AVB, IOL, MOL, TWINS, and VBAC.

Table 13: Item analysis of exam version 6

Item	Topic	A	B	C	D	Difficulty	Discrimination
		Answer Options				Test Item Analysis	
1V06	APH	0.34%	<u>0.39%</u>	0.00%	0.03%	0.00	0.00
2V06	APH	4.56%	0.08%	<u>94.82%</u>	0.54%	0.95	0.11
3V06	APH	0.08%	8.49%	4.77%	<u>86.66%</u>	0.87	0.18
4V06	APH	0.72%	<u>77.75%</u>	18.88%	2.7%	0.78	0.18
1V06	AVB	6.70%	<u>63.50%</u>	7.39%	22.40%	0.64	0.16
2V06	AVB	3.18%	1.21%	<u>93.92%</u>	1.69%	0.94	0.10
3V06	AVB	<u>51.84%</u>	39.76%	7.49%	0.92%	0.52	0.27
4V06	AVB	2.95%	1.15%	<u>92.15%</u>	3.75%	0.92	0.06
5V06	AVB	24.16%	4.85%	24.02%	<u>46.97%</u>	0.47	0.12
6V06	AVB	4.05%	3.98%	<u>78.73%</u>	13.24%	0.79	0.22
1V06	COMM	0.02%	0.00%	<u>0.48%</u>	0.28%	0.00	0.00
2V06	COMM	<u>77.79%</u>	15.96%	1.31%	4.93%	0.78	-0.04
3V06	COMM	1.62%	1.98%	<u>94.49%</u>	1.90%	0.94	-0.02
4V06	COMM	0.79%	0.03%	2.33%	<u>96.85%</u>	0.97	-0.01
1V06	DVT	7.88%	31.14%	2.28%	<u>58.70%</u>	0.59	0.15
2V06	DVT	4.82%	<u>49.21%</u>	29.32%	16.65%	0.49	0.18
3V06	DVT	<u>78.81%</u>	1.67%	3.54%	15.98%	0.79	-0.04
4V06	DVT	1.75%	5.64%	11.96%	<u>80.65%</u>	0.81	0.24
1V06	FWB	<u>64.00%</u>	4.38%	27.27%	4.36%	0.64	0.07
2V06	FWB	22.01%	5.92%	2.72%	<u>69.35%</u>	0.69	0.07
3V06	FWB	9.57%	<u>78.56%</u>	1.36%	10.50%	0.79	0.16
4V06	FWB	<u>78.15%</u>	0.34%	5.41%	16.09%	0.78	0.27
5V06	FWB	2.34%	7.77%	<u>85.25%</u>	4.64%	0.85	0.09
6V06	FWB	12.08%	4.00%	16.63%	<u>67.29%</u>	0.67	0.18
7V06	FWB	16.32%	<u>75.66%</u>	5.36%	2.65%	0.76	0.18
8V06	FWB	10.42%	<u>78.74%</u>	0.21%	10.62%	0.79	0.06
1V06	GBS	<u>67.30%</u>	3.44%	15.54%	13.68%	0.67	0.08
2V06	GBS	0.98%	1.11%	<u>93.28%</u>	4.62%	0.93	0.22
3V06	GBS	0.92%	2.88%	6.33%	<u>89.87%</u>	0.90	0.14
4V06	GBS	1.25%	6.10%	30.84%	<u>61.82%</u>	0.62	0.30
5V06	GBS	<u>89.40%</u>	2.95%	4.28%	3.38%	0.89	0.07
1V06	HDP	0.93%	5.82%	<u>71.01%</u>	22.24%	0.71	0.27
2V06	HDP	2.03%	<u>62.77%</u>	34.27%	0.93%	0.63	0.25
3V06	HDP	4.87%	<u>85.22%</u>	3.16%	6.75%	0.85	0.20
4V06	HDP	<u>61.80%</u>	21.68%	8.69%	7.83%	0.62	0.10
5V06	HDP	0.74%	<u>95.54%</u>	1.69%	2.03%	0.96	0.14
1V06	IOL	11.24%	<u>79.92%</u>	1.46%	7.37%	0.80	0.11
2V06	IOL	0.74%	1.92%	<u>75.70%</u>	21.65%	0.76	0.09
3V06	IOL	2.75%	0.97%	<u>80.97%</u>	15.31%	0.81	0.11
4V06	IOL	10.91%	1.29%	6.47%	<u>81.32%</u>	0.81	0.08
5V06	IOL	1.43%	<u>72.60%</u>	24.48%	1.49%	0.73	0.03
1V06	MOL	<u>98.44%</u>	0.54%	0.10%	0.92%	0.98	0.01
2V06	MOL	4.88%	30.50%	<u>56.82%</u>	7.80%	0.57	0.18

Table 13 (Continued): Item analysis of exam version 6

		Answer Options				Test Item Analysis	
Item	Topic	A	B	C	D	Difficulty	Discrimination
3V06	MOL	5.21%	72.04%	3.46%	19.29%	0.72	0.21
4V06	MOL	0.80%	18.63%	0.36%	80.20%	0.80	0.09
5V06	MOL	1.92%	2.20%	95.08%	0.80%	0.95	0.10
6V06	MOL	37.91%	42.69%	9.73%	9.67%	0.43	0.16
7V06	MOL	1.03%	23.37%	2.13%	73.47%	0.73	0.10
8V06	MOL	70.88%	25.58%	3.13%	0.41%	0.71	0.13
1V06	PS	1.05%	13.73%	11.27%	73.94%	0.74	0.04
2V06	PS	88.74%	0.29%	0.57%	10.65%	0.89	0.08
3V06	PS	78.70%	6.31%	8.05%	6.95%	0.79	0.01
4V06	PS	0.28%	0.16%	5.59%	93.97%	0.94	0.04
1V06	PPH	2.64%	16.18%	71.71%	9.47%	0.72	0.06
2V06	PPH	89.63%	5.74%	3.88%	0.75%	0.90	0.05
3V06	PPH	2.75%	0.29%	91.95%	5.00%	0.92	0.01
4V06	PPH	2.31%	10.24%	76.12%	11.32%	0.76	0.19
1V06	PLROM	3.79%	12.24%	73.17%	10.80%	0.73	0.23
2V06	PLROM	54.97%	25.27%	15.96%	3.80%	0.55	-0.14
3V06	PLROM	0.28%	91.97%	5.93%	1.82%	0.92	0.19
4V06	PLROM	0.82%	73.30%	7.90%	17.98%	0.73	-0.01
1V06	PTL	58.98%	9.24%	27.38%	4.39%	0.59	0.20
2V06	PTL	0.51%	95.41%	3.74%	0.34%	0.95	0.03
3V06	PTL	3.52%	85.22%	2.97%	8.29%	0.85	0.22
4V06	PTL	5.72%	10.95%	12.77%	70.57%	0.71	0.26
5V06	PTL	34.76%	1.67%	57.42%	6.15%	0.57	-0.08
1V06	TWINS	1.87%	83.63%	4.40%	10.06%	0.84	0.09
2V06	TWINS	0.26%	1.54%	1.52%	96.67%	0.97	0.06
3V06	TWINS	44.51%	14.67%	1.59%	39.23%	0.39	0.01
4V06	TWINS	6.85%	84.68%	3.38%	5.10%	0.85	0.00
5V06	TWINS	83.73%	9.11%	2.46%	4.70%	0.84	0.12
1V06	VBAC	1.90%	23.68%	70.47%	3.95%	0.70	0.09
2V06	VBAC	90.77%	1.49%	1.23%	6.51%	0.91	0.16
3V06	VBAC	74.73%	8.85%	5.69%	10.73%	0.75	0.21
4V06	VBAC	9.95%	7.37%	56.41%	26.27%	0.56	0.39

Table 14 presents the item analysis for exam version 12.

Table 14: Item analysis of exam version 12

		Answer Options			Test Item Analysis	
Item	TOPIC	A	B	C	Difficulty	Discrimination
1V12	APH	0.67%	<u>95.38%</u>	3.95%	0.95	0.16
2V12	APH	46.64%	0.51%	<u>52.86%</u>	0.53	0.19
3V12	APH	14.63%	<u>83.53%</u>	1.84%	0.84	0.12
4V12	APH	<u>42.96%</u>	49.06%	7.98%	0.43	0.16
5V12	APH	47.56%	17.45%	<u>34.99%</u>	0.35	0.48
1V12	AVB	3.85%	11.91%	<u>84.24%</u>	0.84	0.15
2V12	AVB	11.07%	4.90%	<u>84.03%</u>	0.84	0.18
3V12	AVB	16.38%	44.68%	<u>38.94%</u>	0.39	0.47
4V12	AVB	<u>61.48%</u>	28.57%	9.96%	0.61	0.25
5V12	AVB	<u>98.36%</u>	0.91%	0.73%	0.98	0.06
6V12	AVB	16.94%	16.21%	<u>66.86%</u>	0.67	-0.02
7V12	AVB	<u>53.34%</u>	5.54%	41.13%	0.53	0.31
8V12	AVB	5.27%	<u>89.84%</u>	4.89%	0.90	0.18
1V12	COMM	<u>64.15%</u>	18.25%	17.60%	0.64	-0.09
2V12	COMM	1.11%	4.48%	<u>94.41%</u>	0.94	0.08
1V12	DVT	31.06%	4.92%	<u>64.02%</u>	0.64	0.26
2V12	DVT	<u>64.75%</u>	7.62%	27.63%	0.65	0.14
3V12	DVT	<u>24.35%</u>	73.97%	1.68%	0.24	0.22
4V12	DVT	<u>58.05%</u>	1.88%	40.06%	0.58	-0.10
5V12	DVT	<u>22.92%</u>	35.20%	41.88%	0.23	-0.10
1V12	FWB	<u>88.66%</u>	3.14%	8.20%	0.89	0.03
2V12	FWB	<u>68.38%</u>	30.02%	1.60%	0.68	-0.03
3V12	FWB	<u>57.43%</u>	12.38%	30.19%	0.57	0.15
4V12	FWB	5.39%	<u>91.10%</u>	3.51%	0.91	0.18
5V12	FWB	4.24%	<u>73.85%</u>	21.91%	0.74	0.07
6V12	FWB	2.88%	11.45%	<u>85.67%</u>	0.86	0.11
7V12	FWB	12.51%	14.52%	<u>72.97%</u>	0.73	0.16
8V12	FWB	<u>63.68%</u>	34.94%	1.38%	0.64	-0.01
9V12	FWB	14.43%	13.83%	<u>71.74%</u>	0.72	0.14
10V12	FWB	14.65%	19.53%	<u>65.86%</u>	0.66	0.09
11V12	FWB	4.20%	<u>84.50%</u>	11.31%	0.85	0.15
12V12	FWB	37.03%	<u>62.97%</u>	[redacted]	0.63	0.44
1V12	GBS	8.57%	0.53%	<u>90.90%</u>	0.91	0.08
2V12	GBS	29.67%	<u>64.29%</u>	6.04%	0.64	0.12
3V12	GBS	0.55%	10.82%	<u>88.64%</u>	0.89	0.11
4V12	GBS	<u>65.97%</u>	4.29%	29.73%	0.66	0.34
5V12	GBS	<u>73.07%</u>	0.06%	21.24%	0.73	0.37
1V12	HDP	<u>95.44%</u>	2.00%	2.55%	0.95	0.15
2V12	HDP	1.50%	<u>84.22%</u>	14.28%	0.84	0.13
3V12	HDP	<u>89.91%</u>	9.47%	1.05%	0.90	0.05
4V12	HDP	31.98%	11.04%	<u>56.98%</u>	0.57	0.13

Table 14 (Continued): Item analysis of exam version 12

		Answer Options			Test Item Analysis	
Item	TOPIC	A	B	C	Difficulty	Discrimination
5V12	HDP	9.74%	8.20%	82.06%	0.82	0.10
1V12	IOL	6.70%	73.37%	19.93%	0.73	0.29
2V12	IOL	80.82%	12.47%	6.70%	0.81	0.15
3V12	IOL	27.28%	61.77%	10.96%	0.62	0.25
4V12	IOL	0.69%	4.27%	95.04%	0.95	0.17
5V12	IOL	82.97%	1.72%	15.31%	0.83	0.23
1V12	MOL	10.43%	6.26%	83.31%	0.83	0.22
2V12	MOL	5.35%	24.34%	70.31%	0.70	0.18
3V12	MOL	88.52%	1.82%	9.66%	0.89	0.08
4V12	MOL	0.93%	2.71%	96.35%	0.96	0.07
5V12	MOL	14.99%	85.01%	[redacted]	0.85	0.11
1V12	PS	1.42%	98.22%	0.36%	0.98	0.00
2V12	PS	41.19%	46.03%	12.78%	0.46	0.08
1V12	PPH	4.52%	8.93%	86.55%	0.87	0.11
2V12	PPH	36.97%	55.52%	7.51%	0.37	-0.13
3V12	PPH	63.99%	17.29%	18.71%	0.56	-0.01
4V12	PPH	31.79%	56.18%	12.03%	0.56	0.44
5V12	PPH	2.55%	76.97%	20.47%	0.77	0.18
1V06	PLROM	11.00%	3.12%	85.88%	0.86	0.33
2V06	PLROM	25.93%	29.55%	44.52%	0.45	-0.02
1V12	PTL	7.09%	1.09%	91.82%	0.92	0.09
2V12	PTL	70.77%	20.26%	8.97%	0.71	0.37
3V12	PTL	0.95%	1.99%	97.06%	0.97	0.08
4V12	PTL	6.74%	87.91%	5.35%	0.88	0.13
1V12	SD	2.39%	89.33%	8.28%	0.89	0.08
2V12	SD	16.61%	10.57%	72.82%	0.73	0.14
3V12	SD	3.38%	91.39%	5.23%	0.91	0.08
4V12	SD	22.83%	74.88%	2.29%	0.75	0.19
5V12	SD	89.49%	1.36%	9.16%	0.89	0.22
1V12	TWINS	13.06%	81.13%	5.81%	0.81	0.14
2V12	TWINS	31.17%	20.76%	48.08%	0.48	0.20
1V06	VBAC	79.95%	16.61%	3.44%	0.80	0.20
2V06	VBAC	11.87%	14.18%	73.96%	0.74	0.28
3V06	VBAC	34.91%	46.62%	18.47%	0.35	0.05

In developing version 12 of the exam, the item writers recognized that there was no significant difference between a four-options question and a three-options question; more likely, the three-options question was stronger (Rodriguez, 2005). The average difficulty index for version 12 is .73 (which is very close to that of version 6; *SD*=.19) and the average discrimination index moved up slightly from .13 to .15, indicating that performance on a particular question is now slightly better (though not strong) indicator of the overall performance. This time, 24 items have a discrimination index of under 0.10. In comparison to the previous exam, one could say that this one is almost equally easy, but has a slightly higher discrimination capability. Regardless, both versions of the exam have discriminant validity.

4.2.1.3 Reliability Analysis

Kuder-Richardson formula 21 (KR-21) was be used to determine the reliability of this exam.

$$r_{total\ test} = \frac{(K)(SD^2) - \bar{X}(K - \bar{X})}{(SD^2)(K-1)}$$

Where K= the number of items in the test
SD= the standard deviation of the scores
$\bar{X}$ = the mean of the scores

Pre-Module 1 (or pre-training) exam administered at all the early adopter obstetrics groups was used for this analysis. This population contained a representative sample of obstetricians, nurses, midwives, general practitioners, and a small number of others like anesthesiologists, residents, and hospital administrators (n=2,666). The KR-21 total reliability of the test was found to be 0.92, which is excellent and above the threshold for an achievement test. Table 15 presents the variables used in the KR-21 formula and the final result.

Table 15: Reliability data for pre-Module 1 exam

Pre-Module 1 Scores	
Mean	60.02
Median	59.62
Mode	57.52
Standard Deviation	11.62
Count	2666
Number of items on the test	75
SD of the scores	11.62
Mean of Scores	60.02
KR-21 Reliability	0.92

4.2.1.4 Comparison of Pre-training Knowledge between Early Adopter and Late Adopters

Knowledge exam scores were collected at the individual level and then aggregated at the obstetrics group level. In order to verify whether or not such aggregation would be appropriate, the normality of the data within each group was verified. Field (2013, p.188-191) suggests using the Kolmogorov-Smirnov (K-S) test of significance (*p*-value should be above .05, indicating that the sample tested did not deviate significantly from a random, normal sample generated by the computer). Also, since the K-S test is highly sensitive in large samples, Field recommends that if the test is significant, one should view the Q-Q plot to determine whether the sample satisfies the conditions for normality. The data from pre-module 1, post-module-1, post-module-2, and post-module-3 knowledge exam scores were tested for each obstetrics unit (n=68). All datasets passed the normality test either based on the K-S test or based on the interpretation of the Q-Q plot. Thus, the individual exam scores were aggregated at the obstetrics group level. Similarly, the second level of aggregation: from obstetrics group level to adopter level (early/late) was verified with normality tests.

Table 16 presents the comparison of pre-module 1 means scores between Early Adopters and Late Adopters. Table 17 presents the results of the independent sample *t*-test. On average, participants from the Late Adopter Group (29 hospitals; M=66.75, SE=1.10) scored higher than those from the Early Adopter Group (39 hospitals; M=59.48, SE=.70). Levene's test for equality of variances (Table 16) indicates that this difference in scores, 7.27, 95% CI [-9.76, -4.77], was significant when equal variances were assumed, $t(66)=-5.82$, $p=.000$. The Shapiro-Wilk test of normality revealed that the significance was above the threshold of .05. The S-W Sig. value for Early Adopters was 0.548 and for Late Adopters was .655. Thus, the pre-module 1 knowledge scores among both groups were normally distributed and the mean knowledge score of the Late Adopter Group was significantly higher than the knowledge score of the Early Adopter Group.

Table 16: Pre-Module 1 average knowledge exam scores

Adopter Group	N	Mean	Std. Dev.	Std. Error Mean
Early Adopter	39	59.48	4.46	.70
Late Adopter	29	66.75	5.84	1.10

Table 17: Results of the independent samples t-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	3.679	.059	-5.82	66	.000	-.7.27	1.25	-9.76	-4.77

4.2.1.5 Comparison of Post-training Knowledge between Early Adopters and Late Adopters

Table 18 presents the comparison of post-module 3 means scores between Early Adopters and Late Adopters. Table 19 presents the results of the independent sample *t*-test. On average, participants from the Late Adopter Group (29 hospitals; M=77.86, SE=0.93) scored higher than those from the Early Adopter Group (39 hospitals; M=74.29, SE=.74). The post-module 3 scores failed the equality of variance test and thus equal variances were not assumed. The difference in scores, 3.57, 95% CI [-5.95, -1.19], was significant when equal variances were not assumed, $t(56.53)=-3.00$, $p=.004$. Thus, the post-module 3 knowledge level of the Late Adopter Group was significantly higher than the knowledge level of the Early Adopter Group.

Table 18: Post-Module 3 average knowledge exam scores

Adopter Group	N	Mean	Std. Dev.	Std. Error Mean
Early Adopter	39	74.29	4.69	.74
Late Adopter	29	77.86	4.91	.93

Table 19: Results of the independent samples t-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances not assumed			-3.00	56.53	.004	-3.57	1.19	-5.95	-1.19

4.2.1.6 Pre- and Post-Training Comparison between Early Adopters and Late Adopters

Figure 10 illustrates the improvements in the overall knowledge scores in Early Adopters and Late Adopters. At the end of Module 3, there is a clear improvement in the clinical knowledge level of participants from both groups.

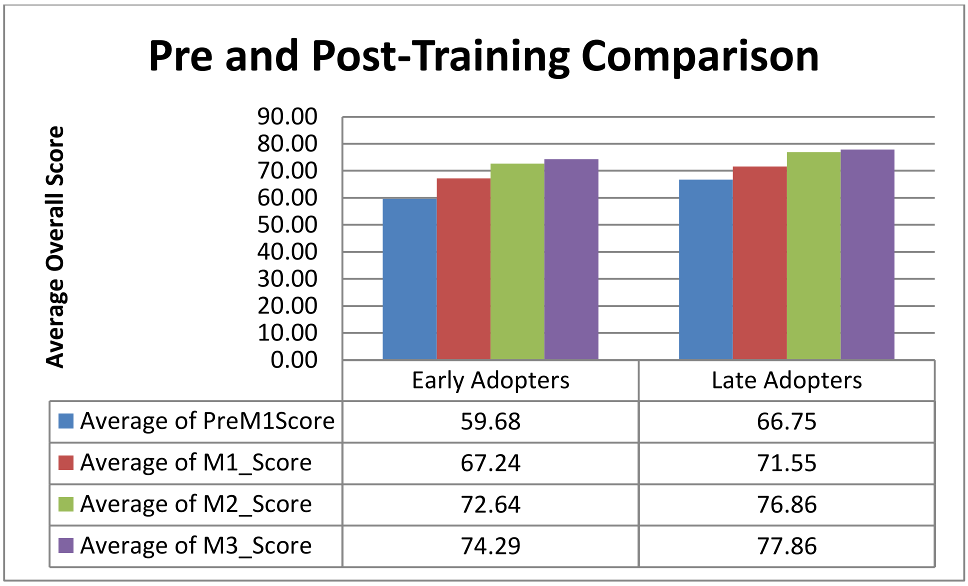


Figure 10: Pre- and post-training comparison of knowledge exam scores

A repeated measures ANOVA was conducted to determine the significance of the differences in scores pre- and post-training. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(5) = 86.36$, $p = .000$; therefore, Greenhouse-Geisser corrected tests are reported ($\varepsilon = .605$). The results show that the change in knowledge exam scores was significant, $F(1.82, 1.82)=218.47$, $p=.000$, $\omega^2=.768$.

Ultimately, the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1) is partially supported based on the improvement in the obstetrics group's clinical and non-clinical (about communication and teamwork) knowledge examination scores. Since knowledge is a component of work performance (Kirkpatrick & Kirkpatrick, 2006), improvement in knowledge exam scores demonstrates that the training was effective in improving the knowledge. Also, since the training transitioned from purely didactic to mostly clinical, the total improvement in knowledge should be considered. Nonetheless, for the hypothesis (H_1) to be fully supported, there must be a demonstrable improvement in clinical outcomes after Module 3, if not after each module.

4.2.2 Clinical Outcomes Analysis

This section presents the results of analyses of clinical outcomes before and after the MORE^{OB} program was implemented. Although a number of clinical outcomes could be justified, four outcomes were considered for this study: (a) Cesarean section rates, (b) postpartum hemorrhage rates, (c) handling of shoulder dystocia, and (d) overall length of stay. The Cesarean rates were deemed important because there is a global interest in addressing the rising Cesarean rates (WHO, 2015) and the MORE^{OB} program specifically targets the control of elective Cesareans; postpartum hemorrhage was selected because it is the leading cause of maternal mortality (Smith, Ramus, & Brennan, 2016) and the MORE^{OB} program specifically targets the management of postpartum hemorrhage; and shoulder dystocia was selected because it is considered "the nightmare of obstetricians" because of its relatively rare occurrence coupled with elevated risks for both the mother and the fetus (Politi, D'Emidio, Cignini, Giorlandino, & Giorlandino, 2010), and the MORE^{OB} program involves specific training and drills to practice deliveries involving shoulder dystocia. The overall length of stay is arguably oversimplified, yet it serves as a popular proxy indicator of quality of care (Kaveh Shojania, Showstack, & Wachter, 2001; Thomas, Guire, & Horvat, 1997)—the higher the length of stay, the greater the probability that the case involved complications and higher the cost of care.

4.2.2.1 The ICD-10-CA and CCI Coding Structures

The Canadian Institute for Healthcare Information (CIHI) provided data for fiscal years 2001-2011 (fiscal year is from April 1- March 31) to the Salus Global Corporation. In accordance with the agreement between Salus Global and CIHI, and the non-disclosure agreement between the researcher and Salus Global, all the CIHI data were accessed and analyzed on site at the Salus Global Corporation office in London, Ontario. The ICD-10-CA (International Classification of Diseases and Related Health Problems) manual (CIHI, 2009b) was used to decode the diagnosis classification data. The CCI (Canadian Classification of Health Interventions) manual (CIHI, 2009a) was used for the intervention data from FY2002-2011; for FY2001, the CCP (Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures) manual was used.

4.2.2.2 Description of the Maternal Sample Population

The total dataset of women admitted to one of the Ontario hospitals included 1,345,624 cases; of these, 81,697 cases (6.1%) did not involve deliveries (they were for a variety of conditions like calculus of the gall bladder, acute appendicitis, postpartum examination visit, etc.). Next, only four cases from FY2001 had complete data; so, this fiscal year was eliminated from further analysis. Table 20 presents the maternal characteristics of the study population (n=1,263,923 cases). From fiscal year 2002 through 2011, the number of women admitted for birthing has increased by about 50 per cent between 2002 and 2004, but between 2005 and 2011, it was within the range of 130,000 to 140,000. The sample under consideration consists of three groups: Non-Adopters (hospitals without MORE^{OB} program), Early Adopters (hospitals that adopted the MORE^{OB} program between 2006 and 2008), and Late Adopters (hospitals that adopted the MORE^{OB} program between 2009 and 2011). While there was some decline in the number of mothers at the Non-Adopter hospitals, it remained steady at about 11 per cent of the total number of mothers per year over 2009 through 2011.

Considering the distribution of the mothers by the level of care, about 3 per cent of the mothers at Level 1 facilities were among the Non-Adopter group, 35.5 per cent were from the Early Adopter group, and the remaining 61.3 per cent were from the Late Adopter group. Similarly, 2.4 per cent of the mothers at Level 2 facilities were among the Non-Adopter group, 71.7 per cent were from the Early Adopter group, and the remaining 25.9 per cent were from the Late Adopter group; about 89.3 per cent of the mothers at Level 3 facilities were among the Early Adopters and the remaining 10.7 per cent were among the Late Adopters.

The age of the mothers ranged from 12 years to 60 years, with an overall mean of 29.84 (SD = 5.54) and median of 30 years. The mean ages for the Non-Adopter, Early Adopter, and Late Adopter groups appear to be reasonably similar; however, with large sample sizes and the three group sizes being of substantially different sizes (non-adopters include 182,986 cases, early adopters include 795,763 cases, and late adopters include 285,174 cases), the differences in means are significant, $F(2) = 15{,}550.789$, p=0.000. While the mean age of the mothers in the Early Adopter group is significantly higher than that in the other two groups, other characteristics like previous preterm deliveries and previous spontaneous abortions are practically identical.

Table 20: Maternal characteristics of the study population

Total number of mothers delivering at hospitals by FY		Non Adopters		Early Adopters		Late Adopters	
		Freq. Count	Rate (%)	Freq. Count	Rate (%)	Freq. Count	Rate (%)
FY2002	83,697	24,006	28.7	38,302	45.8	21,389	25.6
FY2003	99,571	20,197	20.3	55,326	55.6	24,048	24.2
FY2004	121,593	20,426	16.8	72,931	60.0	28,236	23.2
FY2005	129,304	20,317	15.7	80,208	62.0	28,779	22.3
FY2006	133,877	20,021	15.0	84,652	63.2	29,204	21.8
FY2007	139,914	17,490	12.5	91,281	65.2	31,143	22.3
FY2008	140,054	17,776	10.6	94,089	67.2	31,189	22.3
FY2009	139,805	15,204	10.9	93,715	67.0	30,886	22.1
FY2010	137,308	15,198	11.1	92,233	67.2	29,877	21.8
FY2011	138,800	15,351	11.1	93,026	67.0	30,423	21.9
Total	1,263,923	182,986	14.5	795,763	63.0	285,174	22.6

Mothers by Level of Care	Non Adopters		Early Adopters		Late Adopters	
	Freq. Count	Rate (%)	Freq. Count	Rate (%)	Freq. Count	Rate (%)
Level 1 (107,868)	3,479	3.2	38,311	35.5	66,078	61.3
Level 2 (743,071)	17,853	2.4	532,919	71.7	192,299	25.9
Level 3 (251,330)	-	-	224,533	89.3	26,797	10.7
Characteristics of the mothers (FY01 - - FY11)	Non Adopters		Early Adopters		Late Adopters	
	Mean	SD	Mean	SD	Mean	SD
Age (12 to 60) Overall mean of 29.84 (SD= 5.54); median = 30 years	28.24	5.59	30.41	5.45	29.29	5.48
Previous term deliveries (0 to 19)	0.90	1.12	0.80	1.00	.86	1.07
Previous preterm deliveries (0 to 13)	.05	.26	.04	.29	0.05	.26
Previous spontaneous abortions (0 to 20)	.31	.70	.31	.71	.32	.72

Table 21 presents the frequencies of delivery types and maternal conditions. Vaginal births included a wide range of sub-types like manually assisted, spontaneous, forceps and traction, vacuum, and breech delivery. Cesarean Section births included 27 sub-types. Overall, in the Non-Adopter group, the

Cesarean Section births accounted for about 24 per cent of the total; in the case of Early Adopters and Late Adopters, the percentage of Cesarean Section births were about 27 per cent and 23 per cent, respectively.

Table 21: Characteristics of delivery types

	Non Adopters		Early Adopters		Late Adopters	
Delivery Type	Frequency	Rate, %	Frequency	Rate, %	Frequency	Rate, %
Vaginal Delivery	138,633	75.8	582,584	73.2	218,535	76.6
Cesarean Section	44,353	24.2	213,179	26.8	66,639	23.4
Total	182,986	100	795,763	100	285,174	100

4.2.2.3 Effect of the MORE^{OB} Program on Clinical Outcomes

The national Cesarean Sections (C-section) rate in Canada increased from 17 per cent in 1995 to almost 27 per cent 2010 and up to about 29 per cent in Ontario in 2011/2012 (BORN, 2015). Such a rise in the C-section rate is both a financial challenge as well as a patient safety challenge (Murphy, 2015). Thus, the effect of MORE^{OB} program on the C-section rate was chosen as one of the many measures to test the hypothesis that the group-level outcomes improved after the MORE^{OB} training (H_1).

Table 22 presents the C-section rates for Non-Adopters (n=35), Early Adopters (n=39), and Late Adopters (n=29) from years 2002-2005. Since all the Early Adopter hospitals had completed the first module of the MORE^{OB} program during 2006, the 2002-2005 data were considered baseline. CIHI data for 2003 was corrupted and could not be used; thus, the baseline data consisted of years 2002, 2004, and 2005.

Table 22: Baseline C-section rates

Fiscal Year	Non-Adopters	Early Adopters	Late Adopters
2002	24.24%	25.10%	22.00%
2004	26.88%	27.83%	24.74%
2005	27.50%	28.81%	25.44%

Two observations were made from the above data: first, the C-section rates in all three groups were on the rise; and second, the Early Adopter group had the highest C-section rate, which might have been one reason why the Early Adopter group was eager to implement the MORE^{OB} program.

Figure 11 projects the trends for the C-section rates if no intervention were implemented. Data from years 2002, 2004, and 2005 were used to build the initial equation for the trend and then it was extended for six time periods. All three trend lines were logarithmic and the corresponding 2011 C-section rates for the Non-Adopters (NA), Early Adopters (EA), and Late Adopters (LA) were 31.13, 32.75, and 29.21 per cent, respectively.

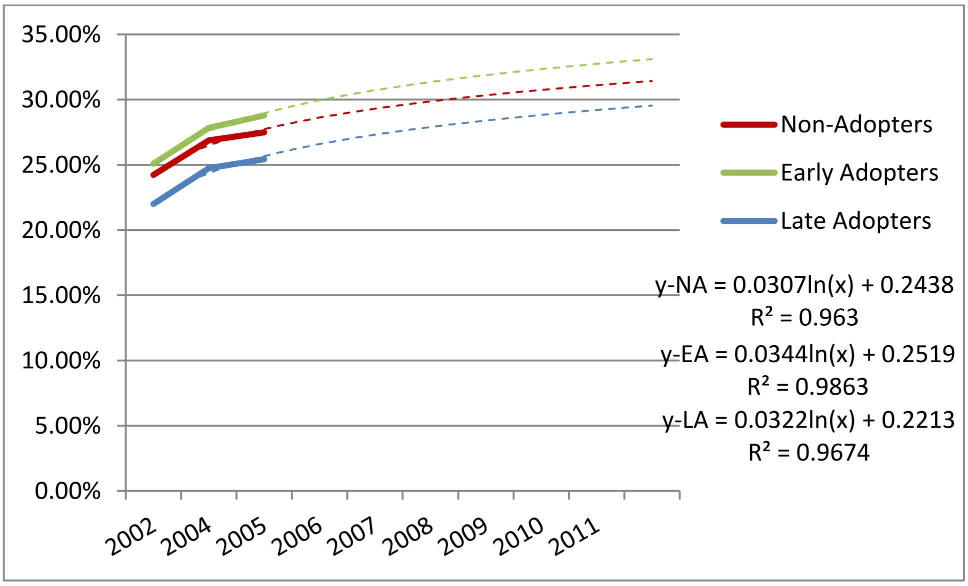


Figure 11: Projected rise in C-section rates

Table 23 presents the actual versus projected C-section rates from 2002-2011 (except 2003); most actual rates were lower than projected. Regardless of when the MORE^{OB} program was implemented (or not implemented at all), the C-section rates did not rise as high as projected. The MORE^{OB} program was implemented at the Early Adopter sites between 2006 and 2008, and at the Late Adopter sites between 2009 and 2011.

Table 23: Actual versus projected C-section rates from 2002-2011

Fiscal Year	Non-Adopters (Projected)	Early Adopters (Projected)		MORE^{OB}	Late Adopters (Projected)	
2002	24.24%	25.10%	Pre-MORE^{O}		22.00%	Pre-MORE^{OB}
2004	26.88%	27.83%			24.74%	
2005	27.50%	28.81%			25.44%	
2006	28.17% (28.64%)	28.63% (29.96%)		←(M-1)	25.61%	
2007	28.59% (29.32%)	28.58% (30.73%)		←(M-2)	26.48%	
2008	28.03% (29.88%)	29.49% (31.35%)		←(M-3)	26.29%	
2009	28.41% (30.35%)	29.42% (31.88%)		(M-1)→	25.54% (28.40%)	
2010	26.95% (30.76%)	29.34% (32.34%)		(M-2)→	26.18% (28.83%)	
2011	27.74% (31.13%)	29.52% (32.75%)		(M-3)→	26.30% (29.21%)	

Murphy (2015) cites many reasons for a C-section including, but not limited to older or overweight mothers, twin births, prior C-section birth, or other fetal complications. None of these factors is specifically within the control of the obstetrics team; also, a C-section can be a medical necessity and simply avoiding a C-section is not necessarily an indication of improved clinical performance. However, Osterman and Martin (2014) conducted a review of low risk[3] C-sections because they may not have been based on compelling clinical needs. While it was impractical to control for all the factors that might classify a particular C-section a "low-risk" case, the researcher was able to control for

[3] Strictly speaking a low-risk C-section is defined as a first birth, at term, single fetus, and head first positioning. An LRC delivery rate is the ratio of low-risk C-sections to low-risk births

multiple births and consider only single birth cases. Table 24 presents the data for these reduced-risk cases (RRC).

Table 24: Reduced risk C-section rates from 2002-2011

Fiscal Year	Non-Adopters	Early Adopters		MORE^{OB}	Late Adopters	
2002	21.9%	21.5%	Pre-MORE		19.5%	Pre-MORE^{OB}
2004	25.9%	23.6%			23.3%	
2005	26.5%	<u>24.5%</u>			24.3%	
2006	27.2%	24.4%	Post-MORE^{OB}	←(M-1)	24.5%	
2007	27.7%	24.4%		←(M-2)	25.3%	
2008	27.1%	25.0%		←(M-3)	<u>25.2%</u>	
2009	27.5%	24.2%		(M-1)→	24.1%	Post-MORE^{OB}
2010	26.2%	23.9%		(M-2)→	24.5%	
2011	26.8%	23.7%		(M-3)→	24.6%	

In the Early Adopter sample, a pre-post comparison of means using independent samples *t*-test revealed $t(2.177)=-1.175$, $p=.353$. Thus, the difference in the mean RRC rate of pre-MORE^{OB} training (23.20%) and post-MORE^{OB} training (24.27%) was not significant. Also, a similar comparison between the pre-post RRC rates within the Late Adopter sample revealed that the difference between pre-MORE^{OB} training (23.68%) and post-MORE^{OB} training (24.40%) was not significant, $t(7)=-.550$, $p=.559$. Considering that the year-to-year RRC rates for Early Adopters and Late Adopters were consistently lower than the Non-Adopters, a one-way ANOVA was conducted. The difference in the means of RRC rates between the three groups was significant, $F(2)=16.84$, $p=.000$. Tukey's post hoc analysis showed that the differences between the RRC-mean section rates between all three groups (Non-Adopters: 24.30%; Early Adopters: 23.91%; and Late Adopters: 21.66%) were significant ($p<.05\%$). These results indicate that it may take longer than six years for the MORE^{OB} program to significantly reduce the RRC rate.

The hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1) was not fully supported on the Cesarean section measure, but showed promise based on the following:

1. Both the Early Adopters and the Late Adopters demonstrated an improvement in reduced risk C-section rates after the implementation of the MORE^{OB} program (in 2006 and 2009, respectively), but the improvement was not statistically significant;
2. The mean reduced-risk C-section rate for Non-Adopters was significantly higher than that for Early Adopters and Late Adopters; and
3. Both experimental groups (Early Adopters and Late Adopters) showed improvements in post-intervention performance compared to the control group (Non-Adopters)

Table 25 presents the baseline postpartum hemorrhage (PPH) across the three groups. Data from 2003 were corrupted and hence eliminated from analysis.

Table 25: Baseline postpartum hemorrhage rates

Fiscal Year	Non-Adopters	Early Adopters	Late Adopters
2002	2.86%	3.69%	3.02%
2004	3.22%	3.50%	2.82%
2005	3.12%	3.56%	2.93%

Three observations were made from the above data: first, the PPH rate at the Non-Adopter obstetrics units had increased; second, the Early Adopter group had the highest PPH rate and although it had come down slightly by 2005, it was still fairly high; and third, the PPH rate at the Late Adopter obstetrics units was starting to rise. Again, a comparatively poor performance might have been one reason why the Early Adopter group was eager to implement the MORE^{OB} program.

Figure 12 projects the trends for PPH rates if no intervention were implemented. The trends for Non-Adopters and Early Adopters were best described by logarithmic equations and the trend for the Late Adopters was best described by a second order polynomial curve (best fit curve; based on the best R^2 value). The corresponding 2011 PPH rates for the Non-Adopters (NA), Early Adopters (EA), and Late Adopters (LA) were 3.38, 3.51, and 3.82 per cent, respectively.

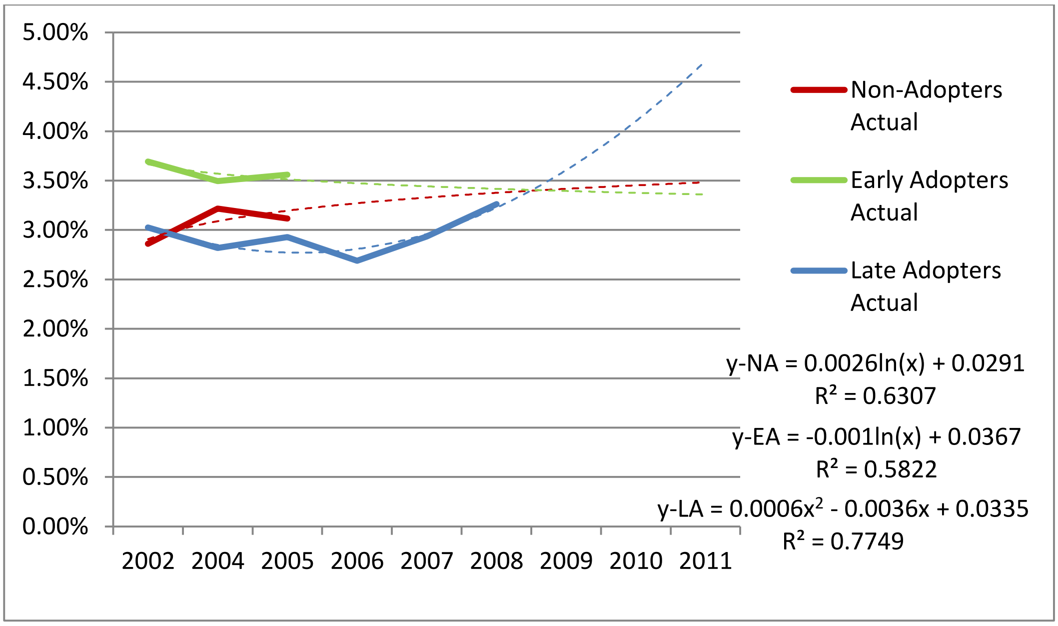


Figure 12: Projected rise in PPH rates

Table 26 presents the actual versus projected PPH rates from 2002-2011 (except 2003); the actual rates ended up higher than projected for the Non-Adopters, but lower than projected for Early Adopters and Late Adopters. Both Early Adopters and Late Adopters consistently performed better than the projected levels. Thus, the experimental group (Early and Late Adopters) performed better than the control group (Non-Adopters). Therefore, the MORE^{OB} program seemed to have helped control the PPH rates.

Table 26: Actual versus projected PPH rates from 2002-2011

Fiscal Year	Non-Adopters (Projected)	Early Adopters (Projected)		MORE^{OB}	Late Adopters (Projected)	
2002	2.86%	3.69%	Pre-MORE^{OB}		3.02%	Pre-MORE^{OB}
2004	3.22%	3.50%			2.82%	
2005	3.12%	3.56%			2.93%	
2006	3.20% (3.27%)	3.36% (3.53%)		←(M-1)	2.69%	
2007	3.26% (3.33%)	3.43% (3.51%)		←(M-2)	2.93%	
2008	3.23% (3.38%)	3.25% (3.49%)		←(M-3)	3.26%	
2009	4.19% (3.42%)	3.30% (3.48%)		(M-1)→	3.22% (3.77%)	
2010	4.07% (3.45%)	3.37% (3.46%)		(M-2)→	3.52% (4.31%)	
2011	4.21% (3.48%)	3.36% (3.45%)		(M-3)→	3.82% (4.97%)	

In the Early Adopter sample, a pre-post comparison of means using independent samples *t*-test revealed $t(7)=4.562$, $p<.01$. Thus, the difference in the mean PPH rate of pre-MORE^{OB} training (3.58%) and post-MORE^{OB} training (3.35%) was significant. Also, a similar comparison between the pre-post PPH rates within the Late Adopter sample revealed that the difference between pre-MORE^{OB} training (2.94%) and post-MORE^{OB} training (3.52%) was significant, $t(7)=-3.577$, $p<.01$. In this case, however, the PPH rate had significantly increased after the MORE^{OB} training. Since there was no reason for the PPH rate to increase as a result of the MORE^{OB} training, the reasons for this increase were most likely other factors. In a one-way ANOVA, the difference in the means of PPH rates between the three groups was not significant, $F(1)=3.958$, $p=.058$. Considering that the actual PPH rates for Early Adopters were lower than projected, and the post-MORE^{OB} rates were consistently lower than the pre-MORE^{OB} rates, the PPH measure at least partially supports the hypothesis that MORE^{OB} training improves group-level outcomes (H_1).

An inexplicable discrepancy was noted in the cases involving shoulder dystocia. From 2002 through 2008, the percentage of cases recorded with shoulder dystocia ranged from 3.33 to 5.15 per cent. However, 2009 onward, the rate ranged between 11.68 and 17.20 per cent. This discrepancy was possibly due to inconsistencies in reporting such conditions. Thus, only the data from 2009 through 2011 were considered. Table 27 presents the data for shoulder dystocia.

Table 27: Shoulder dystocia rates from 2009-2011

Fiscal Year	Non-Adopters	Early Adopters	Late Adopters
2009	16.79%	12.34%	14.27%
2010	17.20%	11.85%	13.78%
2011	17.11%	11.68%	12.79%

The general trend for should dystocia rates in both Early Adopters and Late Adopters was in the downward direction, indicative of a potential influence of the $MORE^{OB}$ program. Thus, there was a possibility that the $MORE^{OB}$ program influenced the probability of a C-section, given shoulder dystocia. To test this possibility, conditional probabilities for a C-section, given shoulder dystocia were calculated; these results are presented in Table 28. Although the probabilities for the Early Adopters were better than those for the Non-Adopters, the probabilities for the Late Adopters were not any better. Thus, this measure was not pursued further.

Table 28: Conditional probability of a C-section given shoulder dystocia

Fiscal Year	Non-Adopters	Early Adopters	Late Adopters
2009	11.5%	9.9%	12.2%
2010	10.6%	9.9%	10.6%
2011	12.2%	10.2%	12.8%

Table 29 presents the mean Length of Stay by fiscal years and adopter status. Although data for 2008 were not available, all three groups indicate a downward trend from a high of 2.57, 2.54, and 2.55 days to a low of 2.25, 2.33, and 2.30 days for Non-Adopters, Early Adopters, and Late Adopters, respectively. The overall means for the three groups were 2.39, 2.36, and 2.31 days. One-way ANOVA for these three groups was significant, $F(2)=64.16$, $p<.001$. Tukey's post hoc analysis indicated that the means of all three groups were significantly different from each other ($p<.05$): the Non-Adopter mean (2.39 days) was significantly higher than the Early Adopter mean (2.36 days) and the Late Adopter mean (2.31 days), and the Early Adopter mean was significantly higher than the Late Adopter mean. In the Early Adopter sample, a pre-post comparison of means using independent samples *t*-test revealed $t(7)=1.524$, $p>.05$. Thus, the difference in the mean Length of Stay pre-MORE^{OB} training (2.43days) and post-MORE^{OB} training (2.33 days) was not significant. However, a similar comparison between the pre-post Length of Stay within the Late Adopter sample revealed that the difference between pre-MORE^{OB} training (2.42 days) and post-MORE^{OB} training (2.25 days) was significant, $t(7)= 3.221$, $p<.05$. Therefore, the hypothesis that the MORE^{OB} train improved group-level outcomes was partially supported by the Length of Stay measure.

Table 29: Mean length of stay

Fiscal Year	Non-Adopters (*SD*)	Early Adopters (*SD*)		Late Adopters (*SD*)	
2002	2.57 (1.812)	2.54 (2.595)	Pre-MORE^{OB}	2.55 (2.387)	Pre-MORE^{OB}
2003	2.40 (1.412)	2.26 (1.721)		2.30 (1.697)	
2004	2.45 (1.524)	2.48 (2.128)		2.47 (2.106)	
2005	2.37 (1.362)	2.45 (2.189)		2.43 (2.174)	
2006	2.38 (1.590)	2.43 (2.520)	Post-MORE^{OB}	2.41 (2.362)	
2007	2.38 (1.542)	2.39 (2.247)		2.38 (2.248)	
2009	2.37 (1.452)	2.33 (2.201)		2.30 (2.094)	Post-MORE^{OB}
2010	2.29 (1.295)	2.27 (2.273)		2.25 (2.174)	
2011	2.25 (1.450)	2.22 (2.106)		2.20 (2.034)	

In summary, the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1) was partially supported by the following measures:

1. Cesarean Section Rates: Early Adopters and Late Adopters (experimental groups) demonstrated a significantly lower reduced-risk C-section rate compared to Non-Adopters (control group); however, a comparison between pre-training and post-training reduced-risk C-section rates did not show a significant change within the experimental group;
2. Postpartum Hemorrhage (PPH) Rates: Early Adopters and Late Adopters (experimental groups) demonstrated a lower than predicted PPH rate after the implementation of the MORE^{OB} training, and the Early Adopters showed a statistically significant improvement in PPH rates after the MORE^{OB} training;
3. Mean Length of Stay: The mean length of stay was significantly lower in both Early Adopters and Late Adopters (experimental groups), compared to Non-Adopters (control group). However, only the Late Adopter group showed significant difference between pre- and post-MORE^{OB} training.

4.2.3 Patient Safety Climate Analysis

The goal of the patient safety climate analysis was to test the hypothesis that training, as a planned intervention, improves group-level patient safety climate (H_2). In order to pursue this hypothesis, the patient safety climate survey instrument was first evaluated for its psychometric properties and a multifactor model was developed using both exploratory and confirmatory factor analysis.

Then, the survey responses were analyzed to determine whether there was sufficient support for the hypothesis.

The total sample of responses to the Patient Safety Climate Survey consisted of pre-training responses (n=3,689), post-module 1 responses (n=4,427), post-module 2 responses (n=3,074), and post-module 3 responses (n=1,626). The pre-training sample was divided into two groups: Group 1 (Early Adopters), which included 39 hospitals that underwent the MORE^{OB} training between 2006-2008 and Group 2 (Late Adopters), which included 29 hospitals that underwent the MORE^{OB} training between 2009-2011. Group 1 consisted of 2,198 responses and Group 2 consisted of 1,491 responses. Table 30 summarizes the distribution of sample sizes.

Table 30: Distribution of the survey samples

	Sample Size	Group 1 (Early Adopters)	Group 2 (Late Adopters)
Pre-Training	3,689	2,198 (59.6%)	1,491 (40.4%)
Post-Module 1	4,427	3,297 (74.5%)	1,130 (25.5%)
Post-Module 2	3,074	2,344 (74.3%)	730 (23.7%)
Post-Module 3	1,626	1,237 (76.1%)	389 (23.9%)

4.2.3.1 Exploratory Factor Analysis

The goal of exploratory factor analysis (EFA) was to discover patterns that might form clusters of variables such that those variables might be considered in terms of more abstract constructs that underpin the responses to survey items, making the subsequent analysis more meaningful and simpler (Child, 2006). In such analysis, each survey question represents an observable variable because response to the survey question is provided by the human subject responding to the survey; whereas, the scales that are formed based on the clustering of the responses are considered to be latent variables or hypothetical constructs (Cattell, 1978). Thus, for example, if responses to survey items 1, 2, 3, and 4 cluster together, indicating that the variables may be measuring the same construct, then the construct could be given a label based on a collective meaning that the researcher might ascribe to that cluster of survey items. At this point, it is important to note that a survey questionnaire with a Likert-type scale is an attempt to convert qualitative data or subjective interpretation of survey items into quantitative data. Furthermore, the meta-level meaning ascribed to the clusters uncovered through EFA is a subjective effort to give qualitative meaning to the quantitatively validated clustering. At the meta-level, the goal of EFA is to discover the smallest number of factors or scales that will represent the most variance in the dataset (McDonald, 1985). Thus, an EFA typically yields 1-5 scales. It is also important to note that purists have argued against the use of Likert-type scales to do EFA because a Likert scale is ordinal and as such, the distance between "1" and "2" on the scale may not be the same as that between "4" and "5"(Jakobsson, 2004; Vigderhous, 1977). However, other methodological research indicates that such analysis could be performed on ordinal or dichotomous variables (Bartholomew, 1980; Mislevy, 1986) as long as analytical methods used are consistent with the characteristics of the data.

For this study, the pre-training, early adopter sample (Group 1) was split into two (approximately 50 per cent) randomly generated groups (Group 1A and Group 1B). Group 1A contained 1,116 responses and Group 1B contained 1,082 responses. Group 1A was used as the derivation sample for EFA and Group 1B was used as the validation sample for Multi-Trait Analysis (MTA).

Prior to conducting EFA, the suitability of the Group 1A data for EFA was verified using the following characteristics/criteria:

1. Sample size and number of observations: the sample size should be at least 300 and the variables that are subjected to EFA should have at least 5 to 10 observations or responses. Normally, a threshold of respondents to variables is set to 10:1, and the factors are considered to be stable and cross-validated with respondents to variables ratio of 30:1 or better (Yong & Pearce, 2013). Thus, larger the ratio, the lower the error in the data. In this study, the Group 1A sample contained 1,116 respondents. With 54 items in the survey, the respondent-to-variable ratio was approximately 20:1. Thus, by these criteria, Group 1A was reasonably above the cut-off levels for EFA.
2. KMO and Bartlett's Test of Sphericity: The Kaiser-Meyer-Olkin (KMO) Measure is often used to determine sampling adequacy. The threshold is set at 0.50. Values between .5 and .7 are mediocre, between .7 and .8 are good, between .8 and .9 are great and above .9 are superb (Hutcheson & Sofroniou, 1999). The Group 1A dataset yielded a KMO of .980, which was excellent. Bartlett's Test of Sphericity is conducted to confirm that the dataset has patterned relationships among variables. The desired *p*-value is less than .001. The Group 1A dataset had a *p*-value of .000; thus, the dataset had a strong likelihood of patterned relationships. Next, the diagonal values of the anti-correlation matrix should be above .50 so that distinct and reliable factors may be produced. In Group 1A dataset, all the diagonal values were above .935. Thus, this dataset ranked very highly on

sampling adequacy and there was very high likelihood that distinct and reliable factors would be produced.

Since the purpose of this analysis was to explore the data and determine what factors may exist, the ability to generalize the findings was limited to the sample used rather than the larger population. Since the original sample was randomly split into two groups (1A and 1B), the findings could be extended to the entire Group 1. Generalization beyond Group 1 may be possible in subsequent analyses of other populations if those analyses yield a consistent factor structure. Principal Axis Factoring was used to extract six factors because the safety climate survey was constructed with six elements (or theoretical factors); otherwise, the more commonly used cutoff of eigenvalues at or above 1.0 would have yielded five factors. The goodness of fit of this six-factor model was determined by examining the percentage of the non-redundant residuals with values greater than 0.05—the cutoff for a good model is below 50 per cent with non-redundant residuals greater than 0.05. For the Group 1A dataset, there were 32 (2.0%) non-redundant residuals with absolute values greater than 0.05. Thus, the six-factor model appears to be an extremely good fit for this dataset.

The Pattern Matrix, with Principal Axis Factoring and Direct Oblimin Rotation with Kaiser Normalization, indicated that the rotation converged in 38 iterations for Group 1A. The Principal Axis Factoring was used instead of Principal Components Analysis because "only factor analysis can estimate the underlying factors" (Field, 2013), while PCA is helpful in reducing a larger survey instrument to a more compact, yet equally reliable instrument. Although the preceding analysis indicated that distinct and reliable factors may be produced, it was not clear the extent to which these factors may be inter-related. Thus, it was assumed that they would be inter-related and hence Direct Oblimin rotation was chosen instead of Varimax rotation.

The factor analysis yielded the first five factors above eigenvalues of 1 and the sixth factor at eigenvalue of .982. The first five factors explained 51 per cent of the variance and the sixth factor added approximately 1 per cent. Thus, the six-factor model would explain 52 per cent of the variance. The Scree Plot (Figure 13) shows a clear inflection point at the fifth factor and the factor loadings indicate that the sixth factor has only one item (Q16), loaded at -.351. Thus, Factor 6 was dropped. Although the Scree Plot indicated a four-factor model, the fifth factor was explored (because of eigenvalue above 1.0) with the intention to drop this factor if subsequent Confirmatory Factor Analysis justified only four factors. The factor loadings are presented in Table 30. All loadings at or below 0.30 are suppressed for clarity. In cases where an item loaded on more than one factor, the highest loading is expressed in bold. Presence of such cross-loading indicates that some factors may be inter-related.

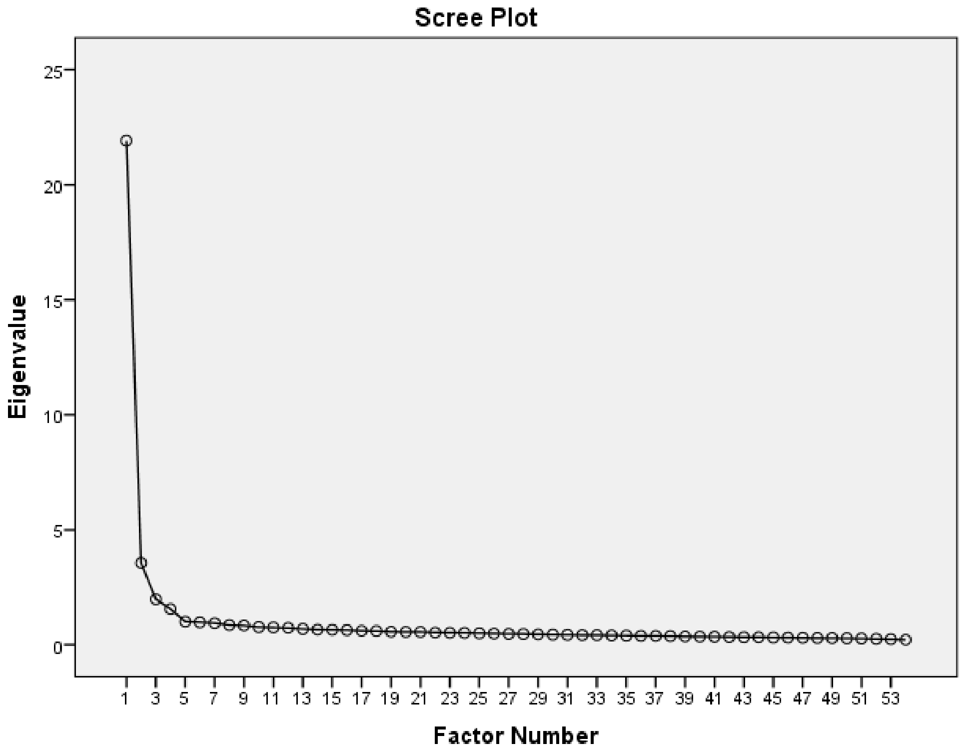


Figure 13: Scree plot indicates inflection at the fifth factor.

Factor 1 was long with 22 items (after Q4 was moved to Factor 2 due to better loading on Factor 2 than Factor 1) and had a very high level of internal consistency ($\alpha = 0.96$), which could mean presence of redundancy within a scale. On the other hand, the item homogeneity (the mean of all inter-item covariances within the scale) was moderate at 0.64. These characteristics were indicative of the presence of subscales or two fairly-correlated scales (Singer et al., 2007).

Table 31: Item descriptive statistics and factor loadings

Scale/Items		*Mean*	*SD*	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 1 (n=1,116)								
Q53	We have a well-structured process to report potential patient safety hazards.	3.47	1.15	.75				
Q44	Clinical errors and near misses are used as learning opportunities to improve and prevent recurrences.	3.55	1.14	.75				
Q50	We have made improvements as a result of our learning from near misses.	3.56	1.10	.69				
Q52	We have a well-structured process to report unexpected events (errors, near misses).	3.48	1.19	.69				
Q17	We are encouraged to report errors, even those that are caught and corrected before affecting the patient.	3.67	1.14	.68				
Q51	We have made improvements as a result of learning from past clinical errors.	3.67	1.05	.67				
Q47	Clinical management processes are examined to identify where errors might be made and how they can be prevented.	3.30	1.16	.65				
Q21	Patient safety occurrences are investigated thoroughly.	3.55	1.15	.65				
Q22	Learning from patient safety occurrences is shared with the entire unit staff.	3.32	1.16	.63				
Q23	When a patient safety issue is reported it is acted upon in a timely manner.	3.59	1.11	.61				
Q25	Our unit is actively doing things to improve patient safety.	3.76	0.99	.54				
Q24	We review our safety procedures and protocols regularly.	3.27	1.14	.48				
Q46	The focus of patient care reviews is on identifying system problems and not on individual blame.	3.41	1.17	.48				
Q30	When things do not go well with a patient, we work together to identify ways to reduce or prevent the chance of recurrence.	3.58	1.09	.47				
Q9	Staff suggestions for improving patient safety are seriously considered.	3.59	1.06	**.47**	.37			
Q41	We are informed about changes that are made as a result of a patient safety occurrence.	3.56	1.08	.43				
Q45	We receive in-service training to update skills and proficiency using the equipment and technology in our unit.	3.69	1.06	.42				
Q19	We participate in regular drills to prepare for common emergency situations.	2.82	1.27	.36				
Q18	I am asked for suggestions on how to improve patient care and safety.	2.89	1.20	.34				
Q4	When a concern is raised there is an effort to act on it and/or feedback is received.	3.60	0.96	.37	**.41**			
Q29	When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.	3.04	1.29	.37				
Q42	There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.	3.07	1.20	.39				
Q20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.	3.23	1.13	.34				

Table 31 (Continued): Item descriptive statistics and factor loadings

	Scale/Items	*Mean*	*SD*	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 2 (n=1,116)								
Q9	Staff suggestions for improving patient safety are seriously considered.	3.59	1.06	**.47**	.37			
Q6	We communicate with each other in a respectful manner.	3.86	0.81		.81			
Q3	We treat each member of our unit with equal respect.	3.64	0.95		.80			
Q7	We are open to hearing each other's points of view.	3.77	0.85		.74			
Q8	We value each other's knowledge base and skill sets.	3.91	0.85		.74			
Q5	We show appreciation for each other's contributions.	3.74	0.89		.62			
Q38	There is a feeling of openness and trust in our unit.	3.50	0.96		.59			
Q2	We know we can count on one another.	4.02	0.84		.52			
Q36	We are able to communicate our points of view without fear of reprisal.	3.45	0.98		.46			
Q32	Input from all disciplines regarding patient care is welcomed and respected.	3.74	1.01		.44			
Q4	When a concern is raised there is an effort to act on it and/or feedback is received.	3.60	0.96	.37	**.41**			
Q10	We are encouraged to make decisions within our own area of expertise.	3.85	0.88		.36			
Q28	I know there is support available whenever I need it.	4.06	0.90		.36			
Q1	My opinion/input is regularly sought.	3.06	1.02		**.34**	.30		
Q26	We overcome individual differences to pull together in the interest of the patient.	3.92	0.88		.34			
Q12	We are encouraged to make decisions with the best interest of the patient in mind.	4.24	0.79		.32			
Factor 3 (n=1,116)								
Q13	I have the skills to manage an emergency safely until someone else arrives to assist or assume management.	3.82	0.96			.76		
Q14	I have the knowledge to identify when someone is about to do something that might threaten patient safety.	3.90	0.80			.36		
Q15	I am comfortable intervening if I see someone about to do something that might threaten patient safety, regardless of their level of authority.	3.62	1.05			.56		
Q37	I am comfortable sharing my observations or concerns in multidisciplinary patient review meetings.	3.23	1.27			.32		
Q16	I feel free to question the decisions or actions of others, regardless of their level of authority.	3.33	1.08			.31		

Table 31 (Continued): Item descriptive statistics and factor loadings

	Scale/Items	*Mean*	*SD*	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 4 (n=1,116)								
Q2	We know we can count on one another.	4.02	0.84		**.52**		.30	
Q28	I know there is+B89 support available whenever I need it.	4.06	0.90			**.36**	.34	
Q49	If we don't know something, we take the initiative to ask someone who does.	4.35	0.72				.60	
Q31	We keep one another appropriately informed about the patient's condition.	4.06	0.78				.48	
Q39	If I don't understand something, I feel free to ask questions.	4.34	0.79				.42	
Q48	We voluntarily share knowledge and experiences with one another.	3.93	0.88				.40	
Q35	Information is communicated accurately between people and between shifts.	3.87	0.82				.39	
Q33	We take the initiative to offer assistance when needed without waiting to be asked.	4.00	0.82				.37	
Q43	Patients are included in discussions and decisions regarding their care.	3.86	1.02				.30	
Factor 5 (n=1,116)								
Q19	We participate in regular drills to prepare for common emergency situations.	2.82	1.27	**.36**				.32
Q37	I am comfortable sharing my observations or concerns in multidisciplinary patient review meetings.	3.23	1.27			**.32**		.31
Q34	I am included in inter-professional meetings regarding patient care and safety.	2.78	1.29					.60
Q27	Multidisciplinary meetings about patient care are a normal part of our practice.	2.96	1.27					.56
Q29	When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.	3.04	1.29					.42
Q42	There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.	3.07	1.20					.40
Q20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.	3.23	1.13					.36
Q40	Information is shared across disciplines on a regular basis.	3.36	1.07					.32

Based on the themes expressed in items clustering under Factor 1, and the potential presence of subscales, Factor 1 was split into two scales: Factor 1A and Factor 1B. Factor 1A was labelled, “Patient Safety is Everyone’s Responsibility” and Factor 1B was labelled, “Learning.” These labels were consistent with the themes expressed in the items as well as the learning outcomes of the MORE^{OB} program. Items inconsistent with the two themes as well as those with loading at or below .40 were deleted. The final items contained in Factor 1 A and Factor 1B, and their loadings, are presented in Table 32 and Table 33, respectively.

Table 32: Factor 1A item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 1A: Patient Safety is Everyone’s Responsibility				
Q53	We have a well-structured process to report potential patient safety hazards.	3.47	1.15	.75
Q52	We have a well-structured process to report unexpected events (errors, near misses).	3.48	1.19	.69
Q17	We are encouraged to report errors, even those that are caught and corrected before affecting the patient.	3.67	1.14	.68
Q21	Patient safety occurrences are investigated thoroughly.	3.55	1.15	.65
Q22	Learning from patient safety occurrences is shared with the entire unit staff.	3.32	1.16	.63
Q23	When a patient safety issue is reported it is acted upon in a timely manner.	3.59	1.11	.61
Q25	Our unit is actively doing things to improve patient safety.	3.76	0.99	.54
Q24	We review our safety procedures and protocols regularly.	3.27	1.14	.48

Table 33: Factor 1B item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 1B: Learning				
Q44	Clinical errors and near misses are used as learning opportunities to improve and prevent recurrences.	3.55	1.14	.75
Q50	We have made improvements as a result of our learning from near misses.	3.56	1.10	.69
Q51	We have made improvements as a result of learning from past clinical errors.	3.67	1.05	.67
Q47	Clinical management processes are examined to identify where errors might be made and how they can be prevented.	3.30	1.16	.65
Q46	The focus of patient care reviews is on identifying system problems and not on individual blame.	3.41	1.17	.48
Q45	We receive in-service training to update skills and proficiency using the equipment and technology in our unit.	3.69	1.06	.42

Factor 2 also contained 16 items. It too had a very high level of internal consistency ($\alpha = 0.93$) and the item homogeneity was low at 0.38. Therefore this factor was also examined for thematic clustering and item reduction. Nine items clustered around the theme, "Valuing Individuals," which was consistent with the learning objectives of the MORE^{OB} program. Items inconsistent with this theme or loading at or below .40 were deleted; seven items were retained. The final items contained in Factor 2, and their loadings, are presented in Table 34.

Table 34: Factor 2 item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 2: Valuing Individuals				
Q6	We communicate with each other in a respectful manner.	3.86	0.81	.81
Q3	We treat each member of our unit with equal respect.	3.64	0.95	.80
Q7	We are open to hearing each other's points of view.	3.77	0.85	.74
Q8	We value each other's knowledge base and skill sets.	3.91	0.85	.74
Q5	We show appreciation for each other's contributions.	3.74	0.89	.62
Q2	We know we can count on one another.	4.02	0.84	.52
Q4	When a concern is raised there is an effort to act on it and/or feedback is received.	3.60	0.96	.41

Originally, Factor 3 had six items. Since item Q1 loaded more strongly on Factor 2 (it was not included in the final list of items because it loaded below the .40 threshold for Factor 2), it was removed from consideration in Factor 3. The dominant theme for these items was, "Empowering People," which was consistent with the learning objectives of the MORE^{OB} program. The final items contained in Factor 3, and their loadings, are presented in Table 35.

Table 35: Factor 3 item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 3: Empowering People				
Q13	I have the skills to manage an emergency safely until someone else arrives to assist or assume management.	3.82	0.96	.76
Q14	I have the knowledge to identify when someone is about to do something that might threaten patient safety.	3.90	0.80	.36
Q15	I am comfortable intervening if I see someone about to do something that might threaten patient safety, regardless of their level of authority.	3.62	1.05	.56
Q37	I am comfortable sharing my observations or concerns in multidisciplinary patient review meetings.	3.23	1.27	.32
Q16	I feel free to question the decisions or actions of others, regardless of their level of authority.	3.33	1.08	.31

Although four items loaded below the desirable cutoff of 0.40, thematically, they seemed to add a more holistic context to the rest of the items; therefore, they were retained in the final model for Factor 3.

Factor 4 started with nine items. Two items were removed because they loaded better on other factors (Q2 and Q28). The dominant theme for these items was, “Open Communication,” which was consistent with the learning objectives of the MORE^{OB} program. Although three items loaded below the desirable cutoff of 0.40, thematically, they seemed to add a more holistic context to the rest of the items; therefore, they were retained. The final items contained in Factor 4, and their loadings, are presented in Table 36.

Table 36: Factor 4 item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 4: Open Communication				
Q49	If we don't know something, we take the initiative to ask someone who does.	4.35	0.72	.60
Q31	We keep one another appropriately informed about the patient's condition.	4.06	0.78	.48
Q39	If I don't understand something, I feel free to ask questions.	4.34	0.79	.42
Q48	We voluntarily share knowledge and experiences with one another.	3.93	0.88	.40
Q35	Information is communicated accurately between people and between shifts.	3.87	0.82	.39
Q33	We take the initiative to offer assistance when needed without waiting to be asked.	4.00	0.82	.37
Q43	Patients are included in discussions and decisions regarding their care.	3.86	1.02	.30

Factor 5 had eight items. Two items were removed because they loaded better on other factors (Q19 and Q37). The dominant theme for these items was, "Teamwork," which was consistent with the learning objectives of the MORE^{OB} program. Although two items loaded below the desirable cutoff of 0.40, thematically, they seemed to add a more holistic context to the rest of the items; therefore, they were retained. The final items contained in Factor 5, and their loadings, are presented in Table 37.

Table 37: Factor 5 item descriptive statistics and loadings

Scale/Items		*Mean*	*SD*	*Loading*
Factor 5: Teamwork				
Q34	I am included in inter-professional meetings regarding patient care and safety.	2.78	1.29	.60
Q27	Multidisciplinary meetings about patient care are a normal part of our practice.	2.96	1.27	.56
Q29	When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.	3.04	1.29	.42
Q42	There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.	3.07	1.20	.40
Q20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.	3.23	1.13	.36
Q40	Information is shared across disciplines on a regular basis.	3.36	1.07	.32

The inter-factor correlation indicates, shown in Table 38, that the correlation across all factors is significant (*p*<.01). Thus, one cannot assume that the six factors are not correlated and therefore, it confirms the use of oblique rotation (Direct Oblimin) rather than orthogonal rotation (Varimax).

Table 38: Inter-factor correlation matrix

		Factor 1A	Factor 1B	Factor 2	Factor 3	Factor 4	Factor 5
1A	Pearson Correlation	1	.843*	.596*	.538*	.621*	.790*
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	1116	1116	1116	1116	1116	1116
1B	Pearson Correlation	.843*	1	.557*	.535*	.600*	.782*
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	1116	1116	1116	1116	1116	1116
2	Pearson Correlation	.596*	.557*	1	.475*	.737*	.584*
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	1116	1116	1116	1116	1116	1116
3	Pearson Correlation	.538*	.535*	.475*	1	.494*	.540*
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	1116	1116	1116	1116	1116	1116
4	Pearson Correlation	.621*	.600*	.737*	.494*	1	.543*
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	1116	1116	1116	1116	1116	1116
5	Pearson Correlation	.790*	.782*	.584*	.540*	.543*	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	1116	1116	1116	1116	1116	1116

*. *Correlation is significant at the 0.01 level (2-tailed).*

4.2.3.2 Multi-Trait Analysis (MTA)

The factors developed through the EFA were used to create summative rating scales in the validation sample (Group 1B, n=1,082), wherein the scale score is the mean of the scores of the individual items contained in that scale.

The key MTA results are summarized in tables 39-44. The first four columns report the question number, text, mean and standard deviations for all the items (since this analysis is for Group 1B, the mean and standard deviation are different from those reported earlier in Tables 31-36; for Group 1B, n = 1,082). The remaining columns of each table report item-to-scale correlations. The boxedcoefficients are the corrected correlations between each item and the remaining items in the hypothesized scale, which is a measure of convergent validity. Comparing these correlations with others in the same row indicates the discriminant validity, which is the extent to which that item measures the hypothesized dimension of safety climate rather than any other dimension.

The convergent item-scale correlations were between 0.46 and 0.74 across the six proposed scales (median, 0.67). Generally, the threshold for the corrected (adjusted for overlap) item-to-scale correlation is set at 0.40 (Kerlinger, 1973; Ware, Harris, Gandek, Rogers, & Reese, 1997). In this study, 100 per cent of the scales met this criterion.

A review of the correlations between each item and its hypothesized scale/factor in contrast to the other scales revealed good item discriminant validity. For example in Table 39, the first row indicates that item Q53 had a corrected item-to-scale correlation of 0.74 and the correlation between item and all other scales was lower than 0.74. Thus, while this item did well in measuring the construct represented by Factor 1A (Patient Safety is Everyone’s Responsibility), it did not measure any other construct as well. The selected items loaded higher on their own hypothesized scale than on any other scale in 187 out of 195 comparisons, yielding a discriminant validity quotient of 96 per cent.

Table 39: Item descriptive statistics and item-to-scale correlations for Factor 1A

Scale/Items		*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 1A: Patient Safety is Everyone's Responsibility									
Q53	We have a well-structured process to report potential patient safety hazards.	3.48	1.18	.74	.68	.48	.46	.50	.61
Q52	We have a well-structured process to report unexpected events (errors, near misses).	3.51	1.22	.71	.65	.45	.42	.46	.61
Q17	We are encouraged to report errors, even those that are caught and corrected before affecting the patient.	3.70	1.13	.61	.58	.44	.35	.49	.50
Q21	Patient safety occurrences are investigated thoroughly.	3.54	1.20	.69	.66	.40	.42	.39	.60
Q22	Learning from patient safety occurrences is shared with the entire unit staff.	3.36	1.18	.71	.70	.50	.39	.50	.66
Q23	When a patient safety issue is reported it is acted upon in a timely manner.	3.61	1.13	.65	.63	.46	.47	.46	.58
Q25	Our unit is actively doing things to improve patient safety.	3.75	1.01	.68	.66	.52	.40	.53	.60
Q24	We review our safety procedures and protocols regularly.	3.35	1.14	.71	.67	.52	.43	.53	.64

Table 40: Item descriptive statistics and item-to-scale correlations for Factor 1B

Scale/Items		*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 1B: Learning									
Q44	Clinical errors and near misses are used as learning opportunities to improve and prevent recurrences.	3.59	1.15	.70	.71	.47	.42	.49	.62
Q50	We have made improvements as a result of our learning from near misses.	3.60	1.12	.68	.74	.44	.45	.48	.60
Q51	We have made improvements as a result of learning from past clinical errors.	3.70	1.08	.69	.72	.48	.46	.52	.58
Q47	Clinical management processes are examined to identify where errors might be made and how they can be prevented.	3.30	1.17	**.71**	.71	.46	.46	.47	.68
Q46	The focus of patient care reviews is on identifying system problems and not on individual blame.	3.46	1.18	.64	.67	.48	.46	.48	.64
Q45	We receive in-service training to update skills and proficiency using the equipment and technology in our unit.	3.69	1.10	**.58**	.52	.44	.45	.49	.50

Table 41: Item descriptive statistics and item-to-scale correlations for Factor 2

Scale/Items		*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 2: Valuing Individuals									
Q6	We communicate with each other in a respectful manner.	3.88	0.81	.43	.40	.74	.31	.57	.40
Q3	We treat each member of our unit with equal respect.	3.70	0.94	.44	.43	.71	.34	.51	.40
Q7	We are open to hearing each other's points of view.	3.81	0.85	.48	.48	.73	.39	.58	.45
Q8	We value each other's knowledge base and skill sets.	3.94	0.86	.44	.42	.71	.34	.58	.40
Q5	We show appreciation for each other's contributions.	3.78	0.91	.50	.48	.72	.39	.60	.46
Q2	We know we can count on one another.	4.02	0.82	.44	.43	.66	.32	.61	.40
Q4	When a concern is raised there is an effort to act on it and/or feedback is received.	3.65	0.96	**.62**	**.58**	.58	.43	.53	.56

Table 42: Item descriptive statistics and item-to-scale correlations for Factor 3

Scale/Items		*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 3: Empowering People									
Q13	I have the skills to manage an emergency safely until someone else arrives to assist or assume management.	3.87	0.93	.25	.24	.18	.49	.28	.24
Q14	I have the knowledge to identify when someone is about to do something that might threaten patient safety.	3.94	0.81	.38	.36	.32	.55	.44	.32
Q15	I am comfortable intervening if I see someone about to do something that might threaten patient safety, regardless of their level of authority.	3.67	1.06	.42	.41	.37	.63	.38	.39
Q37	I am comfortable sharing my observations or concerns in multidisciplinary patient review meetings.	3.30	1.26	.46	**.49**	.35	.48	.31	**.58**
Q16	I feel free to question the decisions or actions of others, regardless of their level of authority.	3.39	1.07	.43	.43	.44	.59	.40	.43

Table 43: Item descriptive statistics and item-to-scale correlations for Factor 4

Scale/Items		*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 4: Open Communication									
Q49	If we don't know something, we take the initiative to ask someone who does.	4.35	0.75	.45	.47	.53	.33	.71	.35
Q31	We keep one another appropriately informed about the patient's condition.	4.10	0.79	.47	.44	.55	.36	.66	.37
Q39	If I don't understand something, I feel free to ask questions.	4.34	0.79	.39	.41	.53	.39	.59	.31
Q48	We voluntarily share knowledge and experiences with one another.	3.96	0.89	.51	.50	.60	.39	.67	.42
Q35	Information is communicated accurately between people and between shifts.	3.88	0.82	.48	.48	.53	.32	.60	.43
Q33	We take the initiative to offer assistance when needed without waiting to be asked.	4.00	0.83	.51	.50	.58	.43	.65	.43
Q43	Patients are included in discussions and decisions regarding their care.	3.85	1.05	.41	.41	.43	.30	.46	.38

Table 44: Item descriptive statistics and item-to-scale correlations for Factor 5

	Scale/Items	*Mean*	*SD*	*Factor 1A*	*Factor 1B*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Factor 5: Teamwork									
Q34	I am included in inter-professional meetings regarding patient care and safety.	2.84	1.33	.48	.49	.32	.46	.28	.62
Q27	Multidisciplinary meetings about patient care are a normal part of our practice.	3.00	1.28	.62	.59	.43	.42	.38	.72
Q29	When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.	2.98	1.30	.61	.62	.43	.46	.37	.68
Q42	There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.	3.09	1.22	.69	.70	.50	.46	.46	.71
Q20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.	3.24	1.14	.64	.61	.48	.40	.42	.66
Q40	Information is shared across disciplines on a regular basis.	3.41	1.06	**.60**	**.59**	.50	.38	.56	.59

Finally, Table 45 presents inter-scale correlations, which could be used to further verify the validity and reliability of the scales. The inter-scale correlations range between 0.46 and 0.85 with a mean of 0.62. The diagonal entries are all higher than the inter-scale correlations. Thus, the scales are not interchangeable and measure distinguishable aspects of patient safety climate among the sample population.

Table 45: Inter-scale correlations

	Factor 1A	Factor 1B	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1A	1					
Factor 1B	0.85	1				
Factor 2	0.61	0.59	1			
Factor 3	0.54	0.54	0.46	1		
Factor 4	0.63	0.63	0.73	0.49	1	
Factor 5	0.78	0.77	0.57	0.56	0.53	1

4.2.3.3 Confirmatory Factor Analysis of the Safety Climate Survey Instrument

The six-factor model developed from exploratory factor analysis and validated by multi-trait analysis served as the hypothesis for the confirmatory factor analysis. Thus, the hypothesis was that patient safety climate in obstetrics could be represented by a six-factor model consisting of the following:

1. Patient Safety is Everyone's Priority: Items 17, 21, 22, 23, 24, 25, 52, 53
2. Learning: Items 44, 45, 46, 47, 50, 51
3. Valuing Individuals: Items 2, 3, 4, 5, 6, 7, 8
4. Empowering People: Items 13, 14, 15, 16, 37
5. Open Communication: Items 31, 33, 35, 39, 43, 48, 49
6. Teamwork: Items 20, 27, 29, 34, 40, 42

Figure 14 shows the CFA model. Since the previous analysis (Table 37) demonstrated that all the factors were correlated, this CFA model also illustrates that all factors are inter-related.

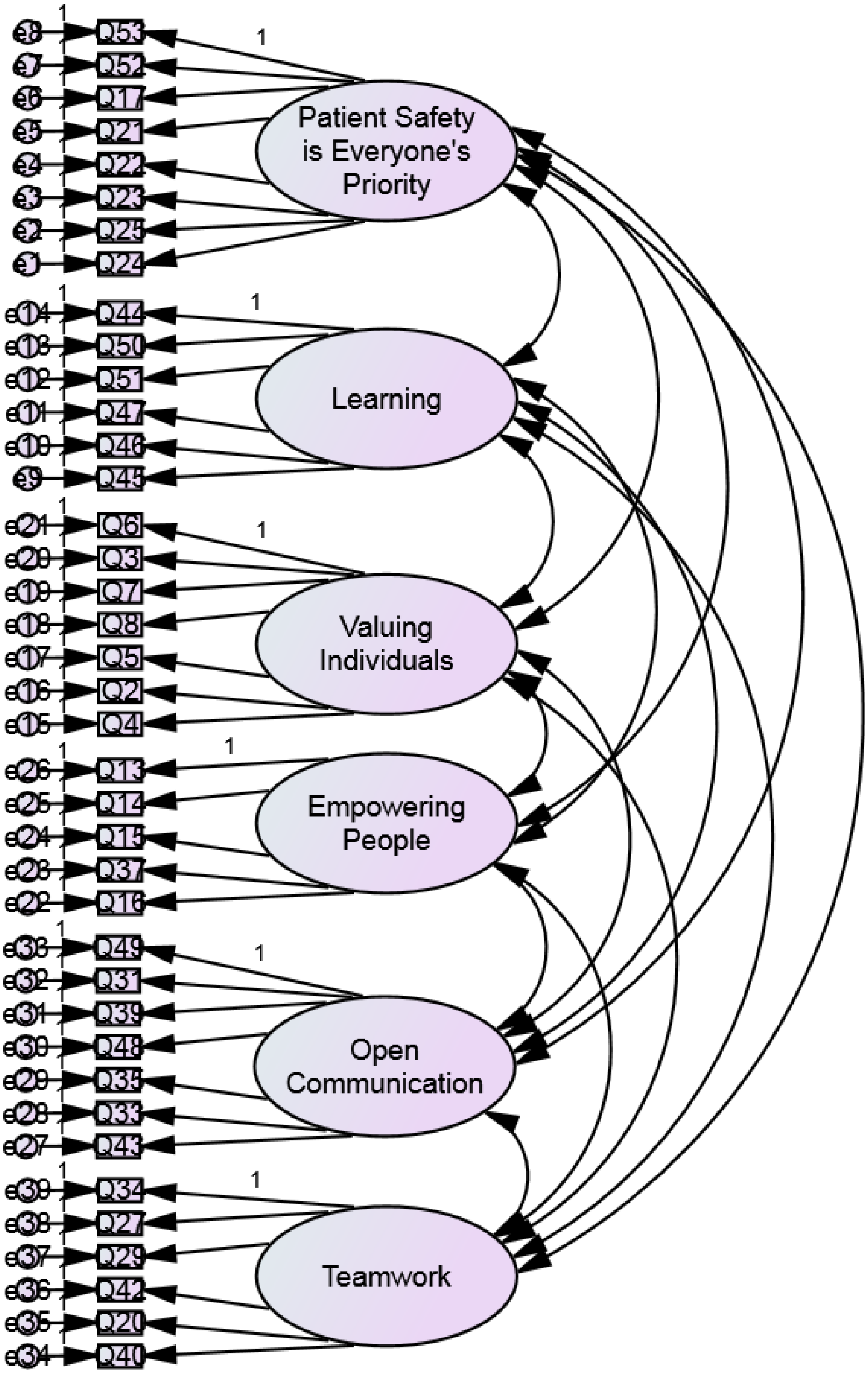


Figure 14: CFA Model with six inter-related factors

A different random sample (Group 1C) of approximately 50 per cent of the pre-training safety climate surveys was selected. After eliminating the cases with missing data, 1082 cases were left. One assumption of structural equation modeling is the absence of multicollinearity within factors, which is a measure of correlation between items that are included in a given factor (Tabachnick & Fidell, 2012). Table 46 presents the variance inflation factor (VIF) and tolerance scores for each factor. In order to rule out multicollinearity, the VIF score should be below 3.0 and the tolerance should be greater than .10 (Tabachnick & Fidell, 2012). All six factors demonstrated absence of multicollinearity.

Table 46: Variable inflation factor scores and tolerances for the six-factor model

Factor	VIF		Tolerance	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Patient Safety is Everyone's Priority	1.657	2.518	.397	.603
Learning	1.382	2.627	.381	.724
Valuing Individuals	1.541	2.317	.432	.649
Empowering People	1.224	1.816	.551	.817
Open Communication	1.293	2.089	.479	.773
Teamwork	1.287	2.134	.469	.777

Another critical assumption of structural equation modeling was multivariate normality (Byrne, 2010, p.102), it was essential to test whether or not the data conformed to this requirement. First, using (West, Finch, & Curran, 1995) guidance on evaluation of univariate kurtosis, no single item was over the threshold of 7.00. Thus, the sample was not kurtotic at the univariate level. Examination of multivariate kurtosis revealed that the critical ratio value was 164.74, which is substantially higher than the threshold of 5.00 suggested by Bentler (2005). Thus, the standard Maximum Likelihood estimation technique could not be used without some remedies.

In accordance with the strategy adopted by Simon and Esau (2004), a two-step approached was used. First, the sample was examined for evidence of multivariate outliers using Mahalanobis distance, and second, when elimination of cases[4] with excessive Mahalanobis distance did not bring the multivariate normality within allowable limits, bootstrapping with Bollen-Stine correction was used. The final sample size was 1049 cases and 2,000 bootstrap subsamples.

Table 47 presents the model fit statistics for the CFA Model. The hypothesized model achieved a reasonable fit. The hypothesized model was a poor fit based on χ^2 alone: $\chi^2(687, N=1049) = 2676$, $p<.001$. However, since χ^2 is not a reliable indicator of model fit (it tends to be heavily influenced by sample size), other goodness-of-fit indicators have been recommended (Hu & Bentler, 1995). Based on the additional robust statistics, χ^2/df was above the conservative value of 3.0, but under the acceptable value of 5.0; NFI was slightly under the acceptable value of .90; the CFI and TLI were between the acceptable and conservative (above.90 to above .95); and RMSEA met the conservative criteria.

Table 47: Goodness-of-fit measures for the CFA Model

	Goodness-of-Fit Measures						
Models	χ^2	*df*	χ^2/df	NFI	CFI	TLI	RMSEA
Minimal Value	-	-	< 5.0	> .90	> .90	> .90	< .06
Hypothesized six-factor model	2676	687	3.895	.894	.919	.913	.053
Final Model	1039	335	3.101	.945	.962	.957	.045

Next, each factor was further examined for squared multiple correlations (R^2 values) and path loadings (β values). Path loadings are a measure of the strength

[4] 33 cases with the greatest Mahalanobis distance were eliminated; resulting sample size was 1049 and the critical ratio for multivariate normality was brought down to 117.02 (still too high)

of the relationship between the survey item (indicator) and the factor (latent variable); thus, higher the path loading, the stronger the contribution of the survey item toward the factor. The R^2 value represents the degree to which variance in the latent factor could be explained by the indicator; thus, the higher the R^2 value, the stronger the role of the survey item. Items with R^2 value lower than .50 or β values lower than .70 were eliminated. Table 48 lists the items that were eliminated from the respective factors.

Table 48: Items eliminated due to low regression weights or path loadings

Factor	Item	R^2 value	β value
Patient Safety is Everyone's Priority	17	.49	.67
Learning	45	.37	.61
Valuing Individuals	4	.44	.67
Empowering People	13	.28	.53
	14	.41	.64
	37	.35	.59
Open Communication	35	.46	.68
	39	.43	.66
	43	.29	.54
Teamwork	34	.42	.65
	40	.45	.67

The model fit data reported in Table 47 under Final Model represent results after eliminating items listed in Table 48. This revised model was a much stronger fit. Next, factors 1 and 2 were combined to determine whether there was any support for a five-factor model, as identified in the Scree Plot (Figure 12), this model produced the following measures: χ^2=1117, df= 340, χ^2/ df =3.28, NFI=.941, CFI=.958, TLI=.953, and RMSEA=.047. These results are certainly supportive of a good model fit, but slightly inferior to the final model with six factors.

Figure 15 presents the final six-factor CFA Model.

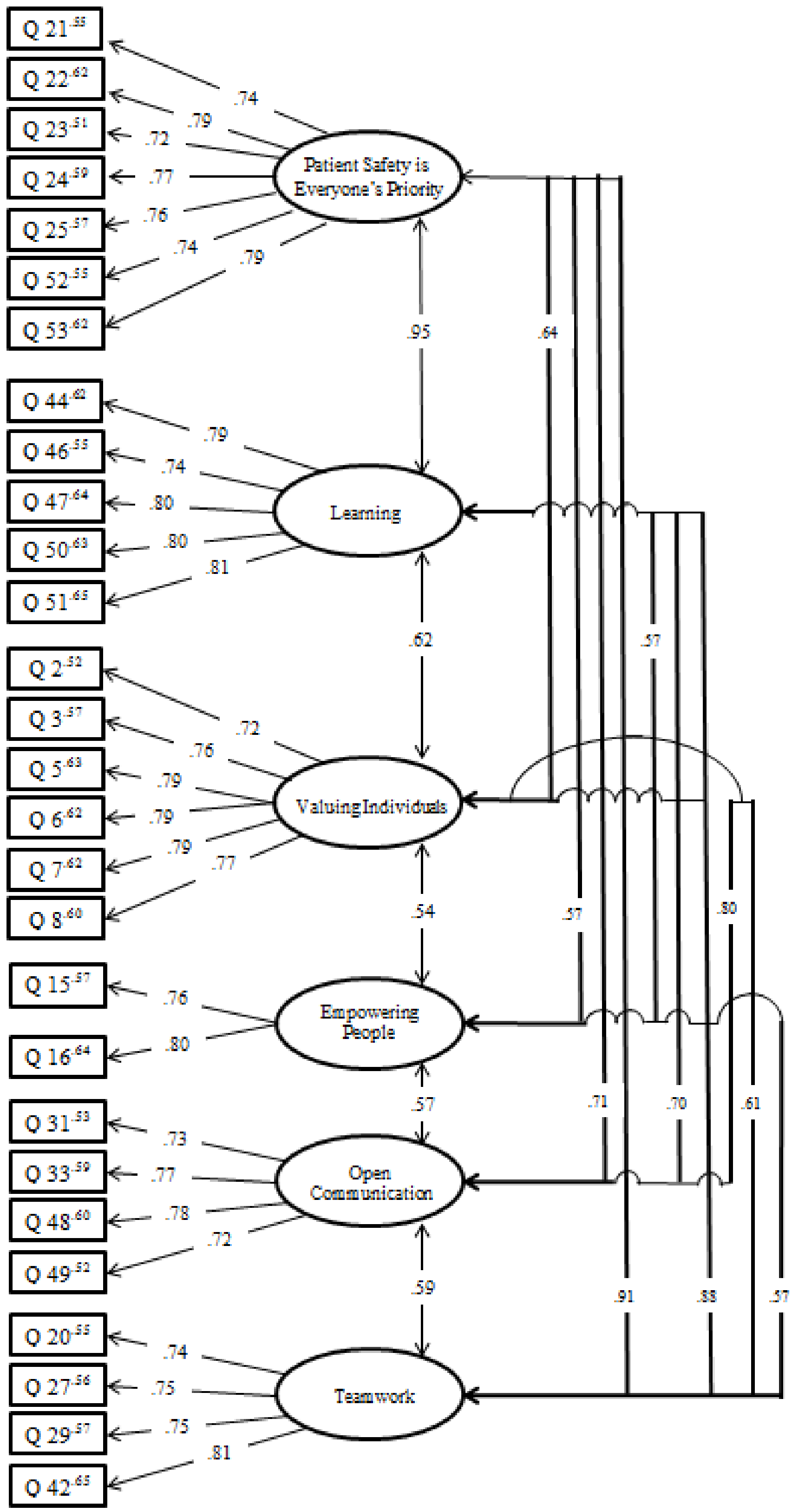


Figure 15: CFA Model with factor loadings

Table 49 presents the factor loadings from the EFA and CFA models, and Table 50 presents the inter-factor correlations derived from the CFA model. Generally, the factor loadings as well as the inter-factor correlations are stronger with CFA than with EFA.

Table 49: Factor loadings comparisons between EFA and CFA

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 1: Patient Safety is Everyone's Responsibility			
Q53	We have a well-structured process to report potential patient safety hazards.	.75	.79
Q52	We have a well-structured process to report unexpected events (errors, near misses).	.69	.75
Q21	Patient safety occurrences are investigated thoroughly.	.65	.74
Q22	Learning from patient safety occurrences is shared with the entire unit staff.	.63	.78
Q23	When a patient safety issue is reported it is acted upon in a timely manner.	.61	.71
Q25	Our unit is actively doing things to improve patient safety.	.54	.75
Q24	We review our safety procedures and protocols regularly.	.48	.77

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 2: Learning			
Q44	Clinical errors and near misses are used as learning opportunities to improve and prevent recurrences.	.75	.79
Q50	We have made improvements as a result of our learning from near misses.	.69	.79
Q51	We have made improvements as a result of learning from past clinical errors.	.67	.80
Q47	Clinical management processes are examined to identify where errors might be made and how they can be prevented.	.65	.79
Q46	The focus of patient care reviews is on identifying system problems and not on individual blame.	.48	.74

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 3: Valuing Individuals			
Q6	We communicate with each other in a respectful manner.	.81	.78
Q3	We treat each member of our unit with equal respect.	.80	.75
Q7	We are open to hearing each other's points of view.	.74	.79
Q8	We value each other's knowledge base and skill sets.	.74	.77
Q5	We show appreciation for each other's contributions.	.62	.79
Q2	We know we can count on one another.	.52	.72

Table 49: (Continued): Factor loadings comparisons between EFA and CFA

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 4: Empowering People			
Q15	I am comfortable intervening if I see someone about to do something that might threaten patient safety, regardless of their level of authority.	.56	.76
Q16	I feel free to question the decisions or actions of others, regardless of their level of authority.	.31	.72

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 5: Open Communication			
Q49	If we don't know something, we take the initiative to ask someone who does.	.60	.74
Q31	We keep one another appropriately informed about the patient's condition.	.48	.73
Q48	We voluntarily share knowledge and experiences with one another.	.40	.76
Q33	We take the initiative to offer assistance when needed without waiting to be asked.	.37	.74

Scale/Items		*EFA Loading*	*CFA Loading*
Factor 6: Teamwork			
Q27	Multidisciplinary meetings about patient care are a normal part of our practice.	.56	.76
Q29	When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.	.42	.75
Q42	There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.	.40	.81
Q20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.	.36	.74

Table 50: Inter-factor correlation matrix comparison

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1 Pearson Correlation CFA	1	.				
2 Pearson Correlation CFA	.843* .947^{+}	1				
3 Pearson Correlation CFA	.596* .638^{+}	.557* .621^{+}	1			
4 Pearson Correlation CFA	.538* .565^{+}	.535* .573^{+}	.475* .541^{+}	1		
5 Pearson Correlation CFA	.621* .706^{+}	.600* .695^{+}	.737* .803^{+}	.494* .566^{+}	1	
6 Pearson Correlation CFA	.790* .906^{+}	.782* .884^{+}	.584* .606^{+}	.540* .571^{+}	.543* .585^{+}	1

*. *Correlation is significant at the 0.01 level (2-tailed).*
$^{+}$. *Correlation is significant at the 0.001 level (2-tailed).*

Next, a second-order CFA was conducted to test whether Patient Safety Climate could be represented by a six-factor model. Table 51 illustrates the goodness-of-fit measures for this model and Figure 16 represents the second-order CFA model with path loadings.

Table 51: Goodness-of-fit measures for the second-order CFA Model

	Goodness-of-Fit Measures						
Models	χ^2	*df*	χ^2/ df	NFI	CFI	TLI	RMSEA
Minimal Value	-	-	< 5.0	> .90	> .90	> .90	< .06
Second-order CFA Model with six factors	1397	344	4.061	.926	.943	.937	.054

Based on these analyses, patient safety climate can be represented by a multi-factor model consisting of six factors: (1) patient safety is everyone's responsibility; (2) learning; (3) valuing individuals; (4) empowering people; (5) open communication; and (6) teamwork.

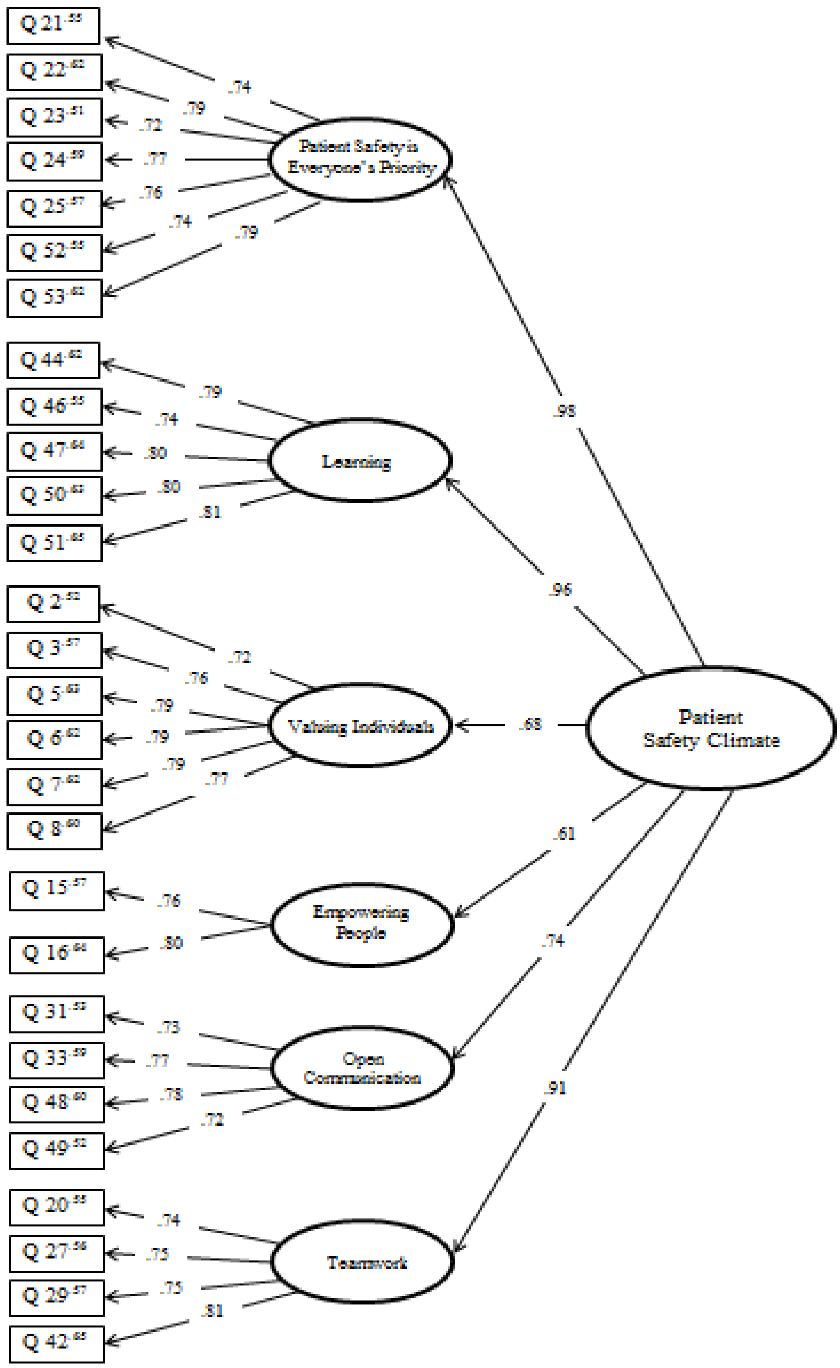


Figure 16: Second-order CFA Model with path loadings

4.2.3.4 Conclusion from the Safety Climate Survey Instrument Analysis

The analysis conducted in this section proves that the Safety Climate Survey instrument used by the Salus Global Corporation has both convergent and discriminant validity. There are six underlying constructs that could be used to represent safety climate in obstetrics units since this instrument was implemented in such facilities. The six factors that represent the safety climate are as follows:

1. Patient Safety is Everyone's Priority
2. Learning
3. Valuing Individuals
4. Empowering People
5. Open Communication
6. Teamwork

Four of these six factors are consistent with the safety climate elements identified in the emergent, integrated model of culture and climate (Section 2.5, p.73). Leadership, Evidence-based Practice, and Accountability are not represented in the six-factor model. These factors may be considered for inclusion in future development of Salus Global's safety climate survey. However, at the present time, all six factors are consistent with Singer et al.'s (Singer et al., 2007) model. Factor 1 (Patient Safety is Everyone's Priority) addresses all three components of Singer et al.'s organizational factors: senior managers' engagement, organizational resources, and overall emphasis on safety. Factor 2 (Learning) is consistent with Singer et al.'s learning component in the individual-level factor. Factor 3 (Valuing Individuals) addresses Singer et al.'s unit-level factors and components like safety norms and recognition and support for safety. This factor is about the obstetrics unit valuing and respecting individuals. Factor 4 (Empowering People) takes a positive approach to individual-level perceptions; whereas, Singer et al. use fear of blame and fear of shame as two constituent components of the individual factor. Factor 5 (Open Communication) represents opinions regarding how individual members of the obstetrics team keep each other informed and how comfortable they are in sharing knowledge as well as including patients in their conversation. Thus, this is a unit-level factor. Factor 6 (Teamwork) is also consistent with Singer et al.'s unit-level factor because the items contained in this factor address opinions regarding the effectiveness of obstetrics teams (including patients). Thus, this theoretical model of safety climate, although it has some different components, is consistent with the overall structure presented by Singer et al (2007); it is mapped against Singer et al.'s model in Figure 17.

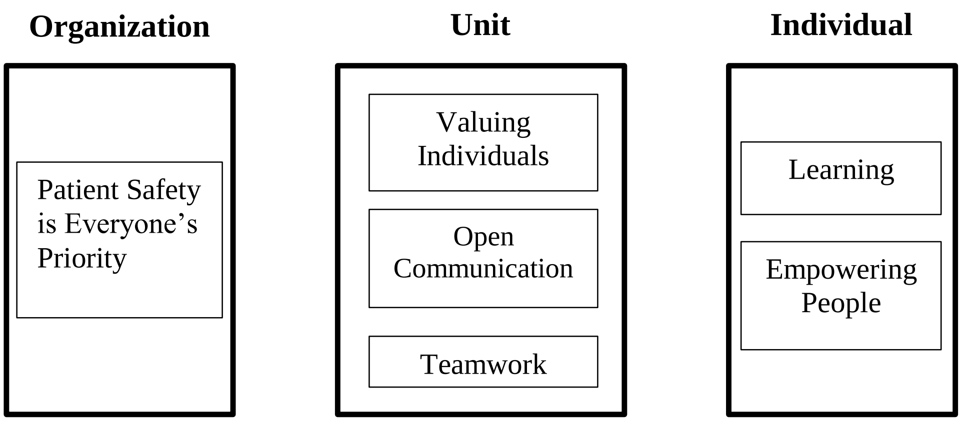


Figure 17: Comparison with Singer et al.'s model of safety climate in obstetrics

4.2.3.5 Results of Safety Climate Assessment

In order to test whether participants' perceptions of the safety climate were relatively homogeneous, the variance of safety climate scores within obstetrics groups was compared with the variance between obstetrics groups (n=68 and 13,123 individual responses) similar to the way Zohar (1980) justified his aggregation from individual to factory-level assessment. The resulting F ratio, $F(67,13146)$ ranged from 8.523 to 27.708; it was highly significant for all six climate factors at p=.000, justifying the level of analysis for safety climate at the obstetrics group level. Additionally, the level of agreement for such aggregation was verified based on the $r_{WG(J)}$ index. For large group sizes (n=>25), (Cohen, Doveh, & Nahum-Shani, 2009) demonstrated that a threshold of .50 is adequate and (LeBreton & Senter, 2008) consider the agreement level between .51 and .70 moderate, but acceptable. The computed $r_{WG(J)}$ index for each factor and obstetrics unit ranged between .55 and .94; the $r_{WG(J)}$ index for obstetrics group to adopter level aggregation ranged from .67 to .93. Since all group sizes were greater than 25, for both levels of aggregation, the $r_{WG(J)}$ index was above the threshold recommended by Cohen et al. (2009): about 10 per cent were between .55 and .69. A detailed table of $r_{WG(J)}$ index values is provided in Appendix C.

Additionally, since the climate model is a multi-class model (individual level to obstetrics group level, and obstetrics group to adopter level) Interclass Correlation (ICC-2) was performed. Table 52 presents the results of this comparison. The ICC-2 values ranged between .80 and .97, well above the threshold of .70 (Field, 2013), justifying group-level analysis.

Table 52: Inter-rater reliability

Individual (n=13,123) to Obstetrics Group (n=68) Level Aggregation and Obstetrics Group to Adopter (n=2) Level Aggregation

Factor	Obstetrics Groups MS		Adopter Groups MS		ICC (2)	
	Between Groups (n=68)	Within Groups (n=68)	Between Groups (n=2)	Within Groups (n=2)	Obstetrics Groups (n=68)	Adopter Groups (n=2)
1	11.779	.615	24.532	.669	.95	.97
2	12.62	.652	8.313	.711	.95	.91
3	6.849	.382	8.015	.413	.94	.95
4	6.546	.729	3.892	.758	.89	.80
5	2.877	.337	2.591	.349	.88	.87
6	22.03	.795	28.868	.899	.96	.97

Figure 18 illustrates the pre-training comparison between the two groups (Group 1: Early Adopters (n=39) and Group 2: Late Adopters (n=29)) across all six factors. The 2-tailed significance for all the differences in mean scores between the two groups was significant (*p <.05)* for all factors.

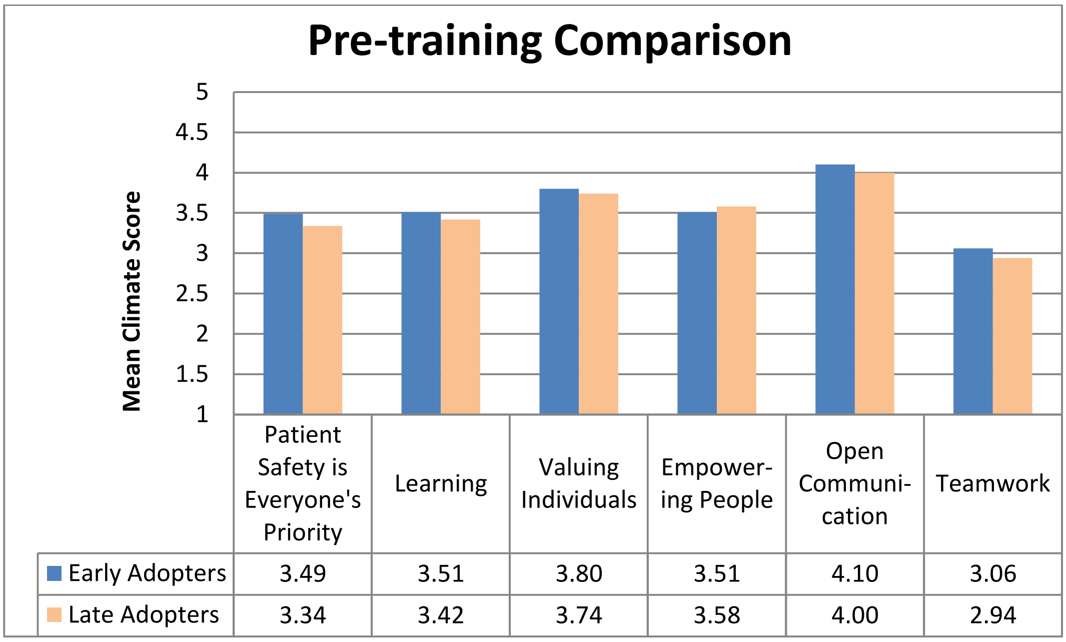
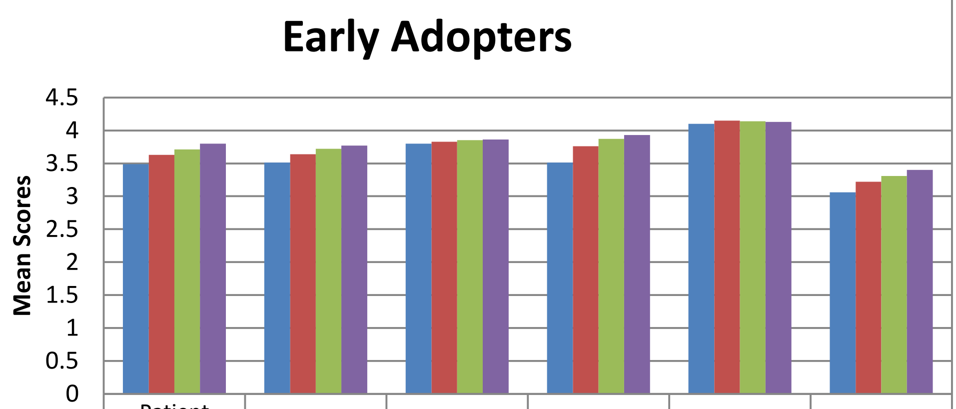


Figure 18: Pre-training comparison between early adopter and late adopter groups

The survey of the pre-training climate at the Early Adopter hospitals was conducted in 2006; while the same survey at the Late Adopter hospitals was conducted in 2009. Both surveys were conducted immediately prior to starting the first MORE^{OB} training module. Considering that the MORE^{OB} program was available to both groups at the same time (in 2006), but one group (the early adopters) chose to implement it first—and three years ahead of the second group—it is not surprising that the early adopter group scored higher on five of the six factors in the pre-training comparison. Thus, one could conclude that there might have been differences in the underlying safety cultures at the early-adopter healthcare facilities versus the late-adopter hospitals.

The post-training surveys were conducted immediately after each training module. In the case of the Early Adopters, the pre-training survey was conducted in 2006, the post-module 1 survey was conducted in 2007, the post-module 2 survey was conducted in 2008, and the post-module 3 survey was conducted in 2009. Within this group, Figure 19 shows changes in safety climate scores across all six factors, starting with pre-training scores and each training module thereafter. Scores for factors 1, 2, 4, and 6 (Patient safety is everyone's priority, learning, empowering people, and teamwork, respectively) improved successively and substantially over the period of the three modules. Scores for factors 3 (valuing individuals) and 5 (open communication) were higher than other factors prior to the MORE^{OB} training, but they too showed slight improvement.



	Patient Safety is Everyone's Priority	Learning	Valuing Individuals	Empower-ing People	Open Communi-cation	Teamwork
Pre-Training	3.49	3.51	3.80	3.51	4.10	3.06
Module 1	3.63	3.64	3.83	3.76	4.15	3.22
Module 2	3.71	3.72	3.85	3.87	4.14	3.31
Module 3	3.80	3.77	3.86	3.93	4.13	3.40

Figure 19: Improvement in safety climate in response to the MORE^{OB} training

Latent Growth Curve Modeling (LGM), for the Early Adopter Group, on Patient Safety is Everyone's Priority (Factor 1) achieved CFI and TFI of .957 and .967, respectively, indicating a good model fit. The intercept was 3.341 and the slope was .467. Thus, the average starting score for Factor 1 is 3.34 out of 5.00 and there was an average improvement in this score by .47 after every module. Table 53 presents comparable data for all six factors for both groups (Early Adopters and Late Adopters). In the case of Early Adopters, the average starting score for Open Communication (Factor 5) was the highest and improved the least over the three modules; whereas, the average starting score for Teamwork (Factor 6) was the lowest and improved the most over the three modules. In the case of Late Adopters, the model fit was not as strong for the first factor, but it was much stronger for the other factors. Similar to the Early Adopters, the Late Adopters had average starting score for Teamwork (Factor 6) at the lowest and it improved significantly over the three modules; however, the most improvement was noted for Patient Safety is Everyone's Priority (Factor 1). In all cases, these estimates were based on a linear model, which is consistent with the theoretical construct that climate would improve gradually along a linear growth curve; however, quadratic estimation was also conducted to test whether there was an alternate explanation. In this test, although the model fit statistics remained stable, the intercept and slope data were substantially lower. Thus, it was clear that climate improvement would be gradual and best estimated using a linear model. Figure 20 illustrates the LGM structure, which was applied across all six factors.

Assuming that the MORE^{OB} program was the only patient safety intervention during the period in which the various training modules were implemented, one could conclude that the MORE^{OB} training program contributed toward a substantive improvement in the safety climate at the participating healthcare facilities. Thus, the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level patient safety climate (H_2) is supported.

Table 53: Latent growth curve statistics

Early Adopters		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1	CFI	.957	.974	.975	.990	.986	.966
2	TLI	.967	.981	.981	.993	.989	.975
3	Intercept	3.341	3.353	3.737	3.491	4.103	2.847
4	Slope	.467	.405	.125	.465	.058	.507
Late Adopters							
1	CFI	.868	.927	.900	.976	.960	.938
2	TLI	.901	.945	.925	.982	.970	.954
3	Intercept	3.314	3.394	3.762	3.607	4.099	2.853
4	Slope	.536	.413	.138	.488	.076	.515

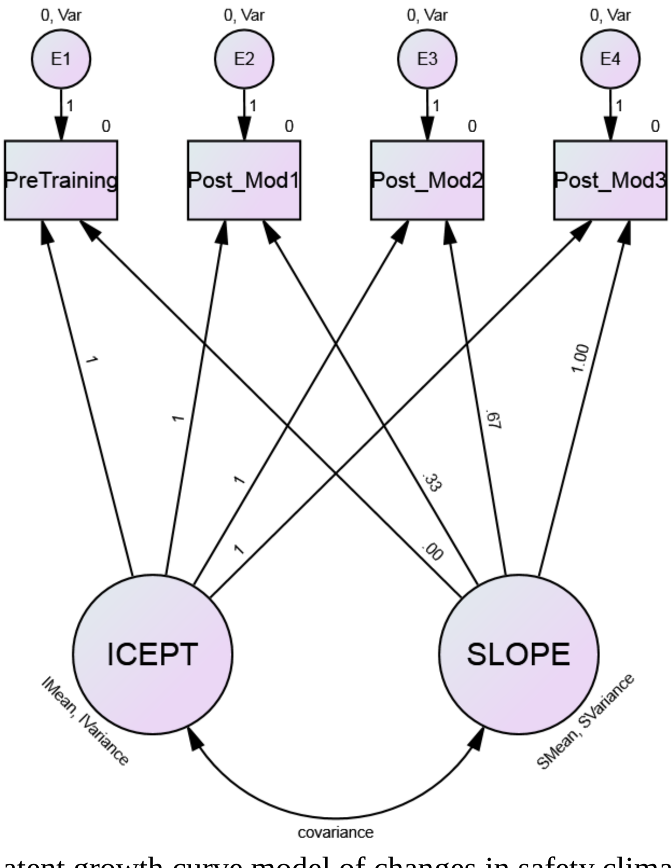


Figure 20: Latent growth curve model of changes in safety climate after each module

4.2.4 Correlation between Knowledge, Climate, and Clinical Outcomes

Similar to Warr et al.'s (1999) correlational analysis, in order to test the relationship between changes in knowledge, climate, and clinical outcomes, the improvement in the knowledge examination scores was compared with the improvement in patient safety climate, and improvements in patient safety climate were compared to the improvements in postpartum hemorrhage and length of stay scores. Of the six available scales in the patient safety climate survey, the scales with greatest improvement were selected for comparison as an example of best case scenario. Thus, for the Early Adopter group, the selected scale was Teamwork, and for the Late Adopter group, the selected scale was Patient Safety is Everyone's Priority. Since Postpartum Hemorrhage (PPH) and Length of Stay (LoS) showed the most improvements, they were used for this analysis. Table 54 shows the results of correlational analysis.

Table 54: Correlation between knowledge, climate, and clinical outcomes

	Knowledge		PPH		LoS	
	Adopter Group		Adopter Group		Adopter Group	
	Early	Late	Early	Late	Early	Late
Climate	.779	.989	-.556	-.532	-.866	-.532

Based on the above results, change in patient safety climate was highly correlated with change in knowledge. Thus, greater improvement in knowledge is likely to be associated with a greater improvement in patient safety climate. Also, changes in patient safety climate showed good correlation with improvements in clinical outcomes. The negative correlation between climate and clinical outcomes illustrates that as the patient safety climate scores improve, the average number of PPH cases and the average Length of Stay (in days) decreases. In general, a change in knowledge exam scores or a change in patient safety climate scores could serve as an early indicator of changes in clinical outcomes.

4.3 Discussion of Training Influence on Performance Outcomes and Climate

The pre/post training knowledge and climate assessments were completed immediately before and after each training module. As reported earlier, the change in knowledge exam scores was significant and can be attributed to the MORE^{OB} training. Since the knowledge assessment was most proximal to the training and aligned with the training content, and there were no other known interventions targeted at improving the participants' knowledge, one could conclude that the first outcome of a training intervention is improvement in participants' knowledge (learning). Since each module was covered over an 8-12 month period concurrent with the participants' experience of their work environment, the post-training climate scores are likely to be reflective of the psychological response to the new shared experience of the entire obstetrics team going through the training together and sensemaking associated with the content of the training itself, as well as any new workplace behaviors or changes in their workplace shared experiences. Since the knowledge scores showed significant improvements, the conditions must have been conducive to changes in workplace behaviors and creation of new shared experiences in the workplace, implementation of new policies, performance standards, and procedures, as well as role-modeling by leaders and key influencers. Participants' experiences between Module 1 and Module 2, are likely to have also contributed toward the improvement in post-Module 2 climate scores, and experiences between Module 2 and Module 3 are likely to have contributed to post-Module 3 climate scores.

Successive improvements in safety climate scores after Module 2 and Module 3 indicate improvement in the organizational safety climate, suggesting a positive response to behaviors of leaders and key influencers, satisfaction with the implementation mechanism and potential change in values, beliefs, and assumptions. Furthermore, since the post-Module 2 and post-Module 3 climate scores in "Teamwork" showed the highest improvement among Early Adopters and those in "Patient Safety is Everyone's Priority" showed the highest improvement among Late Adopters, there must have been factors other than the training intervention that reinforced the importance of these two attributes.

A review of the reduced-risk C-section (RRC) rates indicates that prior to the implementation of the MORE^{OB} training, the RRC rate was on the rise; however, after the implementation of the MORE^{OB} training, the RRC rate stabilized at a slightly lower value for the first two years, climbed slightly, and then started to decline. The difference in the RRC rates before MORE^{OB} and after MORE^{OB} was not significant. Thus, it may take longer than six years (the most data available since the first MORE^{OB} module) for the RRC rate to show significant improvement. On the other hand, the postpartum hemorrhage (PPH) rate showed a significant improvement after the MORE^{OB} training in the Early Adopter group, but not in the Late Adopter group. Also, the pre-post difference in the Length of Stay was not significant in the Early Adopter group, although the differences between the experimental groups (Early Adopter and Late Adopter) versus the control group (Non-Adopter) were significant. Thus, one could conclude that (a) there was a lag in the manifestation of improvements in clinical performance outcomes and (b) there might have been other factors impeding the influence of training on clinical performance outcomes. The delay in transfer of training from knowledge gain to behavioral change and further delay in transfer of training to group-level performance, as well as confounding with non-training factors, has been supported by many other studies (Alvarez et al., 2004; Arthur, Bennett, Edens, & Bell, 2003; Baldwin & Ford, 1988; Birdi, 2007; Blume et al., 2010; Elangovan & Karakowsky, 1999; Sitzman & Weinhardt, 2015; Tannenbaum et al., 1993; Warr et al., 1999). The role of cultural elements in influencing the transfer of training is explored in more detail in Study #3.

4.4 Conclusions from Study #1

Study #1 was a quantitative analysis of three datasets: knowledge examination scores, clinical outcomes data, and safety climate survey data. It tested two hypotheses:

H_1: The MORE^{OB} training, as a planned intervention, improves group-level outcomes.

H_2: The MORE^{OB} training, as a planned intervention, improves group-level patient safety climate.

Two measures were used to test the first hypothesis: knowledge examination scores and clinical outcomes data. Improvement in knowledge is not the same as improvement in work performance; however, such improvement would be one of the expected outcomes of a training intervention. The knowledge examination scores were aggregated from individual scores to the obstetrics team level and therefore considered group-level outcomes; clinical outcomes were reported by external agencies at the firm level, but since they were most pertinent to the obstetrics team, they were considered group-level outcomes.

Based on the analysis of the knowledge exam data, it was concluded that the knowledge exam itself showed good construct validity and reliability (KR-21 was .92). A comparison of pre-Module 1 scores among Early Adopters and Late Adopters revealed that mean knowledge score (M=66.75) for Late Adopters was significantly higher than that of the Early Adopters (M=59.48). Thus, the obstetrics practitioners from the Late Adopter group were more knowledgeable. After the MORE^{OB} training, although both groups showed significant improvement in their respective scores, the Late Adopter group (M=77.86) continued to perform significantly better than the Early Adopter group (M=74.29). A repeated measures ANOVA was conducted to determine the significance of the differences in scores pre- and post-training within each group. The results showed that the change in knowledge examination scores was significant. However, improvement in knowledge alone was not sufficient to support the first hypothesis; improvement in clinical outcomes was also necessary.

Three clinical outcomes (Cesarean section rate, Postpartum Hemorrhage rate, and Mean Length of Stay) were analyzed to determine whether there was any improvement after the MORE^{OB} training. The Cesarean section (C-section) rates in all three groups were on the rise; and the Early Adopter group had the highest C-section rate, which might have been one reason why the Early Adopter group was eager to implement the MORE^{OB} program. Based on a comparison of projected C-section rate versus the actual rate, most actual rates were lower than projected. Regardless of when the MORE^{OB} program was implemented (or not implemented at all), the C-section rates did not rise as high as projected from the baseline of 2002-2005 data. When focused on reduced-risk, single-birth C-section rates, the difference in the mean rates before and after the MORE^{OB} training was not significant in either the Early Adopters or the Late Adopters; however, their rates were consistently lower than those of the Non Adopters. These results indicate that the hospitals with MORE^{OB} training (experimental groups) had a lower reduced-risk C-section rate than those without the MORE^{OB} training (control group).

Three observations were made from the Postpartum Hemorrhage (PPH) data: first, the PPH rate at the Non-Adopter hospitals had increased; second, the Early Adopter group had the highest PPH rate and although it had come down slightly by 2005, it was still fairly high; and third, the PPH rate at the Late Adopter hospitals was starting to rise. The actual PPH rates ended up higher than projected for the Non-Adopters, but lower than projected for Early Adopters and Late Adopters. Both Early Adopters and Late Adopters performed consistently better than the projected levels. Thus, the MORE^{OB} program seemed to have helped control the PPH rates in both Early Adopters and Late Adopters. Considering that the actual PPH rates for Early Adopters were lower than projected, and the post-MORE^{OB} rates were consistently lower than the pre-MORE^{OB} rates, there was at least partial evidence that the clinical outcomes of the obstetrics units improved after the MORE^{OB} training.

Finally, with respect to Length of Stay, all three groups indicate a downward trend from a high of 2.57, 2.54, and 2.55 days to a low of 2.25, 2.33, and 2.30 days for Non-Adopters, Early Adopters, and Late Adopters, respectively. The overall means for the three groups were 2.39, 2.36, and 2.31 days. The Non-Adopter mean (2.39 days) was significantly higher than the Early Adopter mean

(2.36 days) and the Late Adopter mean (2.31 days), and the Early Adopter mean was significantly higher than the Late Adopter mean. Also, the Late Adopter group showed a significant decline in Length of Stay after training.

Therefore, considering both knowledge scores and clinical outcomes, the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1) was supported.

Next, with respect to the second hypothesis, safety climate survey data were analyzed to first develop a multifactor model based on exploratory factor analysis. This model was tested using multi-trait analysis, confirmed using confirmatory factor analysis, and revised. The second order CFA demonstrated that patient safety climate could be represented by six factors and showed good goodness-of-fit measures (CFI=.94, NFI =.93, TLI =.94, and RMSEA = .054). The six factors were as follows: (1) Patient safety is everyone's responsibility; (2) Learning; (3) Valuing individuals; (4) Empowering people; (5) Open communication; and (6) Teamwork.

The Early Adopter group's pre- and post-training scores were used to test whether the patient safety climate in that group improved after the MORE^{OB} training. Latent Growth Curve Modeling was used to determine model fit, intercept and slope for each factor. The model fit indices for each of the factors ranged as follows: CFI=.957-.990 and TLI=.967-.993. Thus, it was a very good model fit. The intercepts ranged from a low of 2.85 to a high of 4.10, and the slopes ranged from a low of .06 to .51. Based on these data, there was an improvement in the scores across all six factors. Similarly for the Late Adopter group, there was improvement in the scores across all six factors. Additionally, it was discovered that there was most significant improvement in Teamwork (slope of .51) in the case of the Early Adopters and in Patient Safety is Everyone's Priority (slope of .54) in the case of the Late Adopters. Therefore, there was sufficient support for the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level patient safety climate (H_2).

In conclusion, the MORE^{OB} training, as a planned intervention, improves group-level outcomes (H_1) as well as patient safety climate (H_2). Also, based on the training schedule and intervals at which performance outcomes and safety climate were assessed, there is evidence to support that (a) improvement in participant knowledge (learning) is an early indicator of training effectiveness;
(b) improvement in safety climate immediately after training is more likely to have been influenced by the actual training experience itself as well as the experience of workplace behaviors during the training period; and (c) performance improvements may lag several years due to other impediments not related to the training. Finally, change in patient safety climate was highly correlated with change in knowledge. Also, changes in patient safety climate showed good correlation with improvements in clinical outcomes. Thus, in general, a change in knowledge exam scores or a change in patient safety climate scores could serve as an early indicator of changes in clinical outcomes.

Chapter 5: Results of Study #2

5.1 Introduction

Study #2 was a qualitative study targeted at addressing four research questions:

RQ_1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

RQ_2: How did leaders and influencers shape shared organizational values at the subject organizations?

RQ_3: How did shared experiences, through implementation mechanisms, help revise and reinforce organizational values at the subject organizations?

RQ_4: How did feedback from group-level performance influence learning derived from shared experiences at the subject organizations?

This study developed a richer understanding of the key cultural elements within a narrow sample of obstetric units.

In July-August 2015, the researcher worked with the Salus Global Corporation (since they had ongoing relationship with all the hospitals) to contact CEOs of all 68 hospitals to inform them about this research project (with the Research Information Sheet, as provided in Appendix A) and invited their obstetrics teams, as well as senior management team, to participate in interview sessions, either individually or in groups, that may last up to two hours. The issues regarding human subject protection as well as lack of any material incentives to participate in the research were made clear to them. Thus, the entire eligible population of obstetrics groups was made aware of this study and was invited to participate.

The initial invitations, which were sent out through email, were followed-up with phone calls and reminder email messages. Ten hospitals responded and sought additional information about the project; one hospital required the researcher to seek approval of their internal Human Subjects Review Board, but subsequently withdrew this requirement. After several months of conversations with various levels of leadership, only three hospitals agreed to proceed with the interviews and appointed a liaison person. This person was responsible for organizing all the interviews based on the availability of the participants. Generally, the following people were recruited: senior management team, including the CEO, obstetricians, nurses, midwives, chief of staff, and other appropriate personnel who may have involvement or sufficient knowledge about the implementation of the MORE^{OB} program. The rationale for including the senior management team was twofold: first, numerous culture studies as well as studies associated with transfer of training to workplace behaviors (as discussed in the Literature Review) had emphasized the role of management commitment in enabling cultural change; second, the MORE^{OB} program specifically required senior management commitment prior to its launch. Thus, it was essential to include them in the interviews and find out about their motivations as well as subsequently determine the differences in their perception as compared to those of the other interview participants. Essentially, they were believed to have key information in response to the research questions. The other personnel were directly impacted by the MORE^{OB} training both from a professional standpoint as well as from an operational standpoint. Professionally, as physicians, nurses, or midwives, the MORE^{OB} training expected them to behave differently and change their established practices. Operationally, the changes in their behaviors would have a direct impact on how their patients were handled and potentially increase the risk to their patients. Thus, it was essential to seek their perspective about the MORE^{OB} training, as well as their reactions before, during, and after the training. These frontline personnel were the primary subjects of the training intervention and therefore, their participation in the interviews was critical.

Three hospitals had agreed to proceed with the interviews; one was from the Early Adopter group and two from the Late Adopter group. After continued conversations with all three liaison members, only two hospitals were consistent in providing access to the requested personnel and arranging the meetings. Thus, participants from these two hospitals (one from the Early Adopter group and one from the Late Adopter group) served as the subjects for this study.

The attributes of these two hospitals and their obstetrics teams were comparable on the level of care, number of births per year, and availability of key informants for the interviews. With the average functional unit size of 70 and two facilities, there were about 140 potential candidates; however, at least half of them had moved to other hospitals or were otherwise not available for the interviews. Thus, 41 candidates who had undergone the MORE^{OB} training, or were sufficiently familiar with the program, were recruited for interviews. These candidates represented senior management, frontline leaders, obstetricians, nurses, and midwives. Interviews were conducted over a two-day period at each facility.

5.1.1 The Interview Instrument

A semi-structured interview approach was used to collect narrative data regarding the experience prior to implementing the MORE^{OB} program, during the implementation, and post-implementation. The general themes explored during these interviews included the following (the specific interview schedule is included in Appendix A):

1. Rationale for the choice of the $MORE^{OB}$ program as a strategic intervention—consider environmental factors, compatibility with existing organizational values and goals of the $MORE^{OB}$ program, and specific desired clinical or financial outcomes;
2. The role of leaders and key influencers in facilitating the adoption of new practices in response to the $MORE^{OB}$ program, challenges in implementing the program, and use of feedback mechanisms to sustain the momentum of change; and
3. Evidence of institutionalization in terms of artifacts, stories, awards, and general recognition of best practices and heroes, as well as transfer of best practices beyond obstetrics.

Follow-up questions varied, depending on the responses to the general questions and the nature of the candidates' involvement with the $MORE^{OB}$ program or their overall role at the healthcare facility. For example, some nurses commented how their practice had changed. Senior management, on the other hand, commented on broad changes in the healthcare sector and how such changes influenced changes in practice. In response, they were asked to give specific examples. A thematic analysis of the narratives generated from the interviews provided depth and context to the quantitative data that were analyzed in the previous study.

5.1.2 Artifact Analysis

Artifacts are symbolic representations of culture (Rousseau, 1990). They are unique to each functional unit and they represent that unit's values. Some examples of such artifacts include mission and vision statements, goals and priorities, logos, awards, commonly told stories, and local heroes and legends.

In addition to the on-site interviews at the two healthcare facilities, the researcher collected examples of awards, physical items created by members of the community, and stories recalled (and told) by the members. Analysis of these items, together with the themes extracted from the interviews, served as manifestation of enacted values and unquestioned assumptions. These artifacts served as tangible evidence of institutionalization of organizational culture.

5.2 Description of the Sample Population

The sample population was drawn from two hospitals. The participating individuals included nurses, midwives, obstetricians, frontline leaders like department heads and educational practice leaders, and senior management like directors, chiefs of staff, vice presidents, and chief executive officers. The general characteristics of the two hospitals and participating interview subjects are presented in Table 55.

Table 55: Hospital and participating subject profile

	Hospital A	Hospital B	Total
Level of Care	IIc[5]	IIc	
Number of Births in 2015	3,100	4,458	
Participant Subjects			
- Senior Management	4	5	9
- Frontline Leaders	1	5	6
- Obstetricians	2	2	4
- Midwives	6	2	8
- Nurses	7	7	14
- Total	20	21	41

[5] Level IIc facilities care for women and their infants from 30 weeks of gestation to full term; generally don't handle premature deliveries and neonatal complications. For details, refer to http://www.pcmch.on.ca/health-care-providers/maternity-care/pcmch-strategies-and-initiatives/loc/

5.3 Results of the Interview and Artifact Analysis

All the interviews were transcribed from audio recordings and subsequently coded using NVivo 10.0 (by QSR International). Participants and Hospitals served as case nodes and each interview transcript served as a source document. Each source document was read multiple times and excerpts were matched with corresponding elements of the integrated model of organizational culture and climate presented in Figure 7. Since the researcher followed a semi-structured interview protocol based on previously identified cultural elements, the responses were categorized in accordance with those elements. Thus, initial coding structure (Level 1 coding) was as follows:

- Environmental Factors
- MORE^{OB} Training [Planned Intervention]
- Leaders and Influencers
- Shared Experiences
- Assumptions
- Values
- Feedback Mechanisms
- Implementation Mechanisms

While there was variation regarding the focus of different participants (e.g., some were more comfortable discussing environmental factors while others were more comfortable describing their shared experiences), no extraneous or additional (outside the initial coding structure) information was discovered. However, the initial coding structure was further refined by adding details emerging from the interview narratives (Level-2 coding structure). When compared to quantitative analysis, qualitative analysis is inherently burdened with the need to establish validity. In some studies, it is appropriate to consider multiple coders and conduct inter-coder reliability to demonstrate the objectivity of the coded results (Guba & Lincoln, 1994). In other cases, it may be more appropriate to use the trustworthiness paradigm recommended by Lincoln and Guba (1986), which consists of credibility, dependability, confirmability, and transferability. In order to strengthen the trustworthiness of this study, the researcher has presented findings with a combination of direct quotes from the participants, external documents that corroborate the participants' comments, images of tangible artifacts that demonstrate the legitimacy of the concept presented, and logical explanation of how the various research questions were addressed. Refinement of the coding structure in response to the narrative analysis demonstrates that the interview protocol was not overly restrictive, and it creates an opportunity to present a further enhanced model of organizational culture and climate.

In spite of all the efforts to establish trustworthiness of the reported findings, the researcher acknowledges that at least four types of biases have influenced this study: self-selection bias, sampling bias, confirmation bias, and the researcher's interpretive framework (Bhattacherjee, 2012; Creswell & Clark, 2007; Mullane & Williams, 2013). A self-selection bias is created because the participants who have particularly positive or negative opinions tend to select themselves or volunteer to participate in such studies. Thus, opinions contrary to the ones expressed by the participants are not equally accessible to the researcher. Sampling bias is introduced because of the limited sample size in qualitative studies and the composition of the sample. Next, a confirmation bias is introduced because when certain hypotheses have been developed by the researcher, there is a tendency to be sensitive to only those opinions that are supportive of the hypotheses; counter opinions have to be much stronger for them to be noticed by the researcher. Finally, the researcher's own framework that reality could be presented from multiple perspectives causes him to pick one perspective at the cost of others. Thus, it is plausible that a similar data collection and analysis exercise could produce different results and bring forth alternate explanations or perspectives of reality. Nonetheless, in order to preserve objectivity and maximize authenticity of the conclusions presented, the researcher used a triangulation approach by providing concrete examples in terms of direct quotes, external reference literature as mentioned by the participants, and artifacts (Kennedy, 2009).

5.3.1 Environmental Factors Influence Organizational Culture

The first research question was regarding the influence of broad environmental factors on organizational culture:

> RQ_1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

In order to remain objective and let the participant guide the flow of the conversation, the researcher asked each participant to reflect on their professional career and talk about key changes over the past 10-15 years and how they might have influenced the patient safety culture in the obstetrics practice at their hospital. They were asked to comment at whatever level they were most comfortable: national, local, or hospital level. Out of the total 50 responses coded in this category, 27 came from senior management, 8 from nurses, 6 from frontline leaders, 6 from obstetricians, and 3 from midwives. Members of senior management (n=9) were most eloquent about the influence of the broad environmental factors on the local culture and practices at their hospital; obstetricians, midwives, and nurses (n=29) focused on the impact of the MORE^{OB} program on their professional practice; and frontline leaders (n=6) focused on the impact of legal and political developments that may have influenced the adoption of the MORE^{OB} program. Thus, based on the actual comments made by the participants, the environmental factors were further coded into four categories: economic, geo-social, legal, and professional. Figure 21 shows the connection map depicting the mapping between the participant attributes and the coding structure for environmental factors. The thickness of the lines corresponds to the frequency of comments linking the participant and the corresponding environmental factor. Table 56 presents the Level 2 coding structure and Table 57 presents examples of responses mapped to various environmental factors.

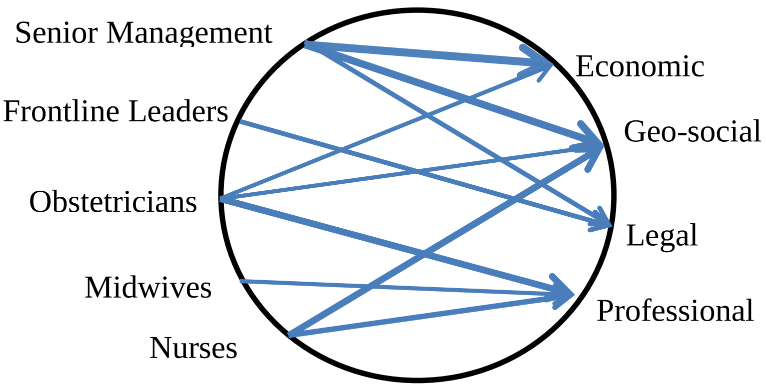


Figure 21: Connection map between participants and comments regarding environmental factors

Table 56: Level 2 coding structure for environmental factors

Level 1 Code	Level 2 Code	Description
Environmental Factor	Economic	Comments related to changes in general economic conditions or assumptions of the industry or the region, changes in budgets or budget models
	Geo-social	Comments related to changes in local population : demographics, medical needs, ethnic cultural peculiarities, religious, linguistic, or social customs
	Legal	Comments related to changes in laws or accreditation requirements impacting the operation, underlying assumptions, and societal expectations
	Professional	Comments related to expectations from professional societies like the Society of Obstetricians and Gynecologists of Canada

Table 57: Examples of participant responses mapped to environmental factors

Participant	Response	Classification
Senior Management	Over the past several years, hospital accountability has been huge. I think this shift is happening all over the world, but also there's a financial reality—all countries are spending more money on healthcare and recognizing that we can't continue the upward spiral of the costs; we have to cut costs and a big part of cutting costs is focusing on quality.	Economic
Senior Management	Unnecessary C-sections are costly and risky to the mother and child. Women with vaginal deliveries are here for 24 hours; those with section deliveries are here for 48-72 hours. Cost/day is higher for C-sections—thus, the burden to the entire system is higher; there's impact on breast-feeding and long-term care for the child.	Economic
Senior Management	We are now more focused on patient experience. Many cultures have different traditions regarding visiting a doctor, child birth, death, etc. This is the most ethnically diverse region of Canada. We have to know more about their cultural background in order to enhance the patient experience. We are trying to reach out to the different ethnic groups and get them engaged with the hospital. We also want representation from different cultural groups on our board. Our staffing has also become more representative of the community.	Geo-social
Nurse	Now we have all these high-rises, a mall, a Walmart, and on and on…there are people everywhere (of child bearing age) and the volume of births is going up. Ten years ago, we were at about 2,400 births per year and now we are more than 3,200 per year and that's a huge difference. In the old days, 4 deliveries per shift was a rare (high), now, that's a rare low.	Geo-social
Senior Management	There was some legislation in 2004 QCIPA (Quality of Care Information Protection Act). What that really supported was these inter-professional teams coming together to review these near misses or adverse events.	Legal
Frontline Leader	There's been a focus on meeting Ministry requirements or practicing evidence-based care. An example is a surgical safety checklist.	Legal
Obstetrician	Because it was SOGC (Society of Obstetricians and Gynecologists of Canada) endorsed and some of the top experts in the field came and spoke to our physician leaders, they really endorsed it.	Professional
Midwife	The Association of Midwives in Ontario has an ongoing dialog with the members about the best practices, and it has endorsed the MORE^{OB} program.	Professional

From an economic perspective, the Canadian healthcare system is a single payer system, which means that nearly 100 per cent of the hospital's operating funds are provided by the Ministry of Health. One respondent cited the Canada Health Act and said that it prohibits hospitals from using philanthropic contributions to support operating expenses, which would be considered privatization of healthcare financing ("The Canada Health Act: Overview and Options," 2005). Also, hospitals bill the Ministry independent of the physicians and midwives, who bill separately for their services and they are compensated 100 per cent of their approved rate. Thus, simplistically, hospitals can maximize their net revenue by maximizing the number of procedures while minimizing the length of stay. Physicians and midwives can maximize their earnings by maximizing their number of cases. From an obstetrics perspective, the financial interest of the hospital and the financial interest of physicians (and midwives) were aligned in support of increased vaginal births and decreased Cesarean sections. Additionally, there were a number of safety benefits. The following comment from one of the senior managers illustrates this point:

> We have had a program on C-sections. That's an excellent example of how costs drove the quality agenda. We limited the OB/GYN department to a fixed amount of budget and they were doing x number of deliveries. We recognized that if they cut their C-section rates down, they could do more deliveries; otherwise, we would have to cap them at a certain number [budget]. That was an impetus for their department to say that they could do better with their C-section rates, particularly if we want to continue with the same number of births or grow the number of births. We capped the amount of money that we were willing to provide to the department and that fixed amount equated to a certain number of births. Let's say they could do 3,000 births in the available budget. So, they either had to find money from other sources to increase the number of births or to limit the number of births to 3,000. It was then recognized that a vaginal birth costs the hospital much less than a C-section birth. The OB department was not happy in the beginning, but realized that the hospital was in a difficult position. The chief took it on as an opportunity. Capping the number of births would have meant a cut in the number of births and the overflow patients would have to go somewhere else. Since the obstetricians get paid for every birth that they handle, this would have meant a cut in their compensation. From reputational

> perspective, the hospital doesn't want to be turning people away. The hospital is caught in the middle—we don't want people to go somewhere else.

Geo-social factors were primarily related to growth and changes in the ethnic diversity of the local community. Both hospitals were community hospitals; hence, they had to be responsive to the needs of their community. Over the past 10-15 years, these communities reported both growth and increase in diversity. According to Statistics Canada[6], the overall population increased between 9.20 and 19.10 percent and the visible minority population in the areas surrounding the subject hospitals increased by between 4.48 and 9.74 percent. Table 58 presents the percentage change in the respective local communities. As of 2011, visible minorities made up almost 50 percent of Hospital A's community and over 70 percent of Hospital B's community.

Table 58: Growth and changes in ethnic diversity in the local communities

Community	Percent change in total population from 2001-2011	Percent change in visible minority population (2001-2011)
A	+9.20%	+4.48%
B	+9.20%	+9.74%

Hospital B reported a particularly traumatic shared experience: the hospital was not able to respond to a wide range of issues, particularly to the needs of its diverse community, and therefore the Ministry of Health appointed a Supervisor to oversee the hospital. Subsequently, the hospital's governing board was dissolved and a new interim CEO was appointed. This was a defining moment for the hospital and it started an avalanche of changes. Two participants recalled this shared experience as follows:

> When I first arrived, we were under the care of a Supervisor, which means that the CEO and the Board was dissolved and a Supervisor was appointed by the Ministry of Health. This Supervisor brought a new, very different Board; the bylaws were changed; it was a 50-50 Board (half elected and half appointed); a

6 http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E&fpv=3867

> new leadership team was brought in—this team saw quality and safety as paramount.
>
> When I started 8 years ago, the hospital was under Supervision—the Ministry had decided that the hospital was not properly running itself and so an external person was brought in as the CEO (X) and then they hired an interim CEO (Y). The community was very negative/unhappy about the hospital (not listening to it, was not providing good care or good feedback to the patients and families)—and there was quite an upheaval. One of the reasons that I was hired was to try to manage the issue around community/patient complaints. At that time, there was no patient relations department.

As a community hospital, it is reasonable to infer that the hospital should be responsive to its community's needs. While it is not known why the hospital was not able to respond to its community's needs, it is clear that the Supervisor's appointment made a profound impact on the subsequent actions of the senior leadership: a thorough strategic planning exercise, new leaders in key positions, transparency, and data-driven management. These changes were summarized in one senior manager's response as follows:

> We have mission, vision, values of the hospital—they were conceived about 8 years ago. They were developed from the ground up and are now flowing back to the frontline. We take into context the values and their alignment with strategic directions and the overall strategic plan—it's about how the organization makes its decisions based on the agreed upon values.

Reflecting on the theoretical model represented in Figure 7, the role of defining moments was noted in revising organizational values. Based on the narrative analysis, however, the role of environmental factors in triggering a defining moment, as well as the pathway between defining moments, leadership, and organizational values needs to be articulated.

Legal factors were primarily related to national regulatory changes that facilitated the development of new practices. The two initiatives were particularly mentioned: The Quality of Care Information Protection Act (QCIPA)[7] and the

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[7] http://www.health.gov.on.ca/en/common/legislation/qcipa/default.aspx

Excellent Care for All Act (ECFAA)[8]. The QCIPA was first passed in 2004 and updated in 2015. This Act is specifically designed to facilitate critical incident reviews within a hospital without fear of reprisal. All information shared during this review is confidential and the goal of the review process is to identify systemic problems and improve the quality of care. However, not all reviews (one hospital calls them "clinical debriefs") have to be done under the formal protection of QCIPA. Following are two examples of how such reviews are handled:

> After a postpartum hemorrhage (PPH), we will have a clinical debrief. In the early days, people were afraid of the debriefings because they thought that there would be a lot of finger pointing. But there's none of that. In fact, if it starts to go that way, it is immediately shut down. It is run by someone from the leadership team. When they are doing that, we have action items that come out and some of them might be related to the kit—some items may be added, others may be removed because they are not necessary. A debrief is triggered by an adverse event or it could also be triggered by a near miss (in the moment debrief). We even do informal debriefings within our team and we talk through the cases—it doesn't always have to be a formal debrief. We just added an item to our checklist to make sure that we have batteries for our Doppler. [Hospital A]

> Under the Public Hospitals Act and the Excellent Care for All (ECFA) Act, Critical Incidents (specifically defined) are reported and investigated. We have about 3,000 patient incidents per year; only a subset of them qualify as critical incidents based on the criteria outlined in the Public Hospitals Act. For Critical Incidents, we review all of them under QCIPA, which is not required under the legislation. It was put into place in 2004 to allow organizations to review incidents under confidentiality protection—the meeting is confidential, the opinions are confidential, the discussion is confidential, but the outcomes of the meeting and the facts of the incident are not confidential. [Hospital B]

While the QCIPA legislation may not have been a factor in Hospital A's debriefing, it seems to have influenced Hospital B's incident review process. With respect to the Excellent Care for All Act, 2010, it seems to have brought a provincial integration and cohesion to efforts around quality of care and patient safety. Sullivan and Brown (2014) report several expectations of this Act. Central to these expectations is an organization-wide emphasis on quality of care and

[8] http://www.health.gov.on.ca/en/pro/programs/ecfa/legislation/act.aspx

continuous improvement. The Act requires the CEO's compensation plan be linked to quality improvement results: "What the legislation effectively does is to require an institution's board to take responsibility for quality and to ensure that the chief executive—its sole report—takes this responsibility seriously…the new imperative for boards is to raise quality reporting at the board table to the same priority as financial reporting" (p.57). Thus, it is not surprising that a senior manager from Hospital B claimed the following:

> The one quality improvement methodology that we have chosen a number of years ago was LEAN, which was originally developed out of Toyota—a number of hospitals have incorporated that as a quality improvement methodology. In certain clinical areas, you will see these whiteboards with dashboards of indicators and quality improvement initiatives that they are tracking and various tools that you would expect with that methodology. This hospital has been on a pretty substantive journey over the last 7-8 years in terms of improving quality and safety and I think it's done a remarkable job and a leader in many areas and we have also been an outlier for the wrong reasons on the other side of the coin!

From a professional perspective, all the key professional bodies have endorsed the quality and safety imperatives both at a general hospital level as well as within the obstetrics practice. The Ontario Hospital Association (OHA) is playing a key role in influencing the senior leadership across all hospitals in Ontario. In support of the provincial focus on quality and patient safety, the OHA developed a series of strategic plans, built awareness about safety issues, and provided resources and mentoring to executives and board members to collectively and collaboratively improve the quality of care and patient safety across all the member hospitals in Ontario[9]. Additionally, the Canadian Institute for Health Information (CIHI) has developed an online tool for patients to determine the relative quality and efficiency at their local hospital[10]. This tool uses performance data submitted by each hospital and presents a dashboard of performance on key

[9] http://www.oha.com/currentissues/keyinitiatives/patientsafety/pages/default.aspx
[10] http://yourhealthsystem.cihi.ca/

indicators such as access, safety, appropriateness and effectiveness, and efficiency. Since the data are presented with respect to a comparative peer group, it is easy for the reviewers to determine the relative quality, safety, and efficiency of their hospital with respect to the peer group, the province, and the nation. The Society of Obstetricians and Gynecologists of Canada (SOGC) has been a principal supporter of the MORE^{OB} program[11] and their endorsement has helped build both awareness as well as credibility for the program. At one of the subject hospitals, it was clear that the SOGC endorsement helped the implementation of the MORE^{OB} program:

> Because it was SOGC endorsed and some of the top experts in the field came and spoke to our physician leaders, they [hospital leadership] really endorsed it.

The Canadian Nursing Association's statement on patient safety proclaims that "Patient safety is fundamental to nursing care and to health care more generally, across all settings and sectors. It is not merely a mandate; it is a moral and ethical imperative in caring for others."[12] In addition to such endorsements, professional organizations have significant power to influence their members' behaviors through award of continuing medical education (CME) credit for courses such as MORE^{OB}. When asked about how professional organizations representing nurses and midwives influence their respective disciplines, the responses were as follows:

> The first three years (of the MORE^{OB} program) were very prescriptive. After that, you are expected to do everything on your own—you can align it with reflective practice per the College of Nurses; the physicians use it for CMEs—so there are ways in which these exercises could be aligned with the recurrent training requirements of your professional society.

> The Association of Midwives in Ontario has an ongoing dialog with the members about the best practices, and it has endorsed the MORE^{OB} program.

[11] http://sogc.org/continuing-medical-education-cme/more-ob/
[12] https://www.cna-aiic.ca/~/media/cna/page-content/pdf-en/ps102_patient_safety_e.pdf?la=en

> The Association also has its own safety culture training as a part of our recertification training.

Figures 22-25 present exemplar artifacts in support of each environmental factor. These items serve as cultural artifacts because they were created by people in support of certain underlying values and with the intention to communicate those values to the members within the community (obstetrics, hospital, province, or the broad healthcare sector) as well as to members outside the community (other units within the hospital, other hospitals, other provinces, other countries, etc.). Artifacts are generally assessed on three levels: instrumentality, aesthetics, and symbolism (Vilnai-Yavetz & Rafaeli, 2012). All these artifacts are high on instrumentality and symbolism because they serve a specific function and the have a special meaning attached—for example, the multilingual information pamphlet serves as an instrument to communicate with a diverse community and it simultaneously symbolizes inclusion.

Figure 22 illustrates how the actual funding (per capita) for hospitals in Ontario has been below average since 2005 and declined below past funding levels since 2010. Thus, hospital-wide emphasis on quality as a means to cut costs and manage the increased patient volume within available budget makes sense.

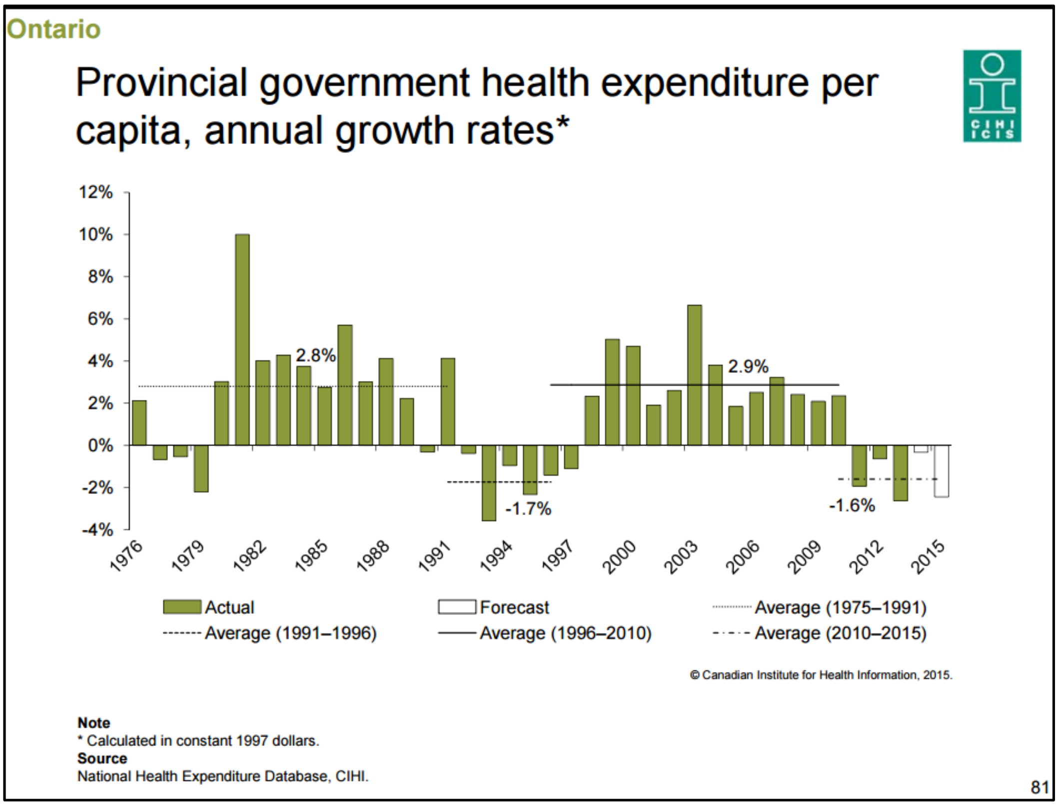


Figure 22: Artifact illustrating the economic pressures influencing changes in safety cultures in hospitals

Figure 23 illustrates how hospitals have adapted to the local demographic changes. In response to the 4.48-9.74 per cent increase (as a percentage of total population) in visible minority population and consistent with the hospital's commitment to be responsive to its community's needs and emphasis on patient experience, the hospitals have adopted multilingual signage and documentation.

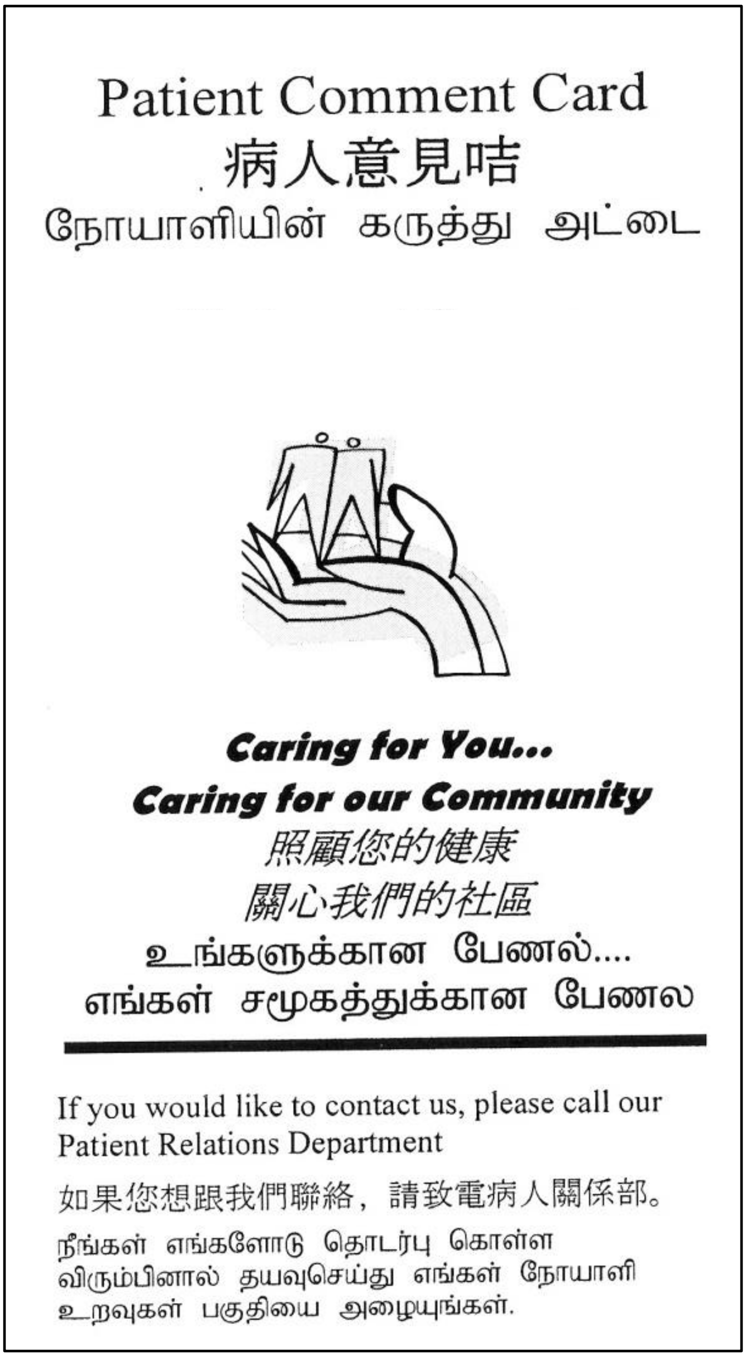


Figure 23: Artifact illustrating geo-social impact on organizational culture

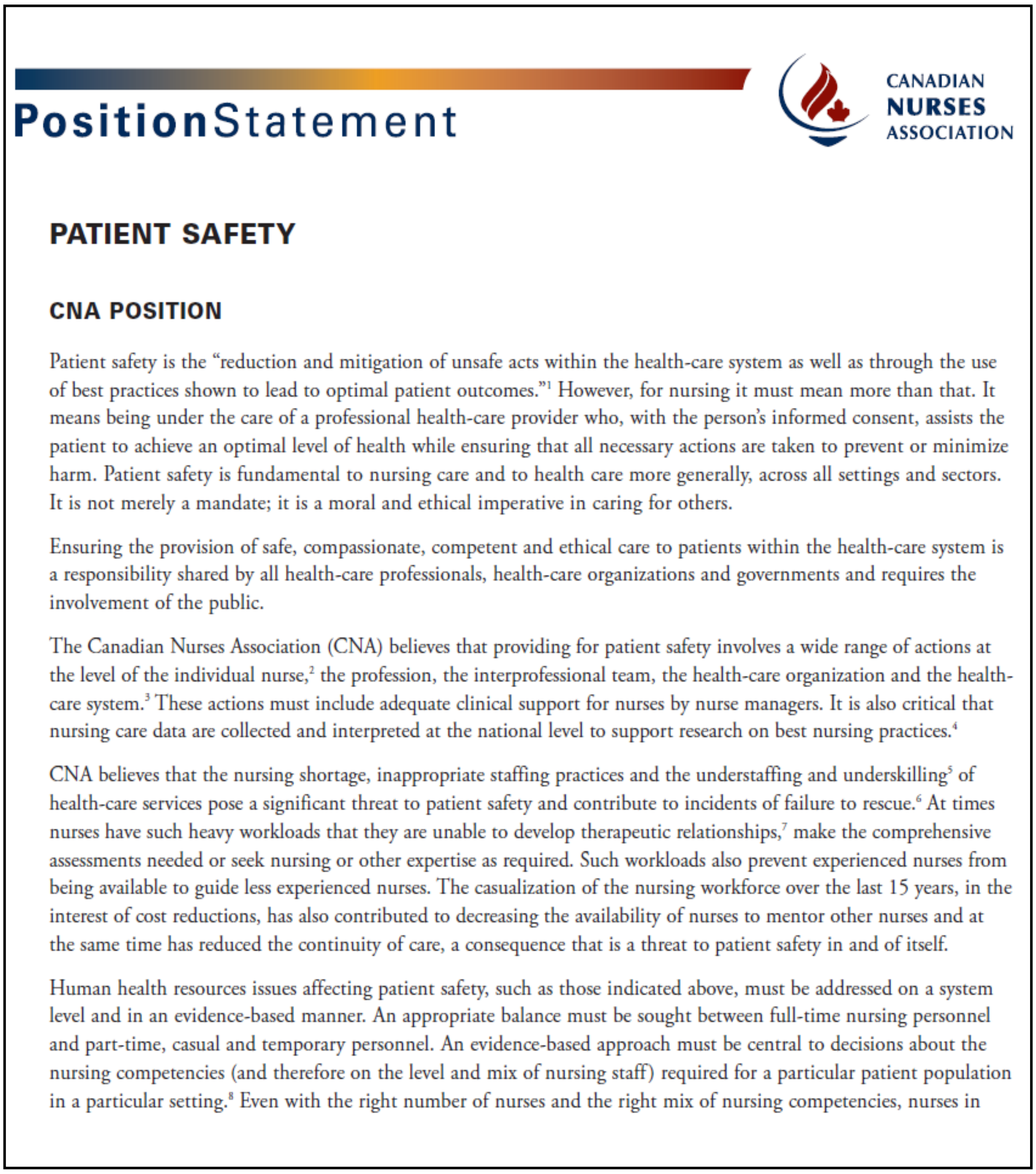
Figure 24 presents the latest requirements from the 2016 Required Organizational Practices handbook of Accreditation Canada, which accredits health organizations in Canada[13], and a historical view of various requirements that have been developed since 2006. This is an example of how federal regulatory

[13] https://accreditation.ca/sites/default/files/rop-handbook-2016-en.pdf

requirements for emphasis on quality and safety have translated into accreditation requirements. Coupled with the formal endorsement of specific programs, like the MORE^{OB} program, by professional bodies like the Society of Obstetricians and Gynecologists of Canada (SOGC) and the Association of Midwives of Ontario (CMO), and the Position Statement[14] on patient safety, see Figure 25, by the Canadian Nurses Association (CNA), there is a confluence of requirements and expectations toward desired cultural attributes, particularly in the areas of quality of care and patient safety.

[14] Full statement is available at https://www.cna-aiic.ca/~/media/cna/page-content/pdf-en/ps102_patient_safety_e.pdf?la=en

Figure 24: Artifact illustrating the influence of regulatory impact on organizational culture



PositionStatement

CANADIAN NURSES ASSOCIATION

PATIENT SAFETY

CNA POSITION

Patient safety is the "reduction and mitigation of unsafe acts within the health-care system as well as through the use of best practices shown to lead to optimal patient outcomes."[1] However, for nursing it must mean more than that. It means being under the care of a professional health-care provider who, with the person's informed consent, assists the patient to achieve an optimal level of health while ensuring that all necessary actions are taken to prevent or minimize harm. Patient safety is fundamental to nursing care and to health care more generally, across all settings and sectors. It is not merely a mandate; it is a moral and ethical imperative in caring for others.

Ensuring the provision of safe, compassionate, competent and ethical care to patients within the health-care system is a responsibility shared by all health-care professionals, health-care organizations and governments and requires the involvement of the public.

The Canadian Nurses Association (CNA) believes that providing for patient safety involves a wide range of actions at the level of the individual nurse,[2] the profession, the interprofessional team, the health-care organization and the health-care system.[3] These actions must include adequate clinical support for nurses by nurse managers. It is also critical that nursing care data are collected and interpreted at the national level to support research on best nursing practices.[4]

CNA believes that the nursing shortage, inappropriate staffing practices and the understaffing and underskilling[5] of health-care services pose a significant threat to patient safety and contribute to incidents of failure to rescue.[6] At times nurses have such heavy workloads that they are unable to develop therapeutic relationships,[7] make the comprehensive assessments needed or seek nursing or other expertise as required. Such workloads also prevent experienced nurses from being available to guide less experienced nurses. The casualization of the nursing workforce over the last 15 years, in the interest of cost reductions, has also contributed to decreasing the availability of nurses to mentor other nurses and at the same time has reduced the continuity of care, a consequence that is a threat to patient safety in and of itself.

Human health resources issues affecting patient safety, such as those indicated above, must be addressed on a system level and in an evidence-based manner. An appropriate balance must be sought between full-time nursing personnel and part-time, casual and temporary personnel. An evidence-based approach must be central to decisions about the nursing competencies (and therefore on the level and mix of nursing staff) required for a particular patient population in a particular setting.[8] Even with the right number of nurses and the right mix of nursing competencies, nurses in

Figure 25: Artifact illustrating influence of professional organizations

In conclusion, the data presented in this analysis identified four environmental factors that influenced the patient safety culture in obstetrics practices in Ontario, Canada: economic, geo-social, legal, and professional. Significant shifts in national economic conditions required the subject hospitals to reduce costs by improving quality and efficiency. As an example, unnecessary C-sections were both costly and risky for patients; thus, reduction in such procedures became a safety goal triggered by economic pressures and facilitated by the MORE^{OB}

training. Closely linked with the economic factors were the geo-social factors because over the preceding decade the local communities for both subject hospitals had become substantially diverse and in order to retain/grow their patient volume (an economic necessity), they had to be more responsive to their communities. Thus, inclusivity became important and the concepts of open communication, respect for the individual, and teamwork that were taught in the MORE^{OB} training were operationalized with a professional as well as a social mindset. Legal or regulatory factors also played a critical role in influencing the patient safety culture in subject hospitals. For example, the Quality of Care Information Protection Act of 2004 supported inter-disciplinary teams coming together to review near misses and adverse events. Such reviews facilitated learning, enabled non-punitive reporting, and reinforced organizational commitment to patient safety. The MORE^{OB} training materials and reference documents were actively used in aligning individual and team behaviors with standardized professional practices. Finally, professional organizations like the Society of Obstetricians and Gynecologists of Canada and the Association of Midwives in Ontario endorsed the practices and standards expected by the MORE^{OB} program. Some leaders of these organizations also personally advocated the need to adhere to the MORE^{OB} training and standards. Therefore, there was strong alignment between economic, geo-social, legal, and professional factors—all creating the conditions for a cultural change in the obstetrics practice in Ontario.

Another finding from the narrative analysis led to the identification of the role of defining moments (or systemic shocks) in shaping organizational culture: (a) in the case of Hospital A, it was a matter of a sudden increase in ethnic diversity and local population and (b) in the case of Hospital B, it was the placement of the hospital under supervisory control, which triggered an avalanche of changes across the hospital. Both these events were classified as defining moments because their impact was sudden; whereas other events like the changes in economic conditions or regulatory requirements were relatively gradual. Nonetheless, the role of defining moments in shaping organizational culture needs to be better addressed in the integrated model of organizational culture and climate.

5.3.2 Leaders and Influencers Shape Shared Organizational Values

The second research question was about the role of leaders and key influencers in shaping shared organizational values (RQ_2). The interview transcripts were analyzed to identify evidence of how leaders and key influencers might have shaped organizational values.

Since the senior management (CEO and C-suite colleagues) as well as the clinical leaders participated in the selection of the $MORE^{OB}$, it was essential to uncover the group's shared values that may have led to the selection of the $MORE^{OB}$ training program as a planned intervention. Uncovering a group's shared values is not about identifying facts, but about understanding and exploring the group's construction of reality (Dibley & Baker, 2001). Dibley and Baker used a laddering technique in their in-depth interviews to probe their participants by repeatedly asking the question, *Why*, to gain progressively higher levels of understanding about the participant's value-oriented behavior. Since their study was focused on consumer behavior, they started with product attributes (Why is each product appealing? Or What do you like about this product?), moved toward identifying the consequences of those attributes (Why are these attributes important? What do these attributes mean to you?), and finally achieved the identification of individually-held values (Why are these meanings important to you?). Such a laddering technique enables researchers to identify the link between a product's attributes and the consumer's personal values (Reynolds & Gutman, 1988) and ultimately helps marketers to align their marketing and advertising campaigns with the product's features and the target consumer group's personal values (Gutman, 1982). Thus, Dibley and Baker constructed a three-step model: Attributes → Consequences → Values. Applying this approach to the present study, the researcher analyzed the interview narratives from the perspective of the following three questions:

1. Why is MORE^{OB} important to the participants? What are its key attributes?
2. Why are these attributes significant? What have the participants been able to do as a result of the MORE^{OB} program (what were the consequences)?
3. Why were these achievements through the MORE^{OB} program important to the participants (what were the higher level values attributed to the MORE^{OB} training program)?

The researcher's thematic analysis identified 90 practices or norms that were linked with the MORE^{OB} program. Thus, the "MORE^{OB} Training" code in the original coding structure was linked with the associated Norms and Practices. Each norm/practice was reviewed to identify its attribute, consequences, and potential higher-level attributed values. This review led to the discovery of following four most commonly identified attributes: Credible, Team-oriented, Evidence-based, and Mixed-methods teaching. These four attributes formed the bottom rung of a ladder and thus four ladders were initiated. Each of the 90 practices or norms was further classified by attributes. Subsequently, each practice or norm was reviewed further by repeatedly pursuing the second question until either a response to the third question was identified or the pursuit did not yield any further responses nor did it identify a meaningful response to the third question (it reached a dead end). The number of practices or norms associated with each of the attributes was not important; it was more important to identify ladders that reached all the way up to the identification of values. Since these values were based on the review of interview transcripts describing actual practices or norms within their respective groups and associated with the MORE^{OB} training, they were coded as shared values aligned with the MORE^{OB} training program.

Table 59 presents the level 2 coding structure of attributes, consequences and the corresponding shared values associated with the MORE^{OB} training.

Table 59: Level 2 coding structure associated with MORE^{OB} Training

Level 1 Code	Level 2 Code	Example
MORE^{OB} Training	Attribute	Credible
	Consequence	It could help against insurance and malpractice claims
	Shared Value (s)	Patient Safety & Quality of Care

Figure 26 illustrates the mapping from attributes to consequences, and from consequences to shared values. For example, the participants thought that one of the important attributes of the MORE^{OB} program was that it was credible. It was deemed credible because it was endorsed by multiple professional societies, the hospital insurance provider, and the hospital management. The perceived consequences of such endorsements included increased belief in the quality of the program; they thought that it must be consistent with the best practices from other industries (particularly aviation) and other countries (because United States had already tested such ideas); the HIROC (Health Insurance Reciprocal of Canada) endorsement supported the belief that there would be some insurance premium adjustments and also provide support for individual level claims; ultimately, they thought that the program could address the national concerns for patient safety, quality, and affordability—all of these were closely held personal values. The notion of affordability was further articulated as accountability because it was about societal responsibility toward its citizens to make judicious use of the resources (taxes) to support universal healthcare.

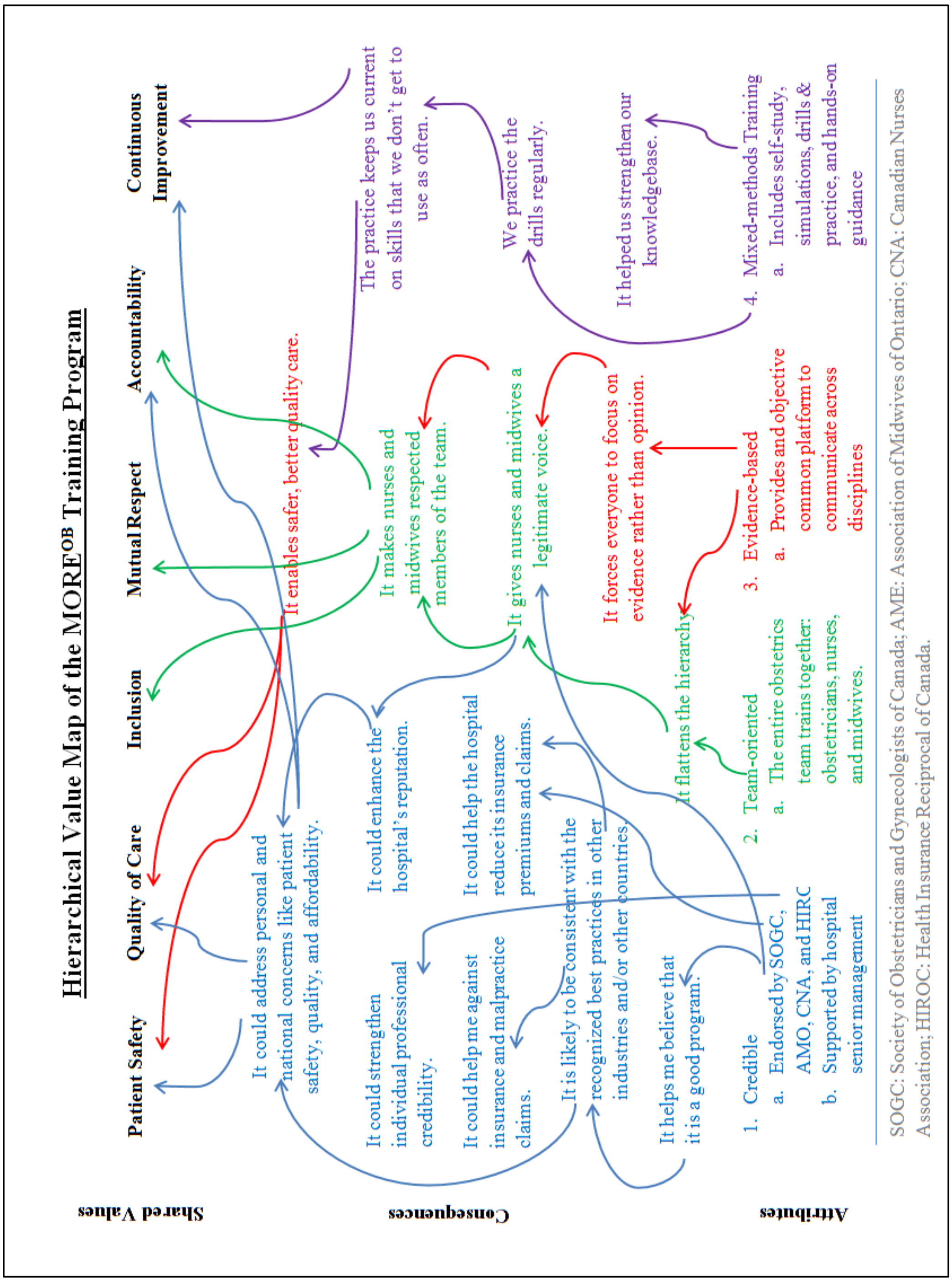


Figure 26: Hierarchical value map of the MORE^{OB} program

Another important attribute of the MORE^{OB} program was its team-oriented approach. Healthcare professionals are typically trained within their professional groups, but are expected to perform as members of a multidisciplinary team. The participants thought that this was a unique opportunity for them to train as a multidisciplinary team—"train as you work and work as you train." One of the most pronounced consequences of such team training was flattening of the hierarchy, particularly between the obstetricians and nurses, which resulted in improved assertiveness and mutual respect. Thus, everyone felt included and treated as a valued member of the team, yet held accountable for their knowledge and actions. Closely associated with team-orientation was evidence-based practice. This attribute forced everyone to focus on evidence (which came primarily from MORE^{OB} training documents). Previously, it was common to engage in opinion-based arguments: one party would say, "research says…" and the other party would say, "in my experience…" and ultimately, the obstetrician's opinion would over-rule everyone else's opinion. After MORE^{OB}, everyone had a common platform and it was less about who was right and more about whether they were consistently compliant with the published (and committed) guidelines. Finally, the mixed-methods approach to training allowed everyone to bring their fundamental clinical knowledge to a consistent baseline level—thus, they knew what to expect from each other. Next, the simulations, drills and hands-on guidance enabled them to practice their skills together without an actual patient. The simulations and drills were practiced regularly because they offered an opportunity to stay current and be prepared for relatively infrequent conditions. Ultimately, the MORE^{OB} program appealed to the following higher-level shared values: patient safety, quality of care, inclusion, mutual respect, accountability, and continuous improvement. Thus, a practical lesson learned from this analysis is that for a planned intervention to be successful, it needs to have attributes that appeal to the shared values of the group in which it is implemented.

In the responses about the influence of leaders and influencers, the participants used the terms "leaders," "leadership," and "management" as either external or internal:

1. External members like Dr. Ross Baker authored *The Canadian Adverse Event Study* in 2004 (Baker et al., 2004) and Dr. Ken Milne who served as the President of SOGC and created the MORE^{OB} program (Milne et al., 2013) were mentioned as key influencers who did not hold any formal positions within the subject hospitals but raised the awareness of patient safety challenges across Canada, including those in obstetrics, and helped hospitals as well as individual professionals be receptive to ideas like non-punitive reporting systems, reduction of variance in practices through standard operating procedures, flattening of the hierarchy under emergencies, evidence-based practice, etc.
2. Internally, senior management—from the Board of Directors to manager-level personnel—was critical in supporting the MORE^{OB} program and the changes to operating practices that resulted from the implementation of the program. Their support was mentioned in the context of implementation mechanism such as non-punitive error reporting system, willingness to add staff when the risk exceeded the pre-set threshold, visible management that was seen by, and was easily accessible to, the frontline personnel, transparency of data—both clinical and financial, and consistent focus on quality, safety, and continuous improvement.

Figure 27 illustrates the various contexts within which the term "leader" or "management" was used by the participants, including "risk management."

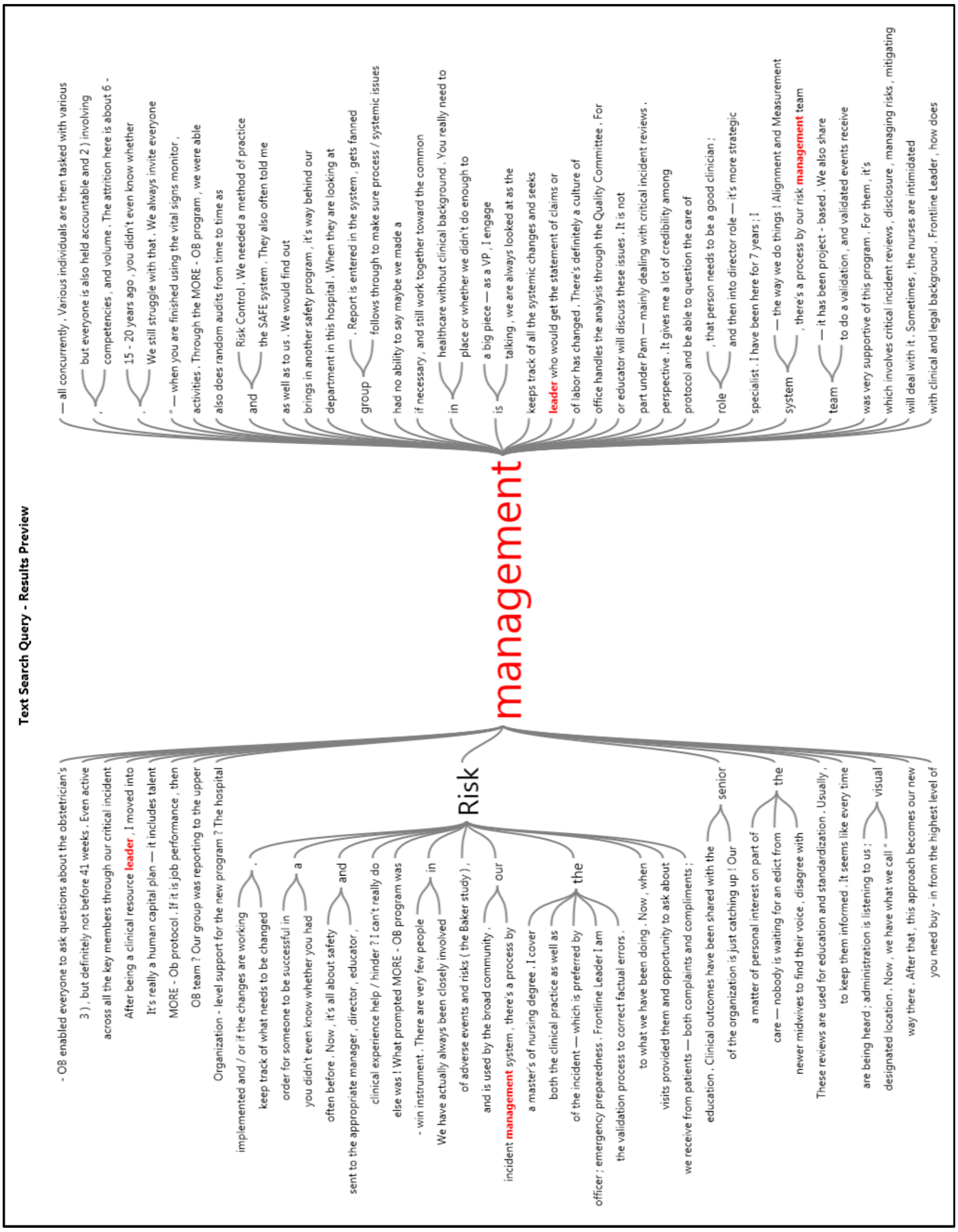


Figure 27: Many references to leaders and management

A review for 90 practices and norms for the influence of leaders and influencers on organizational values revealed the following:

1. External entities such as Accreditation Canada, HIROC, and the Ministry of Health were holding the hospital leadership (both governing boards and

executives) accountable for continuous improvements in quality of care. In some instances, “quality of care” appeared to be an all-encompassing catch phrase with reference to patient safety, efficiency, and patient engagement. Most frontline personnel associated quality and patient safety as related terms; senior management believed that improved quality would result in improved efficiencies and reduction of costs; some frontline personnel included patient engagement in their definition of quality. Thus, a composite definition of quality care emerged as follows: Quality care engages the patients and/or their families in developing and managing the care, all the operational risks are managed within acceptable limits, and it incurs minimal costs to the payer(s).

2. Examples of how leaders and influencers shaped organizational values include the following:
    a. The Ministry of Health appointed a supervisor to manage Hospital B. Based on the subsequent structural and procedural changes made at that hospital, the following values could be attributed:
        i. Diversity and Inclusion
        ii. Clinical Excellence
        iii. Patient Safety
        iv. Financial Viability
    b. Hospital B also implemented Lean methodology to drive process improvements, reduce waste, improve quality, and galvanize its community not only toward their common goals, but also through a common language and process. They articulated their espoused values as follows:

i. Integrity
ii. Compassion
iii. Accountability
iv. Respect

They operationalized these values in the form of four strategic directions and related goals:

i. Patients as Partners
ii. Quality and Sustainability
iii. Integrated Care Networks
iv. Innovation and Learning

Figure 28 presents a photograph of wall-to-wall status boards in Hospital B's CEO's office. Based on these boards as artifacts and conversation with the CEO, the following values emerge:

i. Transparency
ii. Accountability
iii. Continuous Improvement

These three values were consistently visible in the strategic planning documents, a sample of formal communications between the CEO and members of the organization, and the alignment of various performance charts from CEO level down to clinical units.

Figure 28: Planning boards illustrating CEO's influence on organizational values

c. At lower levels of leadership, the implementation of Hospital B's non-punitive event reporting program and the subsequent handling of the investigation brought to light a slightly nuanced set of values. The risk manager reached out to frontline personnel (both clinical and non-clinical) to encourage them to report events—those that resulted in reaching the patient with no adverse outcome, those with adverse outcome, as well as those that were stopped in time and did not reach the patient—these events became "Good Catch" stories. The total number of reports had stabilized at around 2,500 reports per year, but the number of Good Catch reports was growing. At this hospital, most of the critical incident investigations were handled under QCIPA, which meant that the content of the discussions was held confidential and the emphasis was on developing systemic solutions. Also, all the event investigations were regularly reported to HIROC to ensure open communication between the hospital and its insurer. Thus, the underlying values were as follows:

    i. Continuous Improvement
    ii. Respect for Every Individual
    iii. Transparency

d. Finally, at the frontline, nurses and obstetricians served as role models and bearers of standards within their communities of practice. The following story from Hospital B illustrates how nurses reinforced organizational values:

> This was a total catch by the nurses. I was on call one day. Nurses came to me and asked why are all the patients who have had normal deliveries scratching their noses the way our patients who have had a spinal morphine do. So we brought in the anesthetist and started to investigate the problem. What we found was that we had a syringe system in those days for something called PCA (big fat 30cc syringe with morphine for patients to use intravenously) and another syringe system for epidural which looked exactly the same as the PCA. Both these syringes were kept close together. So these patients were given epidural (10x to 100x what they should have received). We picked it up only because the nurses observed that the patients were scratching their noses. So, there was awareness among the nurses, a certain degree of comfort within the team, and a willingness to go forward and find out what might have gone wrong. We placed the patients in ICU through the night, nobody had any further adverse reaction, we explained to them what had happened, and we also learned and changed the system of the syringe labeling. There was no blame on anyone. It was about the system.

The following example from another hospital illustrates how obstetricians reinforced organizational values

> We had a drug cupboard with four bottles and all of them looked the same. In an emergency, they needed Cytotec, the midwife ran and got the bottle, ran down the hall and put it in the physician's hand. He looked at the pills and saw that they were the wrong shape and that's when he caught the error. The nurse looked at the bottle and realized that it was Labetalol. So the process issue is that we can't have similar looking bottles because in an emergency, we know that people don't look as carefully as they should. As a solution, we got different manufacturers for different drugs—this gave us distinct bottles for the different drugs.

The following values emerged from comments by clinical personnel:

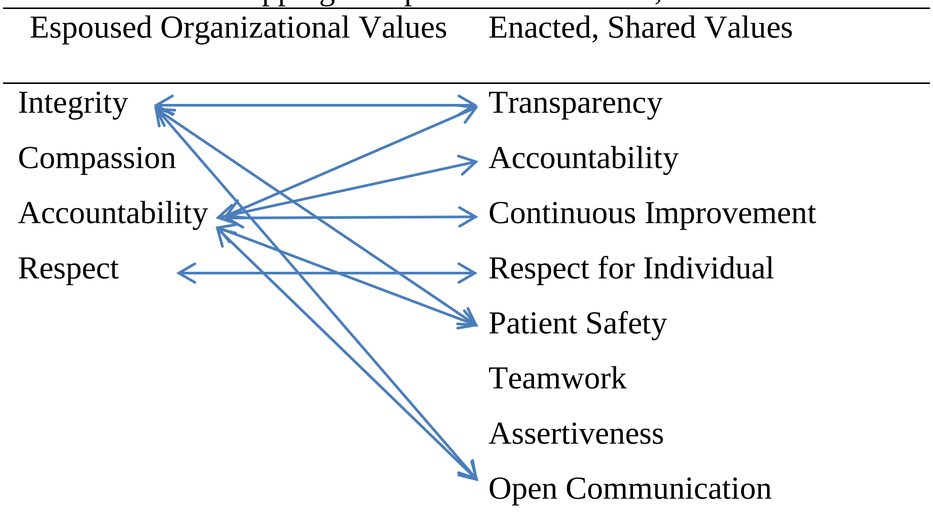
i. Patient Safety
ii. Teamwork
iii. Assertiveness
iv. Open Communication
v. Continuous Improvement

Table 60 presents the values discovered through narrative analysis at different levels of the subject hospitals. Espoused values were those that appeared in marketing materials, strategic plans, and bulletin boards, and enacted values were derived from interview transcripts. Table 61 presents a comparison of espoused versus enacted, shared values. Accountability arose as the dominant value, which was espoused at the organization level and was enacted as a shared value, and in different forms, at multiple levels of the organization. Most notably, however, Teamwork and Assertiveness did not map across any of the espoused values. Thus, there was evidence to support the idea that leaders and influencers not only reinforce and operationalize espoused organizational values, but they also expand on the operational values and enact additional values appropriate to their operational context. Also, Compassion, as an espoused value did not map across any of the enacted values. This may have been a case of an unquestioned assumption: healthcare professionals may assume that they value and exercise compassion simply because of the mission of their organization and their chosen personal profession. One senior manager remarked that their espoused values were so basic that if a person has a conflict with any of them or was not able to live up to any of them, the person should not be in healthcare, not just at that hospital.

Table 60: Values influenced by leaders and influencers

Espoused Organizational Values	Enacted, Shared Values		
	Senior Management	Frontline Leaders	Practitioners
Integrity	Transparency	Continuous Improvement	Patient Safety
Compassion	Accountability	Respect for Individual	Teamwork
Accountability	Continuous Improvement	Transparency	Assertiveness
Respect			Open Communication Continuous Improvement

Table 61: Mapping of espoused and enacted, shared values



In conclusion, leaders and influencers played a significant role in shaping shared organizational values by interpreting, refining, expanding, and operationalizing espoused and shared organizational values. At lower levels of the organization, additional or different values were introduced to match the context in which work was being accomplished. For example, as illustrated in Table 60, while Integrity was the espoused organizational value, it was enacted by senior management in the form of Transparency, by frontline leaders in the form of Continuous

Improvement, and by practitioners in the form of commitment to Patient Safety. Thus, the initial coding structure, which included a high-level code for "Leaders and Influencers," was expanded, as illustrated in Table 62, to include the types of roles played by leaders and influencers: external versus internal. External influencers were found to play a dominant role in raising awareness about the patient safety problem as well as interpreting the problem in the context of the Canadian healthcare system. On the other hand, external leaders played a critical role in raising accountability via new professional standards both for personnel as well as for hospitals. Similarly, internal influencers raised the awareness of the patient safety problem and interpreted it in the context of the obstetrics practice at their hospital, while the internal leaders adopted appropriate formal mechanisms to operationalize the new standards and performance expectations, as well as raised the accountability toward adherence to the new standards and performance expectations.

Table 62: Level 2 coding structure for leaders and influencers

Level 1	Level 2	Description
Leaders and Influencers	External Influencer	External Influencers: general status reports, results of best practices implementation, consequences of patient safety problem in the Canadian healthcare sector
	Internal Influencer	Internal Influencers: operationalized the institutional expectations in the context of obstetrics practice; served as role models.
	External Leader	External Leaders: raised expectations through changes in professional standards for personnel and institutions.
	Internal Leader	Internal Leaders: raised accountability for new performance standards through new programs and incentives at their hospitals.

5.3.3 Shared Experiences Help Revise and Reinforce Organizational Values

The third research question was about the role of shared experiences, through implementation mechanisms, in revising and reinforcing organizational values (RQ_3). The interview transcripts were analyzed to identify different shared experiences and how they might have shaped organizational values.

Theoretically, shared experiences shape organizational values (Schein, 1988, 2010). Analysis of the transcripts revealed two types of shared experiences: infrequent defining moments and routine, refining moments. Defining moments were abrupt and impactful for the entire organization and they were instrumental in changing organizational values; whereas, routine experiences were responsible for reinforcing organizational values. For example, at one hospital, almost every participant commented on the sudden growth in population and diversity and how it impacted every aspect of the organization. Another hospital was dramatically impacted by the appointment of an external Supervisor by the Ministry of Health—it resulted in a chain reaction of changes and brought into focus safety and quality as institutional priorities. Routine shared experiences included non-punitive error reporting programs, the Lean methodology, and clinical debriefings or incident reviews. Table 63 presents this revised coding structure.

Table 63: Level 2 coding structure for shared experiences

Level 1	Level 2	Description
Shared Experiences	Defining Moment	Appointment of a supervisor by the Ministry
	Defining Moment	Sudden growth in population and diversity
	Routine	Non-Punitive Reporting Systems
	Routine	Lean methodology
	Routine	Clinical Debriefing or Incident Review

Additionally, interview transcripts revealed a shift in unquestioned assumptions resulting from the various shared experiences. Thus, the theoretical model, as presented in Figure 7, should include “values, beliefs, and assumptions” instead of just “values.” Furthermore, two types of shifts in unquestioned assumptions were discovered: strategic and operational. Thus, the coding of assumptions was expanded to accommodate these two types of shifts. A particular shift was classified as having a strategic impact if it changed the interpretation of how the fundamental mission of the organization was being accomplished; on the other hand, it was classified as having an operational impact if it changed the way people thought about their routine work. Table 64 lists these shifts in terms of strategic impact and operational impact. Strategically, there were three areas of shifts in assumptions: Accountability, Ethnic Diversity, and Economic Efficiency. Operationally, there were two key areas of shifts in assumptions: Clinical Excellence and Teamwork. It was also noted that unlike shift in organizational values, shifts in assumptions may not be due to dramatic events (defining moments); they could result from chronic exposure to certain conditions like flat or declining budget allocations. Such shifts in assumptions, albeit strategically impactful, may not be sufficient to trigger immediate value-level changes and the subsequent changes in the organizational culture; nonetheless, over time, they may lead to value-level changes. Thus, shifts in assumptions are indicators of potential value-level changes.

Table 64: Level 2 coding structure for assumptions

Level 1	Level 2	Example of Shift in Assumption
Assumption	Strategic	Senior Management will not be held accountable. → Senior Management will be held accountable.
	Strategic	We will always be a small community hospital → We are now a large, diverse community hospital.
	Strategic	The Ministry will always provide enough funding to meet our needs → We will not get what we request or what we deserve; we will have to manage in what we get.
	Operational	Hierarchical obstetrics team structure → Flat team structure
	Operational	Compassion is same as clinical excellence → That's not true; we have to demonstrate that we are both: compassionate and clinically excellent
	Operational	Labor and delivery is going to be generally good, but a random experience → It is going to be a planned, successful experience.
	Operational	We have been assuming that we are good → We must continuously prove that we are at least as good as our peers.

Three types of artifacts were reviewed to determine the degree to which some of the organizational values had been institutionalized: awards, physical items created by the obstetrics unit, and stories about the nature of their work.

Awards, as artifacts of culture, symbolize organizational values: both what is valued by the organization (aspirational value and or shared value) as well as what is valued by the community (attributed value: what value the various sets of communities attribute to their hospital). Table 65 presents these awards and their attributed values. Four external awards and one internal award were mentioned by the participants as artifacts exemplifying the recognition of certain aspects of their organizational culture by their regional community. The Quality Healthcare Workplace Award is presented by the Ontario Hospital Association and it recognizes excellence across three organizational outcomes: quality and patient safety; retention, recruitment, and employer reputation; and employee productivity and costs[15]. The Diversity Employer Award is based on a national competition and the review criteria include not only successful implementation of a wide range of initiatives, but also relative success with respect to peer institutions in the same industry sector[16]. The Excellence in Diversity and Inclusion Award is presented by the Canadian College of Health Leaders and it recognizes leadership in creating and promoting a diversity-friendly work environment[17]. The Accreditation Canada recognition at various levels endorses quality improvement efforts; for example, an "Exemplary Standing" would be awarded to a hospital that demonstrates excellence in quality improvement. Internally, the Good Catch award is presented to individuals or teams that stop an error trajectory from reaching a patient and causing harm. This award celebrates employee alertness to patient safety and encourages all employees (clinical and non-clinical) to be vigilant about patient safety. The Donor Plaques are not traditional awards, but they indicate both the financial support from the community as well as the hospital's appreciation for that support. Also, the diversity in the donors—corporate, individual, ethnic diversity—is indicative of the consistency with which a certain attribute is appreciated.

[15] https://www.oha.com/CurrentIssues/keyinitiatives/QualityHealthCareWorkplaceAwards/Pages/QualityHealthcareWorkplaceModel.aspx
[16] http://www.canadastop100.com/diversity/
[17] http://www.cchl-ccls.ca/site/awards_diversity_inclusion

Table 65: Recognition and attributed values

Recognition	Attributed Value (s)	Hospital A	Hospital B
Quality Healthcare Workplace Award	- Quality and Safety - Reputation - Efficiency	X	X
Diversity Employer Award	- Diversity and Inclusion		X
Diversity and Inclusion Award	- Diversity and Inclusion		X
Accreditation Canada	- Commitment to Quality Improvement		X
Good Catch Award	- Patient Safety	X	X
Donor Plaques	- Gratitude	X	

The obstetric teams as well as the frontline leaders and senior managers talked about various physical items created by their members that could be linked with an underlying value and meaning. Table 66 presents these items, their underlying value, and symbolism. Generally, these items were high on utility because they were designed for a practical purpose and were updated as necessary to improve their effectiveness; they were high on symbolism because they had become an integral part of the participants' work environment and a manifestation of value attached to their work; however, except for the Annual Reports, most of them were low on aesthetics because they were not supposed to be for external use.

Table 66: Physical items and their underlying values and symbolism

Item	Underlying Value	Symbolism (Meaning)	Hospital A	Hospital B
Kits and Checklists - Postpartum Kit - Pregnancy Induced Hypertension Kit - Intubation Kit - Surgical Checklist	- Quality - Safety - Efficiency	- We are prepared - We are experienced - We adopt best practices - We care about patient safety	X	X
Whiteboards, dashboards, and scorecards - Huddle Boards - Quality Metrics - Efficiency Metrics	- Communication - Coordination - Accountability - Transparency	-We keep track of our progress -We keep our team members informed -We take care of discrepancies and deviations -We take responsibility		X
Annual Reports	- Communication - Engagement	- What's important - We are improving - Reputation and Brand Value	X	X
Unit Charter - A code of conduct for the obstetrics unit	- Professionalism - Discipline - Solidarity	- We self-regulate - We prioritize safety and quality - Don't push us below our standard of practice		X
External Performance Indicators - Health System Performance Indicators[18]	- Communication - Standardization - Accountability - Transparency	- Quality, safety, and efficiency are national concerns	X	X

Participants were asked tell stories or anecdotes that were being shared in their group (about obstetrics, hospital, or community) that would be useful in communicating the nature of work at their hospital or obstetric unit. They were asked to consider scenarios that would illustrate cultural changes over time,

[18] https://www.cihi.ca/en/health-system-performance/your-health-system-tools

specific cultural attributes of the current environment, or stories that they would tell prospective employees, new employees, or even patients to communicate what it is like to be a member of this hospital. Twenty-two anecdotes were collected. A set of three anecdotes that illustrate overall organizational values and three others that illustrate values at the obstetrics unit level are presented.

> Story #1: How we reduced the length of stay after surgery
>
> In surgery, our conservable days were 35 percent; today, we range between 11-14 %. How did we do that? We made it transparent. We made it known what the conservable days were by provider—this is what is costing the organization. Conservable days are patients staying over their optimum length of stay (overstay). If the readmission rates, patient satisfaction rates, infection rates, are no different, then why are one provider's patients staying longer than the others? So, we keep working provider-by-provider—that's how we shut a whole unit down: 32 beds! All because of variation in practice!! One spine surgeon was sending patients in 2.5 days, the other was keeping them for 5 days. It required peer-to-peer coaching. It was not about me telling the surgeon, it was about their high-performing peers speaking to their colleagues—that's the dialog, trust and openness that needs to exist. It exists today, but did not exist years ago. No, you would never question anyone's practice—in fact, you didn't even know another provider's performance.
>
> We just implemented ERAS system (Enhanced Recovery After Surgery)—it's another new process that you implement. In orthopedics, through ERAS, our length of stay went from 7 days to 3.5 days for joint surgery. The momentum is building. Day before yesterday, my spine surgeon spoke with our clinical resource leader, "I need to implement ERAS on my spine surgery because if they were solely spine patients, they would be going home within 2 days after the procedure I am doing, but because I am doing the abdominal approach to get to the bottom of the spine, why can't I use ERAS?" Now they are developing a learning plan and an implementation plan.
>
> With orthopedic integration to one site, our access improved, our safety improved, our variation in practice decreased, and our length of stay decreased. The efficiency gains resulted in ability to provide access to more patients with same bed allocation and human resources. Occupancy went up from around 72% to around 90% and we are using our resources more effectively; length of stay went down so our patients are going out faster and our cost per patient went down. We never lose sight of quality indicators like readmission rates, infection rates, or patient satisfaction or staff satisfaction. With our staff, they want to stay on one unit where they were hired; they don't want to be cancelled when they are scheduled to work; they don't want them to be moved to another unit because there's not enough work on a particular unit. So, as you increase your throughput and your efficiency, you are actually retaining your staff; as you retain your staff, you are building knowledge and capacity; the application of consistent knowledge and capacity results in better patient care, which in turn results in better outcomes.
>
> Values: Transparency, Accountability, Clinical Excellence

Story #2: Training in teams fosters working in teams.

I remember having to do the OSCE "OS-KEY" (objective structured clinical examination) stations, we didn't have enough physicians to do all the OSCE stations so I was monitoring and evaluating physicians and nurses who were all applying forceps, doing vacuum deliveries, they started to add MORE^{OB} work that we had done. I could hear nurses saying, "Dr. Smith, why are you doing it like that?" That would never have happened in the old days. Once the physicians were part of it, and part of the groups, they were able to even show off! I can remember doing the forceps OSCE and the doctors were eager to show off their new skills. Physicians, nurses, and midwives were working very well together. For about six months, there was a lot of buzz about MORE^{OB}. When the activity was low, they would read the chapters together and ask questions. There was a lot of excitement! When we were at the first workshop, I remember when we did the OSCE, it was a "wow" moment. We had the pelvic simulator, we had all the equipment on the unit to practice—it was like this is what obstetrics needed for a long time! It brought the inter-professional team together in a way where people could ask questions and learn together. Then, we started hearing, "MORE^{OB} says…" both within professions and across professions. I would see nurses taking out pneumonic for vacuum delivery and work through it. It was not too long where they knew all the pneumonics and became true experts.

Values: Flattened Hierarchy (Teamwork), Assertiveness, Communication,

Teamwork, Clinical Excellence

Story #3: We surprised the rest of the hospital.

We had an amniotic fluid embolism and our OR staff was a little taken back that we had the patient stabilized before they could come and before the doctor had asked. We just saw the patient going into shock; we didn't know what it was because it is extremely rare (I many not see another one of those cases rest of my career). We attribute this ability to our MORE^{OB} training—we didn't have to talk to anyone. We had the IV ready, we had drawn blood, we know what we needed to do and we were doing it. We just knew what was needed. We had another case with placenta accreta and she had delivered vaginally and she kept hemorrhaging—we knew that she would have to have a hysterectomy and we were prepared. Two nurses were on one side with one OB and another two nurses were on the other side with the other OB. We knew what the physicians needed and we didn't need to talk. Physician doesn't have to ask us what to do because we already know.

Values: Teamwork, Clinical Excellence

Story #4: Costs can drive the quality agenda

We have had a program on C-sections. That's an excellent example of how costs drove the quality agenda. We limited the OB/GYN department to a fixed amount of budget and they were doing x number of deliveries. We recognized that if they cut their C-section rates down, they could do more deliveries; otherwise, we would have to cap them at a certain number. That was an impetus for their department to say that they could do better with their C-section, particularly if we want to continue with the same number of births or grow the number of births. We capped the amount of money that we were willing to provide to the

> department and that fixed amount equated to a certain number of births. Let's say they could do 3,000 births in the available budget. So, they either had to find money from other sources to increase the number of births or to limit the number of births to 3,000. It was then recognized that a vaginal birth costs the hospital much less than a C-section birth. The OB department was not happy in the beginning, but realized that the hospital was in a difficult position. The chief took it on as an opportunity. Capping the number of births would have meant a cut in the number of births and the overflow patients would have to go somewhere else. Since the obstetricians get paid for every birth that they handle, this would have meant a cut in their compensation. From reputational perspective, the hospital doesn't want to be turning people away. The hospital is caught in the middle—we don't want people to go somewhere else. Of course, vaginal births are inherently safer for the mother and child.
>
> Values: Cost containment (Accountability), Quality of Care, Patient Safety

In conclusion, a synthesis of value statements, shared experiences, shifts in assumptions, and artifacts consistently supported three fundamental values: Accountability, Inclusion, and Excellence. Table 67 presents the Level 2 coding structure for values.

Table 67: Level 2 coding structure for values

Level 1	Level 2	Supporting Evidence
Values	Accountability	• Stories • Ministry's actions • Accreditation expectations • Legal expectations (ECCFA and QCIPA) • A code of conduct for the obstetrics unit • Kits and Checklists • Good Catch Award
	Inclusion	• Stories • Whiteboards, dashboards, and scorecards • Diversity and Inclusion Award
	Excellence	• Stories • Kits and Checklists • Annual Reports • Health System Performance Indicators Quality Healthcare Workplace Award • Accreditation Canada recognition

The specific ways in which leaders and influencers shaped and institutionalized the shared values varied. For example, the Ministry's decision to hold the senior management team accountable and replace them in order to improve the hospital's overall effectiveness was a wakeup call for everyone at Hospital B. It shifted the community's unquestioned assumption that the Ministry would not hold the senior management accountable to a new assumption that the Ministry would hold the senior management accountable. Subsequently, there was support for accountability through legislation and positon statements or standards from professional bodies. For example, the Excellent Care for All Act (ECFAA) holds the senior management accountable for quality and safety; Accreditation Canada holds the hospital accountable for continuous improvements in quality and safety; and the Canadian Healthcare Reporting Program makes the quality and safety scorecard publicly available, thereby adding transparency. Therefore, one could say that the external influencers institutionalized the values of accountability, inclusion, and excellence by holding senior management accountable for their performance, requiring transparency in key safety, quality, and operational metrics, and linking hospital accreditation to compliance with such requirements.

Two levels of inclusion were noted: community and professional. At the community level, the inclusion was about being responsive to the ethnic diversity of the community in which the hospital was located. There were several artifacts proving that the hospitals were being responsive to their community's needs: for example, multi-lingual information brochures, provision of translation services, diversity in the staffing reflective of the diversity in the community, and donor plaques appreciating philanthropic contributions from the community as well as demonstrating satisfaction across the visible minorities. At the professional level, inclusion was about respecting the different professionals on the obstetrics team, valuing everyone's opinion, encouraging evidence-based decision-making, including patients in decision-making, and being compassionate with each other as well as with the patients.

Excellence included clinical excellence and financial efficiency. The use of the Lean methodology and clinical debriefings were clearly tied to improving the quality of care and emphasizing systemic improvements. However, they also resulted in reduced waste by eliminating the unnecessary process loops and redundant, conflicting or ineffective policies, as well as by streamlining communication. Excellence was also mentioned in the context of accountability: "we are expected to be accountable to our tax payers in how we utilize our financial resources…our quality improvement efforts are expected to improve both patient safety and efficiency…the better the efficiency, the greater the chance of support from our provincial government."

Overall, several shared experiences were reported by the interview participants through which they illustrated how such experiences influenced their shared values. Among these experiences, the defining moments included appointment of the external supervisor and sudden growth of the local population. In contrast, the routine experiences included implementation mechanisms such as the non-punitive reporting system or clinical debriefing. Over a period of time, these experiences resulted in shifts in assumptions, operationalization of shared organizational values, as well as alignment between internally shared values and externally attributed values. Additionally, several daily-use artifacts reinforced the institutional commitment toward their shared organizational values.

5.3.4 Feedback Influences Learning Derived from Shared Experiences

The fourth research question was about the role of feedback regarding performance in influencing learning derived from shared experiences (RQ_4).

Theoretically, and through other empirical studies presented in Chapter 2, feedback plays a critical role in performance improvement, and the means by which feedback is generated and shared are mechanisms that institutionalize cultural values, and the tangible evidence that demonstrates performance improvement serves as a cultural artifact.

The interview narratives were analyzed to determine how performance feedback mechanisms could have influenced learning derived from shared experiences, and what artifacts could serve as evidence to support the participants' claims. Overall there were 29 references to feedback mechanism and they were categorized as internal versus external, and formal versus informal. Also, the label for "Feedback Mechanisms" was changed to "Learning and Sensemaking Loops" (Weick, 1995) to be more descriptive of the actual role of these mechanisms, as derived from the narratives. Table 68 presents the level 2 coding structure for learning and sensemaking loops.

Table 68: Level 2 coding structure for learning and sensemaking loops

Level 1	Level 2	Example
Learning and Sensemaking Loops [Feedback Mechanisms]	Internal, Formal	Monthly review of clinical outcomes by the obstetrics team
	External, Formal	Survey results are compared laterally across peer hospitals in the province and longitudinally across each hospital's preceding cycle's performance. Undesirable outcomes and trends are investigated and appropriate interventions are implemented
	Internal, Informal	The obstetrics team randomly picks patient charts for monthly audits and reviews discrepancies; results are used for education and systemic improvements.
	External, Informal	A group of stakeholders that is used to develop new ideas and initiatives, test initiatives, and champion their dissemination

Table 69 shows the mapping of learning and sensemaking loops with underlying cultural values and artifacts. While there were many examples of internal and external artifacts that were used by the participants, they also identified some intangible artifacts such as a coaching experience that resulted in improved performance. External artifacts included a variety of regularly reported data that were being shared within the group of reporting hospitals as well as some that were publicly available. The Canadian Institute for Health Information played a critical role in improving both transparency and accountability by making performance data on key metrics publicly available. Examples of such metrics include Access and Wait Times, Quality of Care and Outcomes, Integration and Continuity of Care, and Performance Reporting[19].

[19] https://www.cihi.ca/en/health-system-performance

Table 69: Learning and sensemaking loops used to reinforce values

Learning and Sensemaking Loops	Description of its Use	Underlying Organizational Value	Artifact
Monthly review of clinical outcomes by the obstetrics team	The obstetrics team reviews its clinical outcomes with respect to its peer institutions and its own pre-established performance targets. Outlier cases are discussed in detail and systemic solutions are implemented as necessary.	Accountability Clinical Excellence Transparency Continuous Improvement	Change in C-section rate from 29% to 23%; Change in induction rate from 19% to 13%
Regular Surveys: Staff Satisfaction, Physician Satisfaction, Patient Satisfaction, and Patient Safety Culture	Survey results are compared laterally across peer hospitals in the province and longitudinally across each hospital's preceding cycle's performance. Undesirable outcomes and trends are investigated and appropriate interventions are implemented	Accountability Inclusion (employees and patients) Continuous Improvement	Generally, participants noted that their survey results were starting to slip and they needed to refresh some of their previously successful initiatives.
Community Advisory Board	A group of stakeholders that is used to develop new ideas and initiatives, test initiatives, and champion their dissemination	Community Engagement Continuous Improvement	Community Advisory Board
Monthly Audits of Patient Charts	The obstetrics team randomly picks patient charts for monthly audits and determines if there are any patterns for concern. The results of these reviews are used for education and systemic improvements.	Continuous Improvement Accountability	Examples involved review of clinical skills, more consistent enforcement of established policies, and early identification of factors that tend to increase risks.

Table 69 (Continued): Learning and sensemaking loops used to reinforce values

Learning and Sensemaking Loops	Description of its Use	Underlying Organizational Value	Artifact
Strategic Plan with goals and schedules	The hospital’s strategic plan aligns with every clinical and non-clinical unit’s performance goals.	Continuous Improvement Accountability Transparency Excellence	Patient safety and quality scorecard is one of the artifacts used to track unit as well as hospital level improvements.
Incident Reporting System	The Incident Reporting System is available to all hospital personnel. It is used to share critical incidents that resulted in harm to the patient as well as those that did not result in any harm. “Good Catch” stories are also shared through this system	Clinical Excellence Patient Safety Accountability	Several examples of incident reports were shared with the researcher. Also, the format used to report such incidents to management and the Board was shared.

In conclusion, the learning and sensemaking loops could be classified in accordance with a 2x2 matrix: formal versus informal, and internal versus external. Also, overall, learning and sensemaking from group-level performance influenced learning from shared experiences by (a) creating transparency of performance status; (b) engaging employees and patients in assessing their experience; (c) employing a broad array of quality control mechanism; and (d) recognizing personnel who stopped undesirable outcomes.

5.4 Conclusions from Study #2

Study #2 was a qualitative analysis of interview data. Forty-one individuals, representing both management and frontline personnel participated in the interviews. A summary of research questions explored and their respective findings are presented below.

RQ_1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

Analysis of interview transcripts led to the identification of four environmental factors: economic, geo-social, legal, and professional. Economically, the Canadian healthcare system had not been increasing funding to hospitals commensurate with their patient volume and therefore most hospitals were forced to implement innovative cost-containment measures in order to meet the increasing demand within the available resources. From a geo-social perspective, the local population had not only increased, but had become more diverse. They needed multilingual support, their health profile was different (increased cases of delayed pregnancies, diabetes, and hypertension), and they had different traditions with respect to medical care. Legally, QCIPA provided means to hold interdisciplinary dialog about medical errors in a protected environment, and ECFAA required hospitals to link executive compensation to quality improvement initiatives. Professionally, there were complementary requirements from accreditors, and organizations representing obstetricians, nurses, midwives, and hospitals were all in support of quality and safety. All these factors collectively made the values of quality and safety explicit, as well as encouraged the development and use of implementation mechanisms to measure and improve quality and safety, thereby influencing the patient safety culture in the obstetrics practice in Ontario.

RQ_2: How did leaders and influencers shape shared organizational values at the subject organizations?

First, a hierarchical value-mapping exercise was conducted to identify the participants' shared values, which were as follows: Patient Safety, Quality of Care, Inclusion, Mutual Respect, Accountability, and Continuous Improvement. Next, four types of leaders and influencers were identified by the participants: external versus internal as well as formal versus informal. From an external-informal perspective, influencers like Dr. Ross Baker and Dr. Ken Milne were instrumental in influencing national legislature, professional organizations, hospital administration as well as clinical personnel to develop specific measures to reduce adverse events. Internally, formal senior management as well as frontline personnel played a key role in raising expectations of alignment with the shared values of the organization, increasing transparency about quality and clinical performance, and holding each other accountable for modeling the desired behaviors. External-formal influencers like the Ministry of Health held the hospital management accountable and changed the unquestioned assumptions held deeply among the hospital staff. Internal-informal influencers served as role models who practiced the desired behaviors (consistent with the shared values) and encouraged their peers and team members to do the same.

RQ$_3$: How did shared experiences, through implementation mechanisms, help revise and reinforce organizational values at the subject organizations?

There were two types of shared experiences: defining moments and routine, refining moments. Defining moments were abrupt and impactful for the entire organization. For example, at Hospital A, almost every participant commented on the sudden growth (and change in diversity) and how it impacted every aspect of the organization and also threatened its ability to maintain its original, deeply-held values. On the other hand, Hospital B was dramatically impacted by the appointment of an external Supervisor by the Ministry of Health—it resulted in a chain reaction of changes and brought into focus safety and quality as institutional priorities. Routine shared experiences included non-punitive error reporting programs, the Lean methodology, and clinical debriefings or incident reviews. Also, several shifts in unquestioned assumptions were noted. A particular shift was classified as having a strategic impact if it changed the interpretation of how the fundamental mission of the organization was being accomplished; on the other hand, it was classified as having an operational impact if it changed the way people thought about their routine work. Strategically, the three main areas of shifts in assumptions were accountability, ethnic diversity, and economic efficiency. Operationally, the shifts in assumptions were in the areas of clinical excellence and teamwork. Also, analysis of physical artifacts and stories revealed institutionalization of practices consistent with MORE^{OB} training, shared organizational values, and other implementation mechanisms such as the Lean methodology. Thus, there were several examples to illustrate how shared experiences, through implementation mechanisms, helped revise and reinforce organizational values.

RQ$_4$: How did feedback from group-level performance influence learning derived from shared experiences at the subject organizations?

The interview narratives were analyzed to identify feedback mechanisms, the underlying cultural values that might have been reinforced, and artifacts that could serve as evidence to support the claim. Overall, there were 29 references to feedback mechanisms; both formal and informal mechanisms, as well as internal and external mechanisms were considered. External artifacts included regularly reported data that were being shared within the group of reporting hospitals as well as some that were publicly available. The examples presented by the participants revealed that feedback from group-level performance influenced learning derived from shared experiences by identifying performance gaps with respect to benchmark hospitals as well as with respect to past performance and target performance at both group-level (obstetrics) and firm-level (hospital). The title of "feedback mechanisms" was changed to "learning and sensemaking loops" to better reflect their role in shaping the organizational culture.

Ultimately, this study also resulted in a revised coding structure that offers additional detail and insights about the various cultural elements and their interactions. Table 70 presents the consolidated revised coding structure for narrative analysis. In accordance with this structure, there were four types of environmental factors; the MORE^{OB} training's attributes aligned with the shared organizational values; there were four types of leaders and influencers, there were two types of shared experiences; there were three overarching shared values, and there were four types of learning and sensemaking loops.

Table 70: Consolidated revised coding structure for narrative analysis

Level 1	Level 2	Description/Example
Environmental Factors	Economic	Changes in general economic conditions or assumptions of the industry or the region, changes in budgets or budget models
	Geo-social	Changes in local population : demographics, medical needs, ethnic cultural peculiarities, religious, linguistic, or social customs
	Legal	Changes in laws or accreditation requirements impacting the operation, underlying assumptions, and societal expectations
	Professional	Expectations from professional societies like the Society of Obstetricians and Gynecologists of Canada
MORE^{OB} Training	Attribute	Credible
	Consequence	It could help against insurance and malpractice claims
	Shared Value (s)	Patient Safety & Quality of Care
Leaders and Influencers	External Influencer	External Influencers: general status reports, results of best practices implementation, consequences of patient safety problem in the Canadian healthcare sector
	Internal Influencer	Internal Influencers: operationalized the institutional expectations in the context of obstetrics practice; served as role models.
	External Leader	External Leaders: raised expectations through changes in professional standards for personnel and institutions.
	Internal Leader	Internal Leaders: raised accountability for new performance standards through new programs and incentives at their hospitals.
Shared Experiences	Defining Moment	Appointment of a supervisor by the Ministry
	Routine	Non-Punitive Reporting Systems
Assumptions	Strategic	Senior Management will not be held accountable → Senior Management will be held accountable.
	Operational	Compassion is same as clinical excellence → That's not true; we have to demonstrate that we are both: compassionate and clinically excellent
Values	Accountability	Stories; Ministry's actions; Accreditation expectations; Legal expectations (ECCFA and QCIPA); A code of conduct for the obstetrics unit; Kits and Checklists; Good Catch Award
	Inclusion	Stories; Whiteboards, dashboards, and scorecards; Diversity and Inclusion Award
	Excellence	Stories; Kits and Checklists; Annual Reports; Health System Performance Indicators Quality Healthcare Workplace Award; Accreditation Canada recognition
Learning and Sensemaking Loops	Internal, Formal	Monthly review of clinical outcomes by the obstetrics team
	External, Formal	Survey results are compared laterally across peer hospitals in the province and longitudinally across each hospital's preceding cycle's performance. Undesirable outcomes and trends are investigated and appropriate interventions are implemented
	Internal, Informal	The obstetrics team randomly picks patient charts for monthly audits and reviews discrepancies; results are used for education and systemic improvements.
	External, Informal	A group of stakeholders that is used to develop new ideas and initiatives, test initiatives, and champion their dissemination

Chapter 6: Study #3

6.1 Introduction

This study represents the integrative step in Creswell and Clark's (2007) convergence model for mixed-methods research (see Figure 8). The quantitative analysis presented in Study #1 revealed that training, as a planned intervention, can improve the domain knowledge among the participants, can improve the organizational climate, and can have a delayed, but measurable influence on the clinical outcomes. It also helped develop a six-factor safety climate model. The qualitative analysis presented in Study #2 provided a richer explanation of how certain environmental factors, leadership behaviors, shared experiences, and learning and sensemaking loops contributed to shift in assumptions and had a value-level impact. Study #2 also helped refine the previously developed organizational culture model by adding a second level of coding structure. Since the integrated model of culture and climate calls for a holistic analysis of both constructs (culture and climate) in order to develop a robust understanding of how, and under what conditions, an organization maintains and revises its culture, it was essential to structure this final study as an integrative study and specifically focus on the cultural elements that may distinguish specific hospitals from their peer groups. It was known from Study #2 that there were two defining moments or systemic shocks—one to Hospital A (sudden growth in population and ethnic diversity) and one to Hospital B (appointment of the external supervisor)—that may have contributed toward a more distinctive dynamic between the various cultural elements, leading to a potentially distinctive patient safety climate and clinical outcomes at those hospitals. Thus, these two hospitals were selected for a longitudinal study. It is also acknowledged that since these two hospitals emerged from the pool of eligible hospitals as a matter of convenience sampling, the results reported in this study may be subject to self-selection bias—they hospitals decided to participate in the study because they thought/knew that they had a better organizational culture than their peers.

The goals of this study were to (a) determine if the subject hospitals performed any better than their peer group and (b) determine how inherent cultural elements might have influenced the effectiveness of the MORE^{OB} program in changing the patient safety culture within the obstetrics units at these hospitals. Thus, the research question was as follows:

RQ_5: How do inherent cultural elements influence the impact of a planned culture-change intervention?

As presented in Chapter 1, the integrated model of organizational culture and climate consists of six elements of culture: shared experiences, organizational values, implementation mechanisms, leadership (role of leaders and influencers), performance outcomes, and feedback mechanisms (which were later called "learning and sensemaking loops). Organizational climate, on the other hand, is considered the psychological response to culture, and could be described using a six-factor model, which was reported in Study #1. Quantitative data came from sources previously described and used in Study #1 and the qualitative data came from the interview narratives and artifacts discussed in Study #2. Results of these analyses are reported with respect to each subject hospital in terms of (a) shared experiences and organizational values, (b) role of leaders and influencers, (c) learning and sensemaking loops, (d) effects of MORE^{OB} training on outcomes,

(e) effects of MORE^{OB} training on patient safety climate, and (f) an integrated review of culture and climate with respect to the MORE^{OB} training.

6.2 Longitudinal Analysis of Hospital A

Hospital A reported about 3,100 births in 2015 and it was located in a major metropolitan area with a diverse ethnic population. It was considered one of the Late Adopters of the MORE^{OB} program because most of the participants completed their three training modules in the 2006-2009 timeframe. Prior to implementing the MORE^{OB} program, Hospital A's overall mean Length of Stay was 2.19 versus 2.43 days at the rest of the Late Adopters, 2.37 at the Non Adopters, and 2.45 days at the Early Adopters. However, Cesarean section (C-section) rate was higher than that at the other hospitals in the Late Adopter group as well as all the hospitals in the Non-Adopter group: 28.9 versus 25.4 and 27.5 per cent, respectively. Thus, the hospital seemed to be performing well on overall efficiency, but there was room for improvement in the C-section rate. Therefore, reduction in elective (low and reduced risk) C-section rates became one of the key goals for obstetrics. This section presents a longitudinal analysis of the influence of the inherent cultural elements on the effectiveness of the MORE^{OB} program in changing the patient safety culture and climate within the obstetrics unit at Hospital A.

6.2.1 Shared Experiences and Organizational Values

Based on the emergent model of culture and climate used in this study, shared experiences help revise and reinforce organizational values. Therefore, participants from Hospital A were asked to generally describe some of their memorable experiences at Hospital A, and probed further to elicit examples that may reveal deeply-held, unquestioned assumptions as well as values. Most of the shared experiences reported by the interview participants (n=20) related to small size and empathetic care. The senior management recounted two key stories:

> Story #1: Everyone feels proud of the culture here…we give high quality of care. When we do an actual objective, deep dive, we are not necessarily doing what we hope that we would be doing. We seem to be riding on our reputation and there's a bit of a miss-association between care and quality: because we care, we must be providing good quality of care. MORE^{OB} is a good example. When we stopped the program, we saw slippage—when new people came in, we were not able to keep that culture going. We tend to lose the discipline, rigor and consistency. Another example is wound care. If you ask people about pressure ulcers, they will say that we never have issues with pressure ulcers. In reality, if we look at the data, we do have problems—we are no better than anyone else. So, the people's perceptions about quality of care are confounded by the quality of compassion that people have for their patients.

Thus, the prevalent unquestioned assumption was, "because we care, we must have good quality."

> Story #2: I heard many stories where people talk about how they brought their friends and relatives here and how someone really cared and went above and beyond, reflecting personal care. The hospital is therefore very much revered and extremely important part of the community's fabric. Strong emotions are attached to this hospital. The donor plaques in the front lobby reflect not only community's ownership of the hospital, but also the diversity of the community—ethnicities, languages, religions, etc.—is very well represented in the donor-base of the hospital.

Thus, another prevalent unquestioned assumption was that the community took emotional and financial ownership of the hospital.

However, a critical shared experience, which turned into a defining moment, was the fact that the hospital's local community experienced a sudden and drastic increase in population as well as ethnic diversity. As a result of this sudden shift, the hospital had to not only care for a much larger population, but also respond to ethnic needs such as language support and counseling, support significantly different medical care, and engage in a rapid hiring process. Thus, many of the participants were concerned that they would not be able to nurture their cherished organizational values.

Values attributed to Hospital A (by its local community) were derived from interview narratives based on the participants’ reasons for joining the hospital, stories being told in the community about the hospital, and personal experiences as employees and patients. A value-mapping exercise (as described in Study#2) was conducted to identify the following attributed values: compassion, excellence, diversity, and accountability. The espoused values were derived from the hospital’s strategic plan and marketing posters[20]; they were as follows: healthy community, safe and high-quality care, talent development, and accountability.

The MORE^{OB} program, as a team-training intervention, served as a planned intervention. Therefore, narratives (n=28) associated with the experience of participating in the MORE^{OB} training as well as after the implementation of the MORE^{OB} program were analyzed to derive the group’s shared values. Figure 29 illustrates the value map for Hospital A. The attributed value of compassionate care surfaced in the participants’ narrative about why they wanted to reduce the C-section rate and how they included the patients in their decision-making process. Thus, it was also noted as a shared value. Excellence was related to both patient safety and quality of care. Thus, excellence, as an attributed value was linked with the espoused value of safe and high-quality care. The narratives about safety and quality expressed general concern for patient safety and noted examples of increased assertiveness among nurses as well as improved teamwork within the obstetrics team. These shared experiences were linked to patient safety and quality of care as two shared values. Diversity, as an attributed value, was readily visible to the researcher based on observation of ethnic diversity among

[20] These values have been slightly reworded because the original document presented them as belief statements rather than espoused values as stated in the parenthetical statements.

the physicians and staff employed at the hospital. This value was echoed in the espoused value of talent development (by investing in people). It was further noted in shared experiences as to how people were valued and their opinions were sought; also, the MORE^{OB} program was viewed as an example of investment in the people. Finally, accountability was the most consistently mapped value as an attributed, espoused, and shared value. The experiences relating to accountability included responsibility toward patient (clinical and humanitarian) as well as responsibility toward the healthcare system—judicious use of financial resources will be better for the entire system, not just for Hospital A.

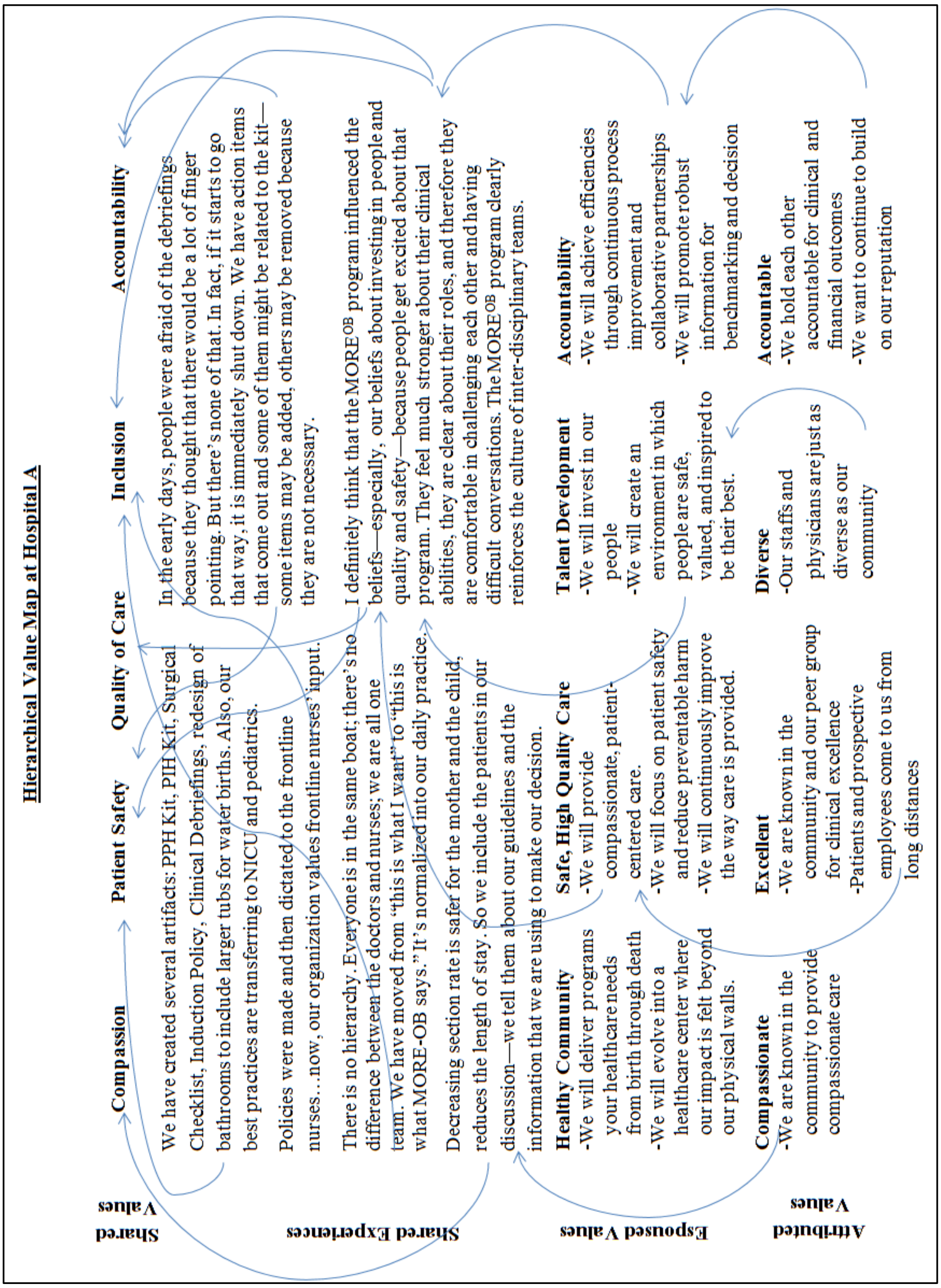


Figure 29: Hospital A's hierarchical value map

As a result of implementing the MORE^{OB} program, participants reported the creation and use of specific artifacts like the PPH kit illustrated in Figure 30. Such artifacts were typically moderate in their aesthetic appeal, but high in utility and symbolism. They served as tools for consistent practice of behaviors and skills learned through MORE^{OB}. Also, the MORE^{OB} program served as a tool to train new entrants into the existing culture of the organization.

Figure 30: PPH kit made by the obstetrics team at Hospital A

Three types of shared experiences were noted: pre-intervention, during the intervention, and post-intervention. In the case of Hospital A, the sudden growth in population and ethnic diversity created a defining moment prior to the intervention and influenced both how the leadership responded to this situation (described in greater detail in the next section) as well as its influence on the alignment between attributed, espoused, and shared values. The experience of implementing the MORE^{OB} program empowered the participants to change their workplace behaviors: they became more assertive, focused on evidence-based practice, flattened the professional hierarchy within their team, etc. The actual practice of these learned behaviors formed their post-intervention shared experience. A review of artifacts illustrated reduction of variation in their practice (as evidenced by the PPH kit) as well as creation of additional, complementary implementation mechanisms like critical incident reviews, routine analysis of C-section rates, labor induction policy, progressive growth in the scope of practice for the midwives, and peer-to-peer enforcement of inter-personal communication standards. As the participants practiced new behaviors and adhered to the new implementation mechanisms, they also witnessed improved clinical performance and experienced a positive reinforcement of their personal learning and sensemaking, which ultimately reinforced their shared values.

In summary, the shared organizational values at Hospital A were mediated by the shared experiences of the participants; first, as members of the community (attributed values) and then, as members of the obstetrics team. Their defining moment emerged from the external environment and triggered three categories of impact: forced the leadership to reframe the emerging challenge into local context (presented in more detail in the next section), challenged the participants to confront their deeply held assumptions, and contributed toward the acceptance of the MORE^{OB} program as one of the potential solutions. The MORE^{OB} program itself created new shared experiences, which resulted in improved clinical outcomes, and helped revise and shape the shared organizational values. As a result, the community was able to further strengthen their culture and use their defining moment toward positive adaptation.

6.2.2 Role of Leaders and Influencers

Based on the emergent model of culture and climate used in this study, leaders and influencers shape shared organizational values. Therefore, participants from Hospital A were asked about how their leaders and influencers might have shaped the shared organizational values at their facility. The participants (n=20) claimed that their senior management was generally supportive of the MORE^{OB} training because it was credible, successful at other hospitals, and promised safety and cost savings. The following response from one of the managers is indicative of how senior management influenced workplace behaviors by aligning the interests of individuals and the organization:

> We limited the OB/GYN department to a fixed amount of budget and they were doing x number of deliveries. We recognized that if they cut their C-section rates down, they could do more deliveries; otherwise, we would have to cap them at a certain number. That was an impetus for their department to say that they could do better with their C-section, particularly if we want to continue with the same number of births or grow the number of births. We capped the amount of money that we were willing to provide to the department and that fixed amount equated to a certain number of births. Let's say they could do 3,000 births in the available budget. So, they either had to find money from other sources to increase the number of births or to limit the number of births to 3,000. It was then recognized that a vaginal birth costs the hospital much less than a C-section birth. The OB department was not happy in the beginning, but realized that the hospital was in a difficult position. The chief took it on as an opportunity. Capping the number of births would have meant a cut in the number of births and the overflow patients would have to go somewhere else. Since the obstetricians get paid for every birth that they handle, this would have meant a cut in their compensation. From reputational perspective, the hospital doesn't want to be turning people away. The hospital is caught in the middle—we don't want people to go somewhere else.

A corresponding comment from a frontline clinician (influencer) was as follows:

> The hospital management was very supportive of this program. For them, it's all about dollars! The program itself is costly, but the cost saving to the hospital is enormous: decreased section rate, decreased length of stay, decreased baby's stay in the NICU—it also puts the hospital on the map. Dr. [Obstetrician] has done many interviews about decreased section rates; other hospitals have come here to learn how we reduced our section rate. Again, it puts [Hospital A] in a leadership position.

In mentoring new entrants, preceptors (influencers) played a critical role in imprinting the shared organizational values on them. In this case, the MORE^{OB} training became the baseline expectation from new entrants:

> We start from the very beginning. When they give their preceptors out, it's usually those nurses that have been here longer and it's usually repetition. We do get to see different styles—we swap the preceptors from time to time to mix up the styles; we refer them back to the MORE^{OB} manuals, we pull skills drills; they do a lot of mentoring even after they have finished formal training—they stay connected to their mentors. We teach them until we have taught them enough and then we watch them in action; then the preceptors feel comfortable as well. I think it takes about 3 years before a nurse is confident and comfortable handing a variety of cases and in thinking outside the box without realizing that they are thinking outside the box…We are really committed to the practice and it has become very normal in our practice and in our teaching of new nurses. It's normalized into our daily practice.

Nurses at Hospital A played a critical role in enforcing the obstetrics team's agreed-upon MORE^{OB} guidelines. For example, in an effort to reduce their C-section rate, they agreed that they would not induce labor unless the patient is at 41 weeks plus 3 days of gestation. Prior to these guidelines being in effect, patients were being scheduled after 38 weeks of gestation based on the doctor's availability or other scheduling conveniences. Maintaining the "41+3" threshold was consistent with the obstetrics team's shared values as well as the hospital's espoused values; yet, adhering to this standard was a challenge in the beginning. The doctors were habituated in the old way of scheduling the C-sections and the nurses and the scheduling staff was hesitant to change the extant practices. However, the MORE^{OB} training empowered the nurses to be assertive and help enforce the 41+3 rule. A senior nurse explained how conflict with the community's shared values was handled:

> With the doctors, they have seen the hierarchy at other places, but when they come here, they see that we work as a team and if they don't work with the nurses, don't communicate with the nurses, they don't stay long because then we complaint that they don't work as team members and they don't fit. It takes several shifts of effort on our part to work with them, but at the end, if it doesn't work, they leave. One of the doctors told us that she had heard that the nurses here tend to eat their doctors so she was fearful coming here, but now that she is here and has gotten to know everyone, she is really happy here.

Thus, leaders and influencers impacted organizational values via two mechanisms: interpretation and operationalization. Senior leaders played a vital role in interpreting the external, environmental factors in the context of the local priorities and constraints. They observed that in order for the obstetrics team to thrive, they needed to grow the patient volume within the current budget constraints. In response, they committed to the MORE^{OB} training and adjusted the incentives so that the entire obstetrics team was motivated to reduce the elective C-sections and increase the total patient volume. The preceptors and senior nurses served as guardians of the new performance standards and professional practices, thereby reinforcing the previously agreed-upon shared values. Together, they influenced implementation mechanisms through policies, guidelines, and incentives, and workplace behaviors through role modeling the desired behaviors and teaching the new expectations to new entrants before they had the opportunity to learn the old habits.

6.2.3 Learning and Sensemaking Loops

Based on the emergent model of culture and climate used in this study, learning and sensemaking loops (feedback) from workplace experiences and group-level performance influence learning derived from shared experiences. Therefore, participants from Hospital A were asked about how various feedback mechanisms may have influenced learning derived from their shared experiences. The participants identified four types of mechanisms in use at Hospital A: formal versus informal, and internal versus external. Table 71 presents a 2x2 matrix of these mechanisms along with examples.

Table 71: Learning and sensemaking mechanisms in use at Hospital A

	Informal	Formal
External	-Canadian Institute for Healthcare Information database of quality and safety performance. -BORN data	-Reports to the Ministry of Health regarding progress on quality improvements -Compliance with Accreditation Canada's guidelines -Patient satisfaction surveys
Internal	-Review of outliers in clinical performance: e.g., C-sections, induction of labor, length of stay -Event debriefings -Peer-to-peer enforcement of MORE^{OB} standards and policies -Quick checks on patient satisfaction, engagement, and safety culture	-Critical Incident Review -Safety and Quality Reports to the Board of Directors -Consistent training of new staff and physicians -Formal engagement of patients in their plan of care: "birth plan" -Internal safety culture survey

The Canadian Institute of Health Information collected voluntarily submitted data from all Canadian healthcare facilities[21]. As such, it was able to present national and provincial data not only to the various participating facilities, but also at an aggregate level to the general public. These data, and the corresponding dashboards, were discussed by the interview participants as influential in providing external feedback to the organization and subsequently reinforcing or changing organizational practices. Figure 31 illustrates a screenshot of a chart showing comparative performance of various healthcare regions within Ontario on Low Risk C-Sections.

[21] http://yourhealthsystem.cihi.ca/hsp/indepth?lang=en#/indicator/032/2/C5001/

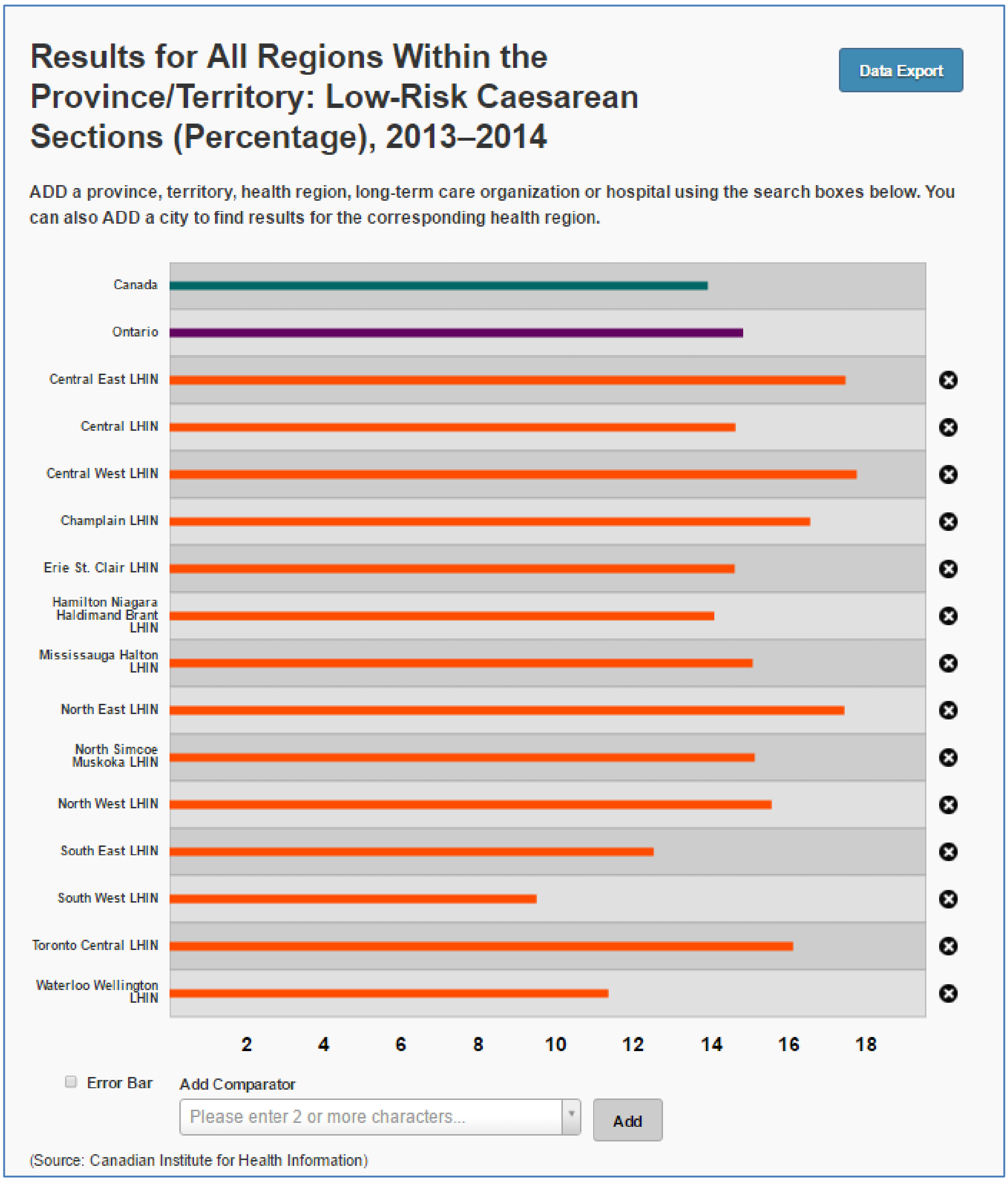


Figure 31: Low-risk C-section rates across Ontario

Such transparency facilitated both conversations and accountability. Also, some participants reported increased interest from Board members to understand the metrics and ways in which hospital performance could be improved.

BORN (Better Outcomes Registry and Network)[22] was another external data source that was reported to influence internal decision-making. For example,

[22] https://www.bornontario.ca/

BORN published reports at regional levels and also on special topics such as preterm birth rates, infant mortality, and maternal mortality. These data were used by Hospital A to (a) triangulate with other available data and (b) make comparative judgments regarding the hospital's performance.

In addition to these external datasets, internal data on key metrics like C-section rate and Length of Stay as well as performance data at the team level prompted incident reviews and streamlining of protocols. Inconsistencies in adherence to induction policy, for example, were noted by the participants and were promptly corrected. At the informal level, the participants did not wait for periodic reports to be released; they simply questioned current status and made minor corrections to their actions. Their assertiveness, structured communication with the help of MORE^{OB} practice guidelines, and focus on systemic solution were noted in several examples.

With regard to external, formal feedback mechanisms, three items were most frequently noted: annual quality improvement plans, patient satisfaction surveys, and employee and physician satisfaction survey. All three of these items were required under the Excellent Care for All Act (ECFAA), 2010[23]. Additionally, this regulation requires that executive compensation be linked to quality improvement targets achieved in accordance with the annual quality improvement plans. Thus, there was strong motivation to measure extant quality, develop mechanisms to improve it, and demonstrate the improvements on a continuing basis.

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23 https://www.ontario.ca/laws/statute/10e14?search=%22excellent+care+for+all+act%22&use_exact=on

These external feedback mechanisms were echoed at the internal level. The Quality Committee, people in charge of patient relations, and practice leaders and risk managers were responsible for data collection, validation, and analysis. Success of externally-mandated reports seemed to rely on an operational system of data collection, inter-personal trust, and transparency. Thus, internal, informal feedback to the providers of vital data was critical to the success of the entire accountability chain. For example, the emphasis of critical incident reviews was clearly on systemic solutions and they linked to the quality improvement efforts. Similarly, patient engagement efforts started with regular tours of the Labor and Delivery facilities and provision of a book to each patient, which described all the details from initial registration through final discharge and postpartum, post-discharge care. Special issues like midwifery services, water births, and high-risk pregnancies were also discussed. This book was so central to the Labor and Delivery practice at Hospital A that all the nurses, midwives, and physicians were required to read it. This book served as a consistent communication tool, enabling conversations, and providing timely feedback from patients to the care providers. Additionally, the formal engagement of patients with their birth plans provided early indication to the nurses about the expectations of the parents and enabled difficult conversations under less stressful conditions, much ahead of the actual birth. This birth plan was periodically updated, if conditions changed. Thus, it served as a living document and as a learning and sensemaking mechanism.

6.2.4 Effects of the MORE^{OB} Training on Outcomes

Based on the emergent model of organizational culture and climate, a training intervention such as MORE^{OB} would be expected to improve group-level outcomes. In particular, the MORE^{OB} training was designed to provide clinical and non-clinical knowledge to the entire obstetrics team with the belief that such an improvement in knowledge would result in improved clinical outcomes. Hence, the following two performance measures were analyzed:

1. Knowledge examination scores and
2. Clinical outcomes.

Figure 32 illustrates the knowledge exam scores after each module. Hospital A's mean scores after all three modules were higher than the mean scores for other Late Adopters.

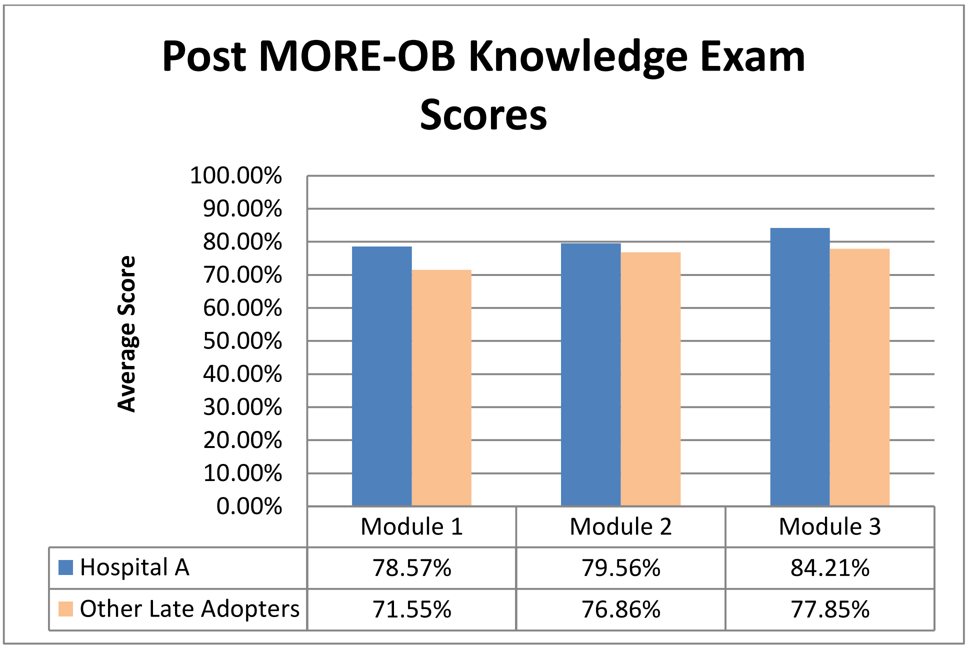


Figure 32: Post-MORE^{OB} Hospital A's knowledge exam scores

A repeated measures ANOVA was conducted to determine the significance of the differences in post-training mean knowledge exam scores after each module. Mauchly's test indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 5.35$, $p = .069$. The results showed that the differences in knowledge exam scores after each module were significant, $F(2)=3.992$, $p<.05$. Also, these results indicate that Hospital A's obstetrics team performed better than the teams from other Late Adopter hospitals.

The review of clinical outcomes focused on C-section rates and Length of Stay; other clinical outcomes data were not available at the hospital level. Also, Cesarean section rates prior to 2005 were not available; however, the rates from 2005 through 2011 are presented in Table 72. Compared with the other Late Adopters, Hospital A's C-section rates were lower in 2010 and 2011, the two years during the MORE^{OB} training, than the preceding five years. Also, the rates in 2010 and 2011 were lower than those at the other Late Adopter hospitals. Thus, with the help of the MORE^{OB} program, Hospital A was able to bring down its C-section rates below the comparable rates at other Late Adopter hospitals.

Table 72: Comparison of C-Section rates between Hospital A and other Late Adopters

Year	C-Section Rate	
	Hospital A	All Other Late Adopter Hospitals
2005	28.9	25.4
2006	26.1	25.6
2007	27.8	26.5
2008	28.9	26.3
2009	29.8←M-1	25.5
2010	24.6 ←M-2	26.2
2011	25.4 ←M-3	26.3

Table 73 presents the mean Length of Stay for Hospital A and all the other Late Adopter Hospitals. Data prior to 2005 were not available; however, since 2008, the mean Length of Stay at Hospital A declined from 2.19 days pre-MORE^{OB} to 1.85 days at the end of Module 3. Concurrently, the mean Length of Stay at all the other Late Adopter Hospitals declined as well; however, the mean Length of

Stay at Hospital A was always lower than that at all the other Late Adopter hospitals. Thus, one could argue that Hospital A was already more efficient than other hospitals in the Late Adopter group and maintained its lead after the MORE^{OB} program.

Table 73: Comparison of the mean Length of Stay at Hospital A and other Late Adopters

Year	Mean Length of Stay (Days) in Obstetrics	
	Hospital A	All Other Late Adopter Hospital
2005	2.19	2.43
2006	2.07	2.35
2007	2.07	2.34
2008	2.07	N/A
2009	1.98←M-1	2.19
2010	1.96←M-2	2.16
2011	1.85←M-3	2.11

In summary, Hospital A's obstetrics team's knowledge exam performance improved after each training module and both the knowledge exam scores as well as the clinical outcomes were better than those of obstetrics teams at other Late Adopter hospitals. The improvements in knowledge exam scores were recorded immediately after the training and the improvements in clinical outcomes were recorded several months later. Thus, one could conclude that the most immediate impact of training was on the knowledge level, and the subsequent impact was most likely on the workplace behaviors of the participants (changes in workplace behaviors were not assessed in this study), which translated into improved clinical outcomes.

6.2.5 Effects of the MORE^{OB} Training on Patient Safety Climate

Based on the emergent model of organizational culture and climate, a training intervention such as MORE^{OB} would be expected to improve patient safety climate. Specifically, the MORE^{OB} training was intended to produce a long-term change in the patient safety culture at the participating obstetrics units. Therefore, the patient safety climate scores before and after the MORE^{OB} training were analyzed to determine whether there was a significant difference in the scores.

Before presenting the results of the patient safety climate survey, a mapping between shared organizational values at Hospital A and the six-factor patient safety climate model developed in Study #1 is presented in Table 74.

Table 74: Mapping between shared values and patient safety climate factors at Hospital A

Shared Organizational Values at Hospital A	Corresponding Patient Safety Climate Factors
Compassion	
Patient Safety	Patient Safety is Everyone's Priority
Quality of Care	
Inclusion	Respect or Valuing Individuals
	Empowering People or Investing in People
Accountability	Learning or Continuous Improvement

Compassion, although a shared value at Hospital A, was not reflected in the patient safety climate survey instrument. However, the remaining four shared values mapped well with four of the six factors of the patient safety climate model, as presented in Study #1. Considering that the patient safety climate is a psychological response to the underlying safety culture, an assessment of pre-training scores on these four factors was considered to be indicative of the underlying differences in organizational culture at Hospital A versus other Late Adopter hospitals.

Figure 33 illustrates the comparison between Hospital A's patient safety climate scores and those of all other Late Adopters on four factors: Patient Safety is Everyone's Priority; Learning; Valuing Individuals; and Empowering People.

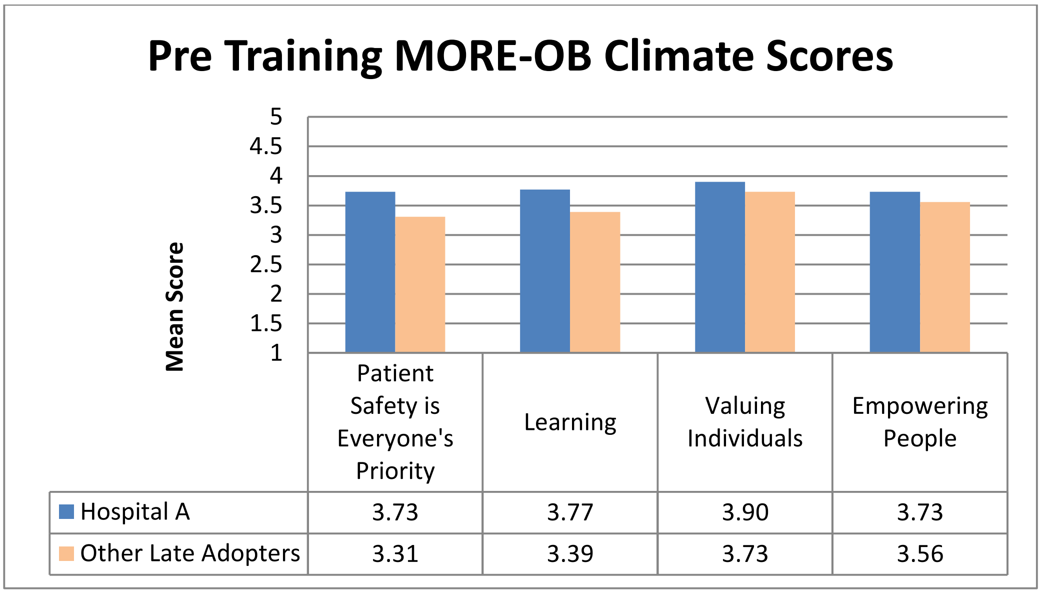


Figure 33: Hospital A's patient safety climate scores

Table 75 presents the results of the independent sample *t*-test of Hospital A's patient safety climate scores. Overall, Hospital A's patient safety climate scores were higher than those for all other Late Adopter hospitals (n=29). Levene's test for equality of variances was significant (p<.05) for one of the four factors; thus equality of variances was not assumed for that factor. The independent sample *t*-test for equality of means indicates that the differences in scores were significant for three of the four factors: for Patient Safety is Everyone's Priority, $F(1488)=2.392$, $p=.000$; for Learning, $F(1488)=.876$, $p=.000$; for Valuing Individuals, $t(149.93)=3.185$, $p=.002$; and for Empowering People, $F(1488)=1.653$, $p=.059$. Therefore, the patient safety climate within Hospital A's obstetrics team was significantly better than within the obstetrics teams from the other Late Adopter hospitals on three scales: (a) Patient Safety is Everyone's Priority, (b) Learning, and (c) Valuing Individuals.

Table 75: Results of the independent samples t-test on patient safety climate scores before MORE^{OB} training

Factor		t-test for Equality of Means						
		F or *t* Value	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Patient safety is everyone's priority	Equal variances assumed	2.392	1488	.000	.41929	.07929	.26376	.57482
Learning	Equal variances assumed	.876	1488	.000	.37863	.07952	.22264	.53462
Valuing Individuals	Equal variances not assumed	3.185	149.93	.002	.17451	.05479	.06626	28276
Empowering People	Equal variances assumed	1.653	1488	.043	.16555	.08772	-.00653	.33762

Figure 34 illustrates the post-Module 1 comparison of patient safety climate scores for Hospital A and all the other Late Adopters

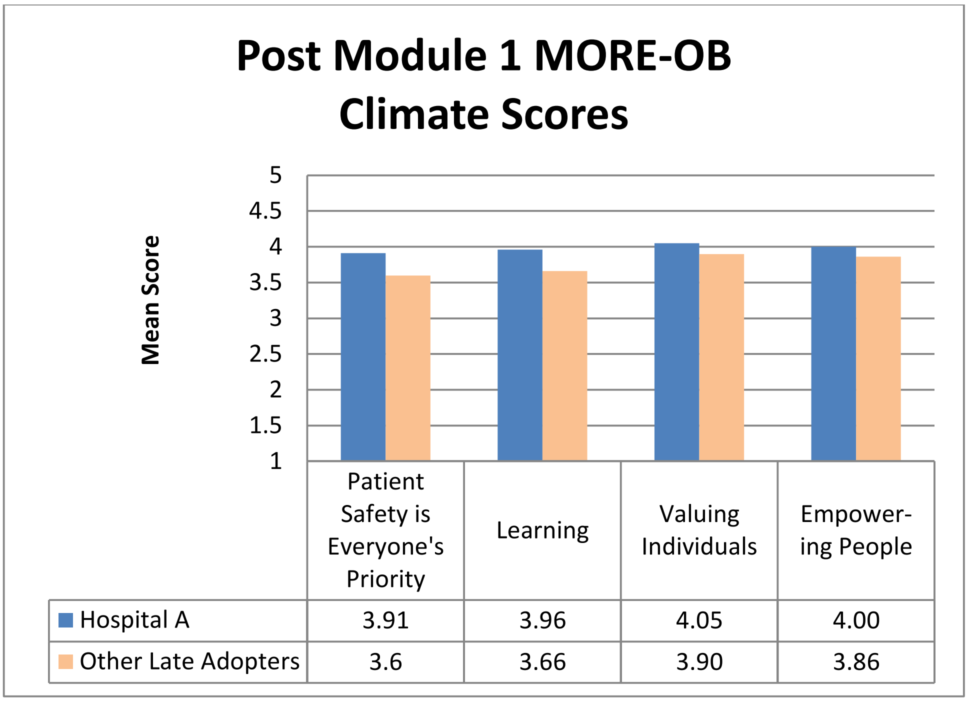


Figure 34: Post Module 1 comparison of patient safety climate scores

Overall, Hospital A's patient safety climate scores were higher than those for all other Late Adopter hospitals (n=29). Levene's test for equality of variances was significant, p<.05, for Learning and Empowering People and hence equal variances were not assumed for those two factors. The independent sample t-test for equality of means indicates that the differences in scores were significant: for Patient Safety is Everyone's Priority, $F(1127)=2.925$, $p=.000$; for Learning, $t(133.29)=4.121$, $p=.000$; and for Valuing Individuals, $F(1127)=.610$, $p=.018$. The difference in scores for Empowering People was not significant, $t(134.58)=1.864$, $p=.065$. Therefore, after the first MORE^{OB} training module, the patient safety climate within Hospital A's obstetrics team continued to be significantly better than within the obstetrics teams from the other Late Adopter hospitals on three scales: (a) Patient Safety is Everyone's Priority, (b) Learning, and (c) Valuing Individuals.

Figure 35 illustrates the post-Module 2 comparison of patient safety climate scores for Hospital A and all the other Late Adopters

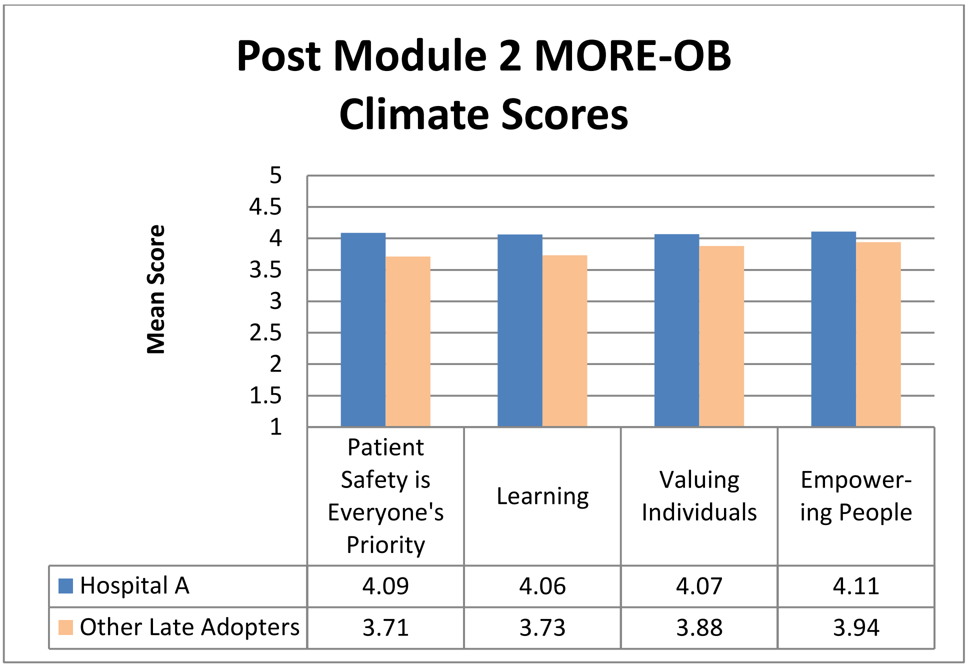


Figure 35: Post Module 2 comparison of patient safety climate scores

Hospital A’s patient safety climate scores continued to be higher than those for all other Late Adopter hospitals (n=29). Levene’s test for equality of variances was significant, $p<.05$, for Patient Safety is Everyone’s Priority and Learning, and hence equal variances were not assumed for those factors. The independent sample *t*-test for equality of means indicates that the differences in scores continued to be the first three factors: for Patient Safety is Everyone’s Priority, $t(107.45)=5.138$, $p=.000$; for Learning, $t(106.37)=4.369$, $p=.000$; and for Valuing Individuals, $F(728)=1.107$, $p=.014$. The difference in scores for Empowering People was not significant, $F(728)=2.725$, $p=.089$. Therefore, after the second MORE^{OB} training module, the patient safety climate at Hospital A continued to be significantly better than within the obstetrics teams from the other Late Adopter hospitals on the same three scales: (a) Patient Safety is Everyone’s Priority, (b) Learning, and (c) Valuing Individuals.

Figure 36 illustrates the post-Module 3 comparison of patient safety climate scores for Hospital A and all the other Late Adopters

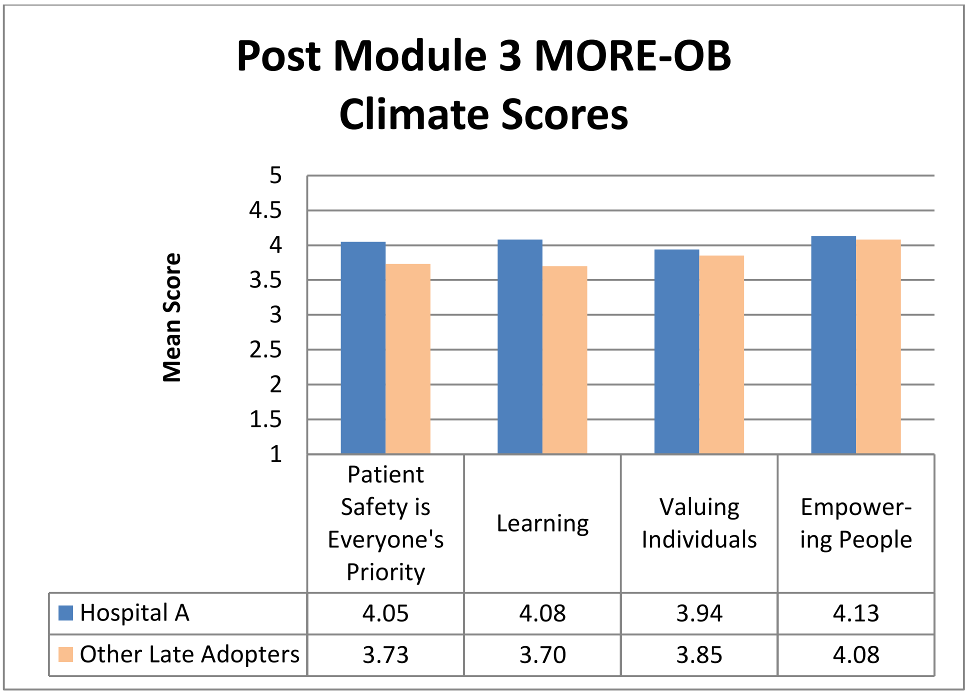
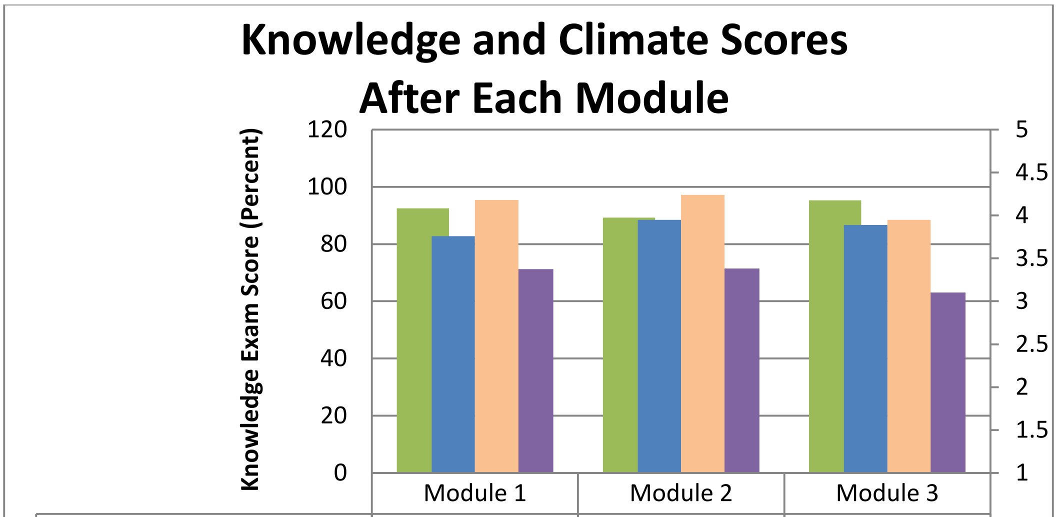


Figure 36: Post Module 3 comparison of patient safety climate scores

Again, Hospital A's patient safety climate scores continued to be higher than those for all other Late Adopter hospitals (n=29). Levene's test for equality of variances was significant, $p<.05$, for three of the four factors and hence equal variances were not assumed for them. The independent sample *t*-test for equality of means indicates that the differences in scores were significant for two of the four factors: for Patient Safety is Everyone's Priority, $t(89.80)=3.928$, $p=.000$; for Learning, $t(86.98)=4.086$, $p=.000$; for Valuing Individuals, $t(92.42)=1.437$, $p=.154$; and for Empowering People, $F(387)=.002$, $p=.652$. Therefore, after the third MORE^{OB} training module, the patient safety climate within the obstetrics team at Hospital A was significantly better than within the obstetrics teams from the other Late Adopter Hospitals on two scales: (a) Patient Safety is Everyone's Priority and (b) Learning. Thus, there appeared to be narrowing of the gap in safety climate between Hospital A and other Late Adopters after the third module of the MORE^{OB} training. Therefore, on the one hand, the MORE^{OB} training seems to influence patient safety climate at all participating hospitals; and on the other hand, since Hospital A's patient safety climate was already better and continued to better than that at the other Late Adopter hospitals on two scales, there must have been a much stronger emphasis on patient safety and learning within the underlying cultural elements at Hospital A. Also, it is important to note that since there was a lag in noting any improvements in the patient safety climate scores, one could argue that the participants needed to experience the changes in underlying assumptions, role-modeling by leaders and key influencers, changes in workplace behaviors, effectiveness of new implementation mechanisms and incentives, and corresponding improvements in clinical outcomes before they would change their psychological response.

Section 6.2.4 demonstrated a significant improvement in the participants' knowledge after the MORE^{OB} training modules. Since the patient safety climate also improved after MORE^{OB}, it seemed reasonable to investigate whether there was any relationship between level of knowledge and strength of the patient safety climate. Two topics in the knowledge exam were directly linked with the patient safety climate: Communication and Patient Safety. While both these topics were non-clinical, since they were specifically covered and tested in the MORE^{OB} training, and there were specific factors in the safety climate survey linked to these two topics, it was reasonable to expect that an improvement in knowledge in these two areas would have a positive influence on the climate scores in the corresponding areas. Figure 37 illustrates the comparison between the knowledge and climate scores after each module.



	Module 1	Module 2	Module 3
Patient Safety Knowledge	92.5	89.29	95.24
Communication Knowledge	71.25	71.43	63.1
Patient Safety Climate	3.76	3.95	3.89
Communication Climate	4.18	4.24	3.95

Figure 37: Knowledge and climate scores after each module

Knowledge scores for Patient Safety dipped slightly after Module 2, but show an overall increase from Module 1 to Module 3. Climate scores for Patient Safety improved from Module 1 to Module 2 and dropped after Module 3, but ended at a level slightly higher than after Module 1. Knowledge scores for Communication increased slightly from Module 1 to Module 2, but decreased after Module 3. Also, there was a net decrease in the knowledge level about Communication from Module 1 to Module 3. While such a decline is uncharacteristic, its reasons are not known. Patient Safety Climate scores showed an improvement between Module 1 and Module 2, but a decline between Module 2 and Module 3. Similarly, the Communication Climate scores also improved after Module 1, but dropped after Module 3. Since there appeared to be a relationship between the knowledge scores and the corresponding climate scores, the correlation between the two was tested. Pearson's Correlation between the knowledge and climate about patient safety was moderate after the first two modules (r_1 = -.35 and

$r_2 = -.40$), but was low after the third module ($r_3 = .09$). Correlation between knowledge and climate about open communication was low after the first two modules ($r_1 = -.15$ and $r_2 = .25$), but was lower after the third module ($r_3 = .04$). Thus, patient safety climate scores and knowledge exam scores were not related. This finding further underscores the lead-lag phenomenon noted earlier: improvement in knowledge exam scores is most proximate to the training, followed by a delayed improvement in safety climate.

6.2.6 Integrated Review of Culture and Climate with Respect to the MORE^{OB} Training

All hospitals in the Late Adopter group were presumed to have been under the influence of same environmental factors; thus, controlling for these factors, the participants' shared experiences prior to the implementation of the MORE^{OB} program, during the implementation, and after the implementation were analyzed. In the case of Hospital A, however, there was one notable exception: the community around the hospital had undergone a dramatic increase in population and an accompanying spike in its ethnic diversity. This change in the geo-social environmental factor formed the pre-intervention shared experience and due to its sudden nature, it was classified as a defining moment. At that time, Hospital A was performing well on overall efficiency (its mean Length of Stay was lower than the rest of the Late Adopters, all the Early Adopters, and all the Non-Adopters), but there was room for improvement in the C-section rate. As a result of the sudden growth in population and ethnic diversity, its goal of maintaining the overall efficiency became much more challenging and the need to improve its C-section rate became a safety/quality priority, as well as a financial imperative.

Also, at that time, the hospital's shared organizational values were Compassion, Patient Safety, Quality of Care, Inclusion, and Accountability. These values mapped very well with four of the patient safety climate factors: Patient Safety is Everyone's Priority, Respect or Valuing Individuals, Empowering People, and Learning or Continuous Improvement. A pre-intervention climate assessment indicated that Hospital A's obstetrics team's patient safety climate was significantly better than within the obstetrics teams at other Late Adopter hospitals on three factors: Patient Safety is Everyone's Priority, Respect or Valuing Individuals, and Learning or Continuous Improvement. Thus, one could conclude that it was critical for Hospital A to maintain these values, serve its community, and strengthen its clinical performance outcomes.

The participants' shared experiences revealed the underlying values of Compassion, Patient Safety, Quality of Care, Inclusion, and Accountability. They also revealed two unquestioned assumptions (a) compassionate care was viewed as a proxy for quality of care and (b) the local community took emotional and financial ownership of the hospital. There was also a high degree of coherence between the attributed values, espoused values, and shared values. Four of the five shared values resonated well with the goals of the MORE^{OB} program and the associated patient safety climate factors: Patient Safety is Everyone's Priority; Valuing Individuals; Empowering People; and Learning. Hospital A applied a number of implementation mechanisms to reinforce these values. While the MORE^{OB} training was in itself an implementation mechanism, there were other mechanisms such as Critical Incident Review, Induction Policy, and Peer-to-Peer Coaching that were concurrently operational. Leaders and influencers played a critical role in reinforcing the shared organizational values by interpreting the environmental factors in the context of local constraints and needs, as well as by enforcing the MORE^{OB} guidelines. Overall, the obstetrics team created a number of cultural artifacts such as the PPH kit, which symbolized their preparedness and professionalism while serving the utilitarian purpose of saving lives.

Before the implementation of the MORE^{OB} program, the safety climate within the obstetrics unit at Hospital A was better than that at other Late Adopter hospitals; thus, it was favorably disposed to receiving and implementing the MORE^{OB} training. As the training was implemented, Hospital A maintained its lead for two of the three modules, but by the end of the third module, Hospital A's climate was better in only two areas: Patient Safety is Everyone's Priority and Learning. Hospital A's knowledge exam scores were consistently better than those from other hospitals in the Late Adopter group. There was no correlation between the knowledge exam scores and the safety climate scores; they were independently better.

A review of two clinical outcomes, C-section rates and Length of Stay, showed improvements after the MORE^{OB} program. Hospital A's C-section rate went down from 29.8 per cent in 2009 to 25.4 per cent in 2011; however, the C-section rate at the other Late Adopter hospitals climbed from 25.5 to 26.3 per cent during the same timeframe. The mean Length of Stay at Hospital A was already lower than that at the other Late Adopter hospitals and it continued to decline, but so did the Length of Stay at the other Late Adopter hospitals.

Active use of feedback (learning and sensemaking) was a critical element of Hospital A's organizational culture. Informal feedback was used regularly by the hospital staff to cross-check their internal data and keep track of their benchmark hospitals. Formal feedback from Accreditation Canada and the mandatory reporting of quality and safety improvements as well as patient and staff satisfaction surveys were actively reported throughout the organizational chain of command and appropriate corrective actions were implemented. Internally, practice leaders as well as clinicians were consistent about attention to detail and follow-through on recommendations resulting from Critical Incident Reviews and event debriefings. Peer-to-peer enforcement was particularly noteworthy among nurses. Also, formal engagement of patients and their families through a birth plan and regular review of that plan, with appropriate changes, was distinctive.

In conclusion, the inherent cultural elements make a definitive impact on the influence of planned culture-change interventions. A summary of observations noted in conjunction with the MORE^{OB} training implementation are as follows:

1. Four of the five shared values resonated well with the goals of the MORE^{OB} program and the associated patient safety climate factors: Patient Safety →Patient Safety is Everyone's Priority; Quality of Care → Patient Safety is Everyone's Priority; Inclusion → Respect or Valuing Individuals and Empowering People; and Accountability → Patient Safety is Everyone's Priority and Learning or Continuous Improvement. Thus, the planned intervention's attributes were well-aligned with the inherent shared values of the organization.
2. Leaders and influencers helped shape organizational values through two mechanisms: interpretation and operationalization. First, they interpreted the systemic shock or the defining moment experienced by their hospital into operational context. Then, they committed to the MORE^{OB} program and adjusted the incentives so that the entire obstetrics team was

motivated to reduce the elective C-sections and increase the total patient volume. The preceptors and senior nurses served as guardians of the new performance standards and professional practices, thereby reinforcing the previously agreed-upon shared values. The leaders and key influencers believed that the planned intervention would enable them to overcome the extant challenges, particularly the issues associated with their defining moment, and were able to make appropriate changes to implementation mechanisms and incentives, thereby influencing the inherent assumptions and values.

3. Knowledge from the MORE^{OB} training facilitated the use of formal and informal feedback mechanism, particularly the event debriefings, peer-to-peer enforcement of standards, critical incident reviews, and consistent training of new staff and physicians, all of which served as concurrent impact mechanisms for cultural change. Thus, the planned intervention provided complementary knowledge, tools and techniques that could help improve workplace behaviors and group-level outcomes.
4. Practice of teamwork, communication, and respect for individuals, as prescribed in the MORE^{OB} training, helped flatten the hierarchy within the obstetrics team. Thus, the use of the skills taught in the planned intervention created new workplace behaviors and shared experiences that were consistent with the shared values, implementation mechanisms and incentives, and performance goals.
5. Improved clinical outcomes (particularly in reducing the C-section rate) resulted in improved support from management and heightened

expectations from each other. Thus, learning and sensemaking associated positive association between the desired outcomes and shared experience.

6. In response to the MORE^{OB} training, since the knowledge assessment was conducted immediately after the training, improvement in knowledge could be claimed as the first observable change. Although climate assessments were also conducted immediately after the training, there was no correlation between climate scores and knowledge scores. Since the training modules were completed over an 8-12 month period, one could conclude that the increase in climate scores after training was most likely due to the participants' satisfaction with the training program itself as well as their reaction to workplace behaviors concurrent with their training experience. Based on the interview data, there were reports of changed workplace behaviors and performance outcomes, and the participants were pleased with those changes. Thus, one could conclude that in response to the MORE^{OB} training, the knowledge level improved first, then the workplace behaviors and performance outcomes, and finally, the patient safety climate. This lag in improvement in the patient safety climate suggests that the participants needed to experience the new workplace behaviors and performance improvements in order to improve their psychological response to the underlying improvements in organizational values, implementation mechanisms, leadership behaviors, and workplace behaviors and new shared experiences.

6.3 Longitudinal Analysis of Hospital B

Hospital B reported about 4,458 births in 2015 and it was located in a major metropolitan area with a diverse ethnic population. It was considered one of the Early Adopters of the MORE^{OB} program because most of the participants completed their three modules during the 2004-2005 timeframe. Prior to implementing the MORE^{OB} program, Hospital B's C-section rate was on the rise from 21.8 to 25.8 per cent; however, it was well below the C-section rate at other Early Adopter hospitals. At that time, the mean Length of Stay was 2.01 at Hospital B versus 2.28 days at the rest of the Early Adopters. This section presents a longitudinal analysis of the influence of the inherent cultural elements on the effectiveness of the MORE^{OB} program in changing the patient safety culture and climate within the obstetrics unit at Hospital B.

6.3.1 Shared Experiences and Organizational Values

Based on the emergent model used in this study, shared experiences help revise and reinforce organizational values. Therefore, participants from Hospital B were asked to generally describe some of their memorable experiences at Hospital B, and probed further to elicit examples that may reveal deeply-held, unquestioned assumptions as well as values. The following two stories constructed by combining narratives from seven individuals illustrate the extant conditions and their impact on shared values and unquestioned assumptions:

> Story #1: After we went under supervisory control, we had a top level structural change, a bottom-up development of the mission-vision-values (MVV) document, which brought the organization/people together. Based on this MVV document, we developed the strategic plan. Then, with the new CEO, we revisited the strategic plan to test whether the plan was still aligned with our aspirations, and refined it just enough to keep it current. The new CEO was conscious of not starting over again because a lot of good work already happening—he wanted to build on the previous work. We went through a couple of cycles of financial challenges and other considerations, but we stayed with our

> plan. We wanted to make sure we were financially stable and viable in order to keep serving our community—so we developed a concept of integrated clinical services across our two sites. Early on, the community was not in favor and our physicians were not in favor of organizational integration, but slowly, we are able to manage unit-by-unit integration and gradually demonstrated viability as well as quality, access and financial benefits of integration of clinical services across the two sites. So, the lesson here is that sometimes, it is better to take baby steps—test the change, prove that it works to build confidence (it may take longer to get to your goal), it doesn't create as much noise, and it helps change culture in small bits.

The most critical aspect of the above story is that the hospital experienced a defining moment when it was placed under external supervisory control. An avalanche of changes ensued as a result of this action and the following shifts in unquestioned assumptions emerged for further discussion:

1. The Ministry would never put the hospital under supervisory control and hold the senior management accountable → The Ministry would hold the senior management accountable.
2. The changes made during the supervisory control won't last → The mission, values, and vision developed during the supervisory control were retained and only slightly revised by the new CEO, give credit for the past work and moving the organization forward; in the process, the CEO built trust with his staff, physicians, and the community.
3. Organizational integration, in the interest of efficiency, would not work → With appropriate attention to key concerns and demonstration of quality improvements, the hospital was successful in accomplishing multiple integration efforts and achieved both quality and efficiency gains.

> <u>Story #2</u>: Prior to MORE^{OB}, there were very different practices in obstetrics across the two sites of the same hospital: one site did all their C-sections and subsequent recovery within the Maternal-Newborn (MN) unit and the other site said that C-section is a surgical procedure and wanted them done only by the Surgery staff. It did not perform its own C-sections in the obstetrics program—as a result of very old practices. They came to the meetings in tears—they were really concerned that their patients would die. The MORE^{OB} program helped us standardize our procedures and bring industry best practices

> to our facility. It was a commitment that we made in Surgery—we will not pull our staff until the whole group was ready for it. We supported MN for over 18 months. We had Surgery nurses working with the MN nurses side-by-side. Ultimately, we went from the sentiment that "mothers and babies will die" to "this was the best thing that happened." I used to think, this is not rocket science, but it was a huge culture shift for physicians to trust the administrators, educators, and nurses that their patients were going to be safe. It was probably one of the greatest achievements of my career! If you lived in the old culture, you would agree that it was transformative!

The following shift in unquestioned assumption emerged from further discussion of the above story:

1. Efficiency enhancement efforts are direct challenges to safety → With evidence-based practice, as recommended by the MORE^{OB} program, it is possible to improve processes and achieve both safety and efficiency.

Values attributed to Hospital B (by its local community) were derived from interview narratives based on the candidates' reasons for joining the hospital, stories being told in the community about the hospital, and personal experiences. Prior to the MORE^{OB} program and through the early days of supervisory control, the community viewed Hospital B as a poor-quality facility, but the staff within the hospital firmly believed that the quality of care was good. The following two anecdotes illustrate this point:

> The reputation in the community was not good at all, but the internal perception was quite positive. The press didn't really care about the good news; they only wanted to put us on the front page when something bad happened. They don't want to hear about how wonderful we are. Because we are not a teaching hospital, we can't brag about our research or about our high-profile physicians. We have a lot of regular folks getting very good care. I personally come here for my medical needs and I would advise others to come here

> Initially, when I applied to work for this hospital, the reputation of Hospital B was pretty bad. I have always lived in this area so this hospital was close, but this hospital was not my first choice of employment. At that time, however, nobody wanted to work at Hospital B. I remember when I first got the job, most of my friends from my nursing program would question why I was taking this job (why don't you go to downtown, why don't you go down to a teaching hospital)—the reputation of this hospital was certainly not good. Even though I have stayed here throughout the years, I think because I understand the structure of the hospital a little bit more, as an employee, I think our reputation has gotten a little bit better. My friends don't bother me anymore—they know I belong to Hospital B! I certainly remember that it was not that great, but we have done pretty well as a community hospital.

The interview participants (n=21) provided 44 experiences that illustrated a variety of changes resulting after the MORE^{OB} program. Applying the hierarchical value mapping technique illustrated in Study #2, these experiences were treated as shared experiences and the following shared values were derived: Quality and Safety, Respect for Individuals, Open Communication, and Accountability. Figure 38 illustrates the hierarchical value map for Hospital B.

The external attributions of poor quality, non-responsiveness to diversity, and non-accountability came from the remarks made by the interview participants based on their interactions with the community. Over the past 10-15 years, this reputation had changed significantly as evidenced by external awards, which served as artifacts of the current attributed values (see Figure 39). These artifacts have low utility, moderate aesthetic, and very high symbolic value. Four espoused values and strategic directions were derived from the hospital's 2015-2019 strategic plan: Integrity, Compassion, Accountability, and Respect.

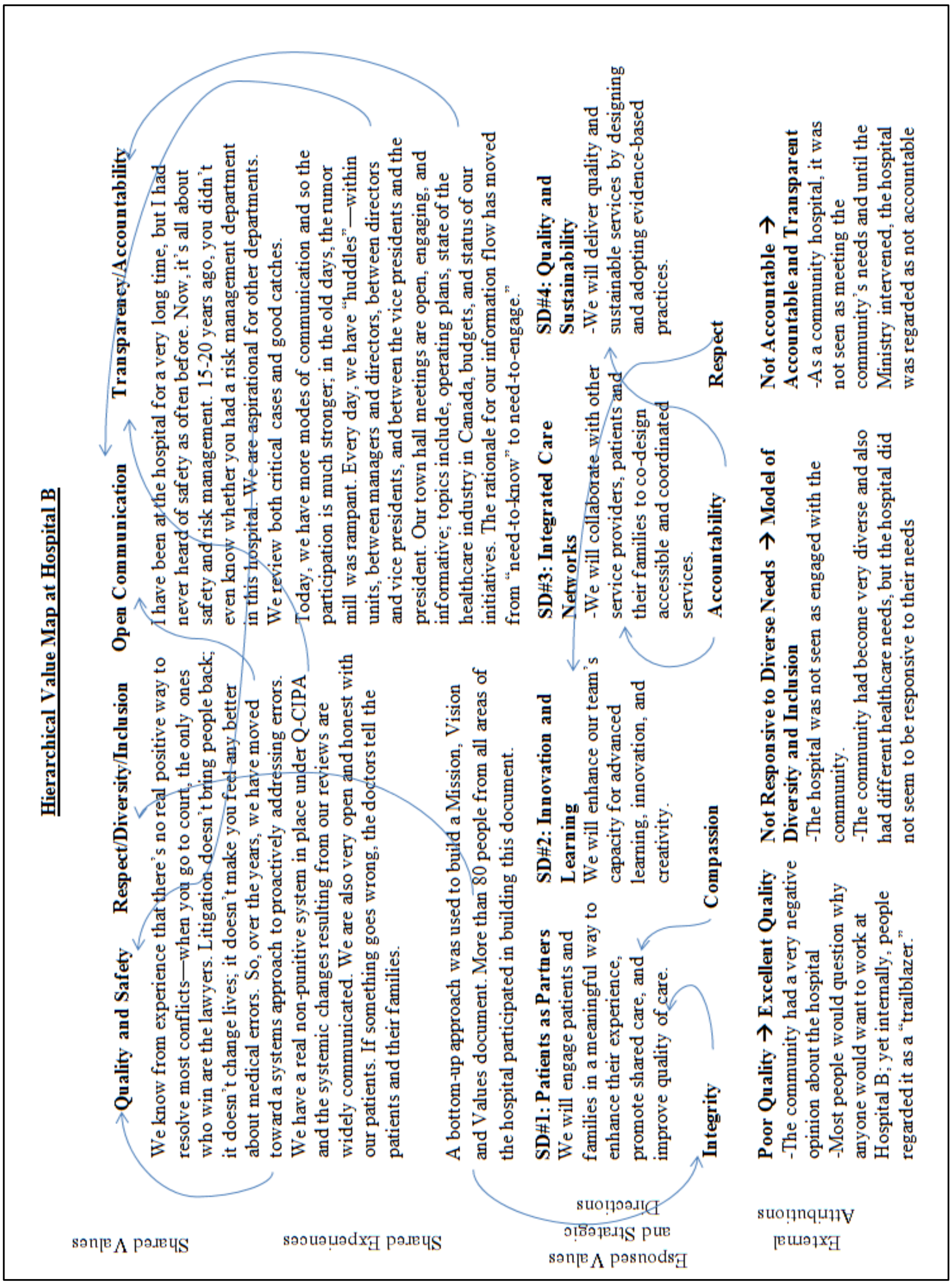


Figure 38: Hierarchical value map for Hospital B

Figure 39: Artifacts illustrating Hospital B’s recognition by its community

Accreditation Canada recognizes overall commitment to quality and patient safety as well as improvements in accordance with the quality improvement goals. Hospital B received the highest level of recognition: “Exemplary” rating. The Quality Healthcare Workplace Award is presented by the Ontario Hospital Association and is based on both individual-level and organization-level outcomes. Individual-level outcomes include competency, engagement, and safety. Organization-level outcomes include quality and safety, retention and recruitment, and efficiency metrics. Hospital B received “Gold” level recognition; the next higher level recognition is "Platinum." The Diversity and Inclusion Award is presented by the Canadian College of Health Leaders and is based on distinctive contributions to making the workplace accessible, friendly, and productive for diverse communities. The Registered Nursing Association of Ontario recognizes hospitals that have demonstrated exceptional nursing practices and could serve as role models for other hospitals. Finally, the Diversity Employers Award is presented by Mediacorp editors. This award recognizes top achievements compared to peer institutions in the same industry. Hospital B was recognized as a Top 100 Diversity Employer in Canada. Based on these artifacts, it is clear that Hospital B's new attributed values were Quality, Patient Safety, and Diversity and Inclusion. These values were consistent with Hospital B's shared values.

6.3.3 Role of Leaders and Influencers

Based on the emergent model used in this study, leaders and influencers shape shared organizational values. Therefore, participants from Hospital B were asked about how their leaders and influencers might have shaped the shared organizational values at their facility. The participants (n=21) claimed that their senior management played a distinctive role at Hospital B. They were highly consistent about their commitment to quality and safety through the Lean methodology across the hospital and the use of the MORE^{OB} program in obstetrics. Since the MORE^{OB} program was implemented well before the Lean methodology, and it was consistent with the basic principles of Lean, it was regarded by many of the frontline personnel as "ahead of Lean." As a result of the MORE^{OB} program, the frontline personnel were already trained to look at systemic issues while reducing errors, and they were well-versed in the principles of high reliability organizations. These personnel served as role models and champions of key behaviors—such as evidence-based practice, assertiveness, structured debriefings, regular review of clinical skills, etc.—and modeled the desired behaviors themselves. Thus, they changed the workplace behaviors and the workplace experience. The one area that the frontline personnel lamented about was limited visible support from senior management. The following comment from an obstetrician illustrates this point:

> One of the things that MORE^{OB} says is that you need buy-in from the highest level of management. We still struggle with that. We always invite everyone to our meetings, but I don't think they get it the way they were supposed to get it. They didn't buy in, the way we bought in. The reality is that there's much more awareness about safety culture throughout the hospital. There's a high level safety meeting once a month. We always felt really good about our success, but it never really seeped up higher. There was no realization of what we were achieving in our department and they never really understood the culture of MORE^{OB}. I don't know whether it was a matter of personal interest on part of the management in place or whether we didn't do enough to keep them informed. It seems like every time management brings in another safety program, it's way behind our MORE^{OB} program: the hospital is playing catchup with what we have been doing for the past 15 years. There's a conversation and vocabulary that people in our program have (e.g., Swiss Cheese model) that the rest of the organization is just catching up! Our senior management had no ability to say maybe we made a mistake here and let's look at it another way.

On the other hand, the senior management appeared to be highly focused on using the Lean methodology to address all the issues: quality, safety, efficiency, communication, and operational management of the hospital. One of the senior managers commented that at more advanced facilities, they don't even do annual budgets; resources are allocated based on achievement of performance targets. It was also apparent that at the hospital level, the senior management was faced with several other pressing challenges related to financial performance, a sense of entitlement among certain groups, and interpersonal aggression. The following comment from a senior manager illustrates this point:

> As I reflect back 11 years and think about the first day that I started, my first meeting was in a conference room. It's the OR (Operating Room) Committee, which was all docs, there was a new program director that was brought in six months before I arrived and that individual brought me here from another organization. I walked out of the meeting where the surgeons were pounding their fists on the table. I told them I was not going to tolerate behavior like that. Day 1 on the job, 9 am, one of the physicians started yelling. In front of everyone, I said to her: I don't know who you are, but I will not tolerate this behavior. If you have an issue, I will be more than happy to assist you, but if that's the behavior you are going to have with me, I can't help you because I don't know what your issue is, and by this behavior, it is not going to solve the problem. Three days later, I had three physicians walk into my office, shut the door and started yelling because I was making changes. I had to make those changes because we were already $1 million over budget—first month of the fiscal year! I said to them, "[get] out of my office." You want to talk to me, I will by all means talk to you, but you are not going to bang that door shut, you are going to leave that door open, and until you calm down, you are not going to be allowed back in my office. When the nurses saw this, they came back to me and said, boy, you have guts, don't you. I said, no, I don't have guts; I am standing up for my entitlement of respect and dignity. You are expected to have the same respect and dignity, but if you allow people to walk over you, then you are the one at fault. I think, organizationally, what we have done is we have put in processes, education, dialog, coaching-mentoring, huddles—people are starting to see the culture change and they are now more comfortable standing up or if they have concerns, they are comfortable bringing them up.

Overall, both parties—leaders and influencers—seemed to be playing their part in improving the organizational culture and recognizing it as a part of continuous improvement, but they may not be appreciating each other's contributions. The senior leaders seemed to be too focused on the use of the Lean methodology, and the leaders and influencers in the obstetrics teams wanted more direct attention and recognition of their local efforts. Thus, although both parties interpreted and operationalized their shared organizational values, the lack of cohesion in their efforts and the lack of mutual recognition could serve as a barrier to realizing the full potential of both the MORE^{OB} program as well as the Lean methodology.

6.3.4 Learning and Sensemaking Loops

Based on the emergent model used in this study, learning and sensemaking loops (feedback) from group-level performance influences learning derived from shared experiences. Therefore, participants from Hospital B were asked about how various feedback mechanisms may have influenced learning derived from their shared experiences. The participants identified four types of mechanisms in use at Hospital A: formal versus informal, and internal versus external. Table 76 presents a 2x2 matrix of these mechanisms.

Table 76: Learning and sensemaking loops in use at Hospital B

	Informal	Formal
External	-Canadian Institute for Health Information database of quality and safety performance -BORN data -Health Quality Ontario data	-Reports to the Ministry of Health regarding progress on quality improvements -Compliance with Accreditation Canada's guidelines -Patient satisfaction surveys
Internal	-Review of outliers in clinical performance: e.g., C-sections, induction of labor, length of stay.	-The Lean methodology -Safety and Quality Reports to the Board of Directors -SAFE Reporting System

While most of the external and internal feedback mechanisms were quite similar to the ones discussed earlier with respect to Hospital A, two distinctive mechanisms were noted at Hospital B: the Lean methodology and the SAFE Reporting System.

The Lean methodology had become the *de facto* management and communication system. A strategic plan was developed with broad stakeholder input. This plan was then used to develop strategic directions and goals, which were then translated into annual objectives and key deliverables. Hospital B focused on Quality and Sustainability as a strategic direction because of the pressure from the Ministry of Health and Long-term Care and the Health Quality Ontario[24] for standardization of evidence-based practice, as well as economic

[24] HQO is a provincial advisory body for quality of healthcare in Ontario. Additional information is available at http://www.hqontario.ca/

incentives inherent in the Health System Funding Reform[25], which will reward hospitals based on where the patients choose to seek services. Two of the specific strategic goals were listed as follows:

1. Reduce unnecessary clinical practice variation by standardizing and adopting evidence-based practices; and
2. Grow and spread lean adoption and culture to improve quality of care and reduce waste.

Success of the first strategic goal would be measured in terms of "conservable days," which are days of overstay, beyond the normal or planned stay for any procedure. For example, if a patient was admitted for vaginal delivery and was expected to stay for 2 days, but faced some complications and had to stay for a third day, the system would account for the extra day as one conservable day. A set of short-term and long-term targets have been set to progressively reduce the number of conservable days. Success of the second strategic goal would be measured in terms of percentage of units with business performance system and subsequent successful audits. The long-term target for this goal was 100 per cent.

Health Quality Ontario also provides open access to hospital level performance on select quality indicators. Figure 40 illustrates the screenshot of HQO's web page[26] as an artifact of provincial commitment to transparency and accountability that may serve as an informal feedback mechanism for internal quality improvements.

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[25] In accordance with this model, 30% of the funding is based on quality of care. Additional information is available at http://www.health.gov.on.ca/en/pro/programs/ecfa/funding/hs_funding.aspx

[26] http://www.hqontario.ca/System-Performance/Hospital-Care-Sector-Performance accessed on May 7, 2016.

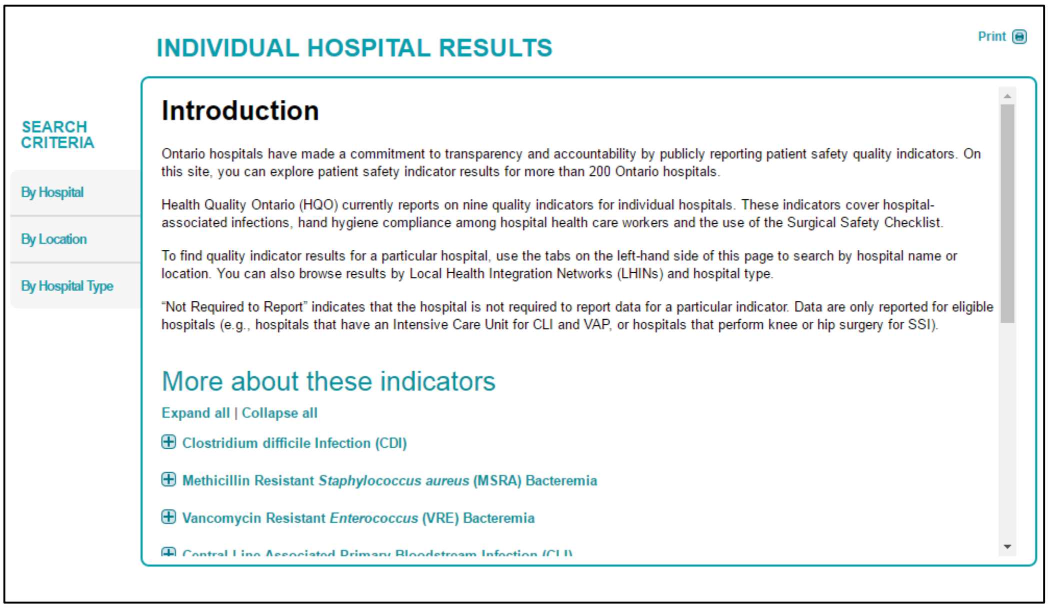


Figure 40: An artifact of external, informal feedback mechanism

Hospital B formed an Office of Innovation and Performance Improvement to provide expert guidance in implementing the Lean methodology at unit level. Also, adequate training was provided to key influencers (n>100) at the unit level to ensure consistent understanding, implementation, and reporting of the metrics. For each performance target, there was a clear statement linking performance with funding: "This is to meet Pay-for-Results expectations. There could be funding impact if targets are not met." Thus, the feedback was both in terms of operational or clinical outcomes, as well as budget allocation.

Hospital B had a reporting program, called SAFE: Safety and Accountability For Everyone. When an undesirable event occurred, either a person made a mistake or a systemic error was detected, people were encouraged to submit a SAFE report and classify it according to its severity and criticality. Anyone could submit such a report. The patient information was filled in automatically; there were drop-down selection choices to facilitate standardization and simplicity in filling out these forms. There was also space for a narrative description of the event. This information was then simultaneously sent to the appropriate manager, director, educator, and risk management. Various individuals were then tasked with follow-up actions depending on the severity of the incident. The system gave a definition of different levels of severity—although the reporter was able to assign the level of severity according to their interpretation, the Risk Management Department either validated it or up/down graded it based on a broader context and investigation of the incident. However, both ratings (original and final) of severity were retained in the system. Most often, the severity rating was downgraded after the investigation of the incident with appropriate rationale.

The risk management group followed-up with appropriate parties to make sure that process/systemic issues were addressed; also, if other departments needed to be brought in the conversation, they were included. All the investigations were done locally and reported in the computerized system. The Risk Management Department collaborated with the managers and helped them manage the investigations. After the investigation, depending on the severity and type of case, it could move to a Quality of Care Review—this was done under QCIPA (Quality of Care Information Protection Act). Under the Public Hospitals Act and the Excellent Care For All Act (ECFAA), Critical Incidents (specifically defined) were reported and investigated. Hospital B had about 3,000 patient incidents per year; only a subset of them qualified as critical incidents based on the criteria outlined in the Public Hospitals Act. They reviewed all Critical Incidents under QCIPA, which was not required under the legislation; however, the staff and physicians were more comfortable with the confidentiality protection afforded by QCIPA—the meeting, the opinions expressed by the participants, and the overall discussion was confidential, but the outcomes of the meeting and the facts of the incident were not confidential. The Risk Management Department was trying to slowly move away from reviewing everything under QCIPA because people were now accepting of the incident reviews. The original intent of QCIPA was for facilities to review cases and improve the quality of care, without fear of reprisal; however, it did not protect anyone from the facts of the incident. So, factually, if a person performed a procedure in a negligent manner, that remained a fact and it was discoverable in a lawsuit. Hospital B had been transparent about their QCIPA meetings: they told staff that they had a meeting, they disclosed the facts of the case, and they disclosed the outcomes (recommendations and actions), as required by the Act.

Based on the facts of the case and the criteria outlined in the Public Hospitals Act, an incident may be deemed critical when it causes serious harm to the patient, harm is not related to the condition for which the patient was admitted, and it happened at the hospital. In the early days, Hospital B was over-inclusive—they would include all cases with any harm to the patient as critical, but they discovered that such interpretation was extreme and inconsistent with their peer hospitals. Thus, they pulled back and focused on serious harm to the patient as critical event. There was often some negotiation on whether there was an underlying condition that contributed to the harm. For example, if an elderly person fell and fractured their hip: the patient fell at the hospital and the fracture was serious; however, the fracture was not directly related to their dementia for which they were admitted. In the past Hospital B would have called it a critical incident, but now they spend more time deliberating whether such a patient would have fallen anywhere (not necessarily in the hospital) under similar conditions and therefore was it really the hospital's fault? Now, the only clear cases of critical incidents are those that are specifically outlined in the Public Hospitals Act as reportable critical incidents; the rest are discretionary. In the near future, QCIPA revisions may require hospitals to report all such incidents into a central database.

Two key challenges with the SAFE system were noted by the interview respondents:

1. The definitions of criticality and severity had not been standardized across the Ontario healthcare system. Thus, it was possible for one hospital to under report and another hospital to over report, making comparison of critical incidents across hospitals unreliable.
2. The Governing Board and Senior Management believed that lower the number of SAFE reports, safer the system. In fact, they should encourage increase in reporting so that systemic problems could be addressed proactively. Thus, the metrics need to be changed from number of reports filed to number of changes accomplished. The Business Performance System, under the Lean methodology, already provides comparative phraseology: “Hospital B’s staff addressed over 1,000 improvement opportunities in 2014”

At the obstetrics team level, the MORE^{OB} program itself guided routine operations and served as a feedback and reinforcement mechanism that helped improve assertiveness, teamwork, patient engagement, and reduction in variation through evidence-based practice. However, at the broader organizational level, additional complementary mechanisms were noted. The shared values of Quality and Safety, Respect for Individuals, Open Communication, and Accountability were being reinforced through the following mechanisms:

1. The Lean Methodology: The Lean methodology was presented by the interview participants, and demonstrated through artifacts (score cards that link unit level performance with the hospital's performance on key metrics reported to the Board of Directors and the Ministry of Health and Long-term care), as the core organization-wide method to reduce costs, reduce variance in practices, improve quality, and progressively bring about alignment between the organizational mission, vision, and goals , and the operational practices at the frontlines. Regular, real-time feedback was a key feature of this methodology. The following comment by a senior manager illustrates the changes accomplished through the Lean methodology:

   > If you look at the HSMR (Hospital Standardized Mortality Ratio), we were over the 100 mark; if you look at today, we are at the low 80s[27]. Although HSMR is no longer an indicator, I recall that 5-7 years ago, with respect to the quality indicators reported to the Ministry, we were not among the high performers. Then, 3-4 years ago, we were among the top 10 organizations.

   This comment illustrates how externally-reported data were incorporated in the Lean methodology as feedback on overall performance and subsequently used to demonstrate improvement.

2. Multiple Communication Channels and Transparency: Throughout the hospital, there was a strong sense of open communication through a wide range of channels and transparency of critical information. Examples of open communication included face-to-face interactions through town hall meetings hosted by the CEO and senior management team to hear concerns from the staff, physicians and the local community; regular interaction between the vice presidents and the frontline employees to

[27] HSMR of 100 is normal; above 100 is worse than normal and below 100 is better than normal.

communicate concerns and appreciate the good work on a very short time-cycle; daily huddles for 15 minutes within each workgroup; use of social media, email, and newsletters to keep all the stakeholders informed; and consistent , thematic messaging—the focus on quality and safety as well as accountability throughout the organization was most significant.

Overall, the frequency of communication, sharing of real-time performance data, and commitment to meet face-to-face on critical issues created numerous feedback loops between past performance, corrective actions, and results, improving their overall comfort level with the corrective actions and keeping the focus on systemic improvements rather than individual blame.

3. Structured Communication and Escalation Process: The Lean methodology gave everyone across the organization a standard vocabulary, process, and a set of tools for their internal communication. As they practiced this method, they developed structured communication protocols that encouraged assertiveness and respect for all members of the team, and they also legitimized escalation of an issue if it was not being resolved at a local level. Similarly, in obstetrics, the MORE^{OB} program democratized the obstetrics team and flattened their hierarchy—particularly between the obstetricians and the nurses. The following comment from a senior manager illustrates how these mechanisms are used to reinforce their shared values:

> In the past, people would feel scared for calling a physician at the middle of the night for fear of being yelled at. Now, we have escalation processes in place. You try to make efforts to get hold of the most responsible provider—if he doesn't respond within 5-10 minutes, you can respond to the chief of the division; if he doesn't respond, you can escalate it to the chief of staff. Allowing

> the staff to be able to do that—and both parties know that it is going to happen—it is two pieces: one is setting expectations (this is what we expect from you) but at the same time, we have to support it. If a physician starts yelling at the nurse for calling him in the middle of the night, the support system in the organization should be such that there is dialog with that physician for his inappropriate behavior. We were able to coach the different groups and have their buy-in progressively. I am not saying we are perfect, but we have changed.

Overall, the obstetrics team seemed to be ahead of the rest of the hospital in implementing the use of formal and informal feedback loops because the $MORE^{OB}$ training predated the launch of Lean methodology. However, both approaches emphasized the use of feedback to implement prompt corrective actions.

6.3.5 Effects of the $MORE^{OB}$ Training on Outcomes

Based on the emergent model of organizational culture and climate, a training intervention such as $MORE^{OB}$ would be expected to improve group-level outcomes. In particular, the $MORE^{OB}$ training was designed to provide clinical and non-clinical knowledge to the entire obstetrics team with the belief that such an improvement in knowledge would result in improved clinical outcomes. Hence, the following two performance measures were analyzed:

1. Knowledge examination scores and
2. Clinical outcomes.

Figure 41 illustrates the knowledge exam scores after each module. Hospital B's mean scores after all three modules were higher than the mean scores for other Early Adopters.

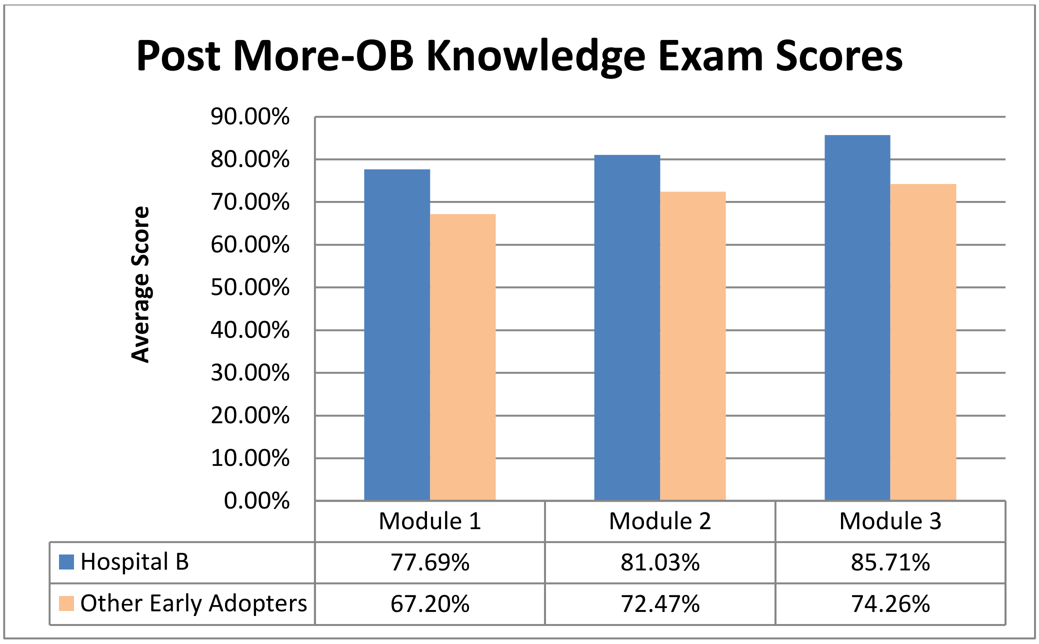


Figure 41: Post-MORE^{OB} Hospital B's knowledge exam scores

A repeated measures ANOVA was conducted to determine the significance of the differences in post-training mean knowledge exam scores after each module. Mauchly's test indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 4.08$, $p = .130$. The results showed that the differences in knowledge exam scores after each module were significant, $F(2)=26.303$, p=.000. Also, these results indicate that Hospital B's obstetrics team performed better than the teams from other Late Adopter hospitals.

The review of clinical outcomes focused on C-section rates and Length of Stay; other clinical outcomes data were not available from all the Early Adopter hospitals. At Hospital B, the MORE^{OB} program started in 2006 and was completed by the end of 2008. Table 77 presents the actual versus projected C-section rates for Hospital B and all other Early Adopter hospitals. Between 2002 and 2006 there was a gradual rise in the C-section rate, from 21.8 per cent to 25.8 per cent; however, it was well below the C-section rate at other Early Adopter hospitals. In the summer of 2007, the Ministry of Health and Long-term Care moved the hospital under a supervisor's oversight, who subsequently appointed an interim CEO and a new Board of Directors. With increased scrutiny brought about by the supervisor across all functions of the hospital, coupled with the recently adopted MORE^{OB} program, it was not surprising that in 2007, there was a dip in the C-section rate down to 24.2 per cent. By 2008, the interim CEO had been appointed on a regular basis and the pressure from the Ministry must have subsided or the obstetrics team may have been distracted by these external influences because in 2008, the C-section rate rose to 25.9 per cent. However, the obstetrics team was able to maintain it at 25.9 per cent in 2009 and bring it back down to 25.1 in 2010. For 2011, the team appears to have slipped in its discipline because the C-section rate increased to 27.1 per cent. In the interview narratives, the obstetrics team acknowledged that their emphasis on the MORE^{OB} program had faded a bit as they were trying to incorporate other initiatives, like fetal health monitoring, within the available budget. Thus, while the dip in C-sections in 2007 may be attributable to the dual influence of overall increased in organization-wide attention to safety and the freshness of the MORE^{OB} program, the subsequent maintenance of the C-section rate between 25.1 and 25.9 for three years is most likely due to consistent practice of the MORE^{OB} program. Based on the interview narratives, it seems that the obstetrics team has the opportunity to align the practice of MORE^{OB} principles with the organization-wide Lean methodology so as to renew the momentum of the MORE^{OB} program.

Table 77: Comparison of C-section rates between hospital B and other Early Adopters

Year	C-Section Rate (% of all births): Actual versus Projected	
	Hospital B	All other Early Adopter Hospitals
2002	21.8	25.4
2004	24.6	28.1
2005	24.4	29.1
2006	25.8←M-1	28.8
2007	24.2 / 27.10←M-2	28.9 / 30.65
2008	25.9 / 28.28←M-3	29.7 / 31.77
2009	25.9 / 29.46	29.6 / 32.89
2010	25.1 / 30.64	29.6 / 32.89
2011	27.1 / 31.82	29.7 / 35.13

Figure 42 illustrates the trend line for C-section rates. If there had been no significant changes in the practices in obstetrics, the projected C-section rate would have been 31.82 at Hospital B and 35.13 per cent at the other Early Adopters in 2011. Both groups were able to keep their C-section rates below the projected levels.

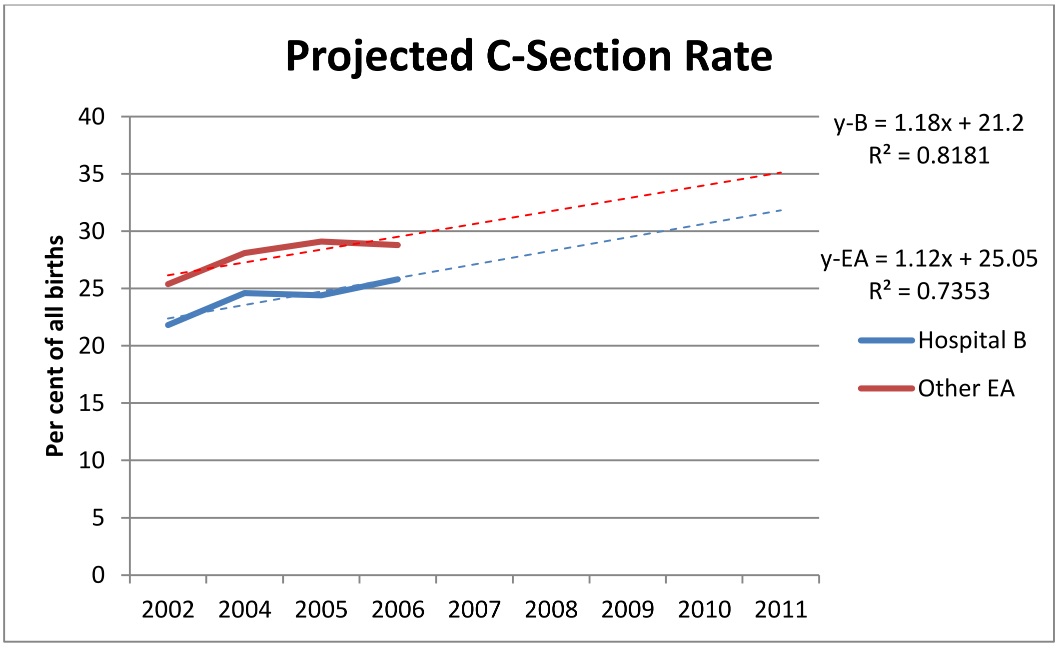


Figure 42: Projected C-section rate at Hospital B and Early Adopters

Table 78 presents the mean Length of Stay for Hospital B and all other Early Adopter hospitals. Data for 2008 were not available. The Length of Stay has declined during the implementation of the MORE^{OB} program in the 2006-2008 timeframe and stabilized at about 1.86 days per admission. Since the completion of the program, the standard deviation has been declining, indicating lower variation among the individual cases. During this same period, however, the Length of Stay and standard deviation at all the other Early adopters have also declined, particularly after 2006. Thus, the MORE^{OB} program appears to have had a positive influence at those hospitals as well. The mean Length of Stay at Hospital B was consistently lower than that at all the other Early Adopter hospitals.

Table 78: Comparison of mean Length of Stay at Hospital B and other Early Adopters

Year	Mean Length of Stay (Days), SD, and Projected ()	
	Hospital B	All other Early Adopter Hospitals
2002	2.18/1.44	2.56/2.65
2003	2.01/1.29	2.28/1.76
2004	2.19/1.80	2.50/2.15
2005	2.10/1.47	2.48/2.23
2006	1.99/1.36 ←M-1	2.47/2.58
2007	1.86/1.15 (1.95)←M-2	2.42/2.30 (2.43)
2009	1.87/1.91 (1.82)	2.36/2.21 (2.37)
2010	1.86/1.39 (1.75)	2.29/2.31 (2.34)
2011	1.86/1.16 (1.69)	2.24/2.14 (2.31)

Figure 43 illustrates the trend line for mean Length of Stay. If there had been no significant changes in the practices in obstetrics, the projected mean Length of Stay would have been 1.69 at Hospital B and 2.31 days at the other Early Adopters in 2011. While Hospital B was not, the other Early Adopters were able to keep their mean Length of Stay below the projected level.

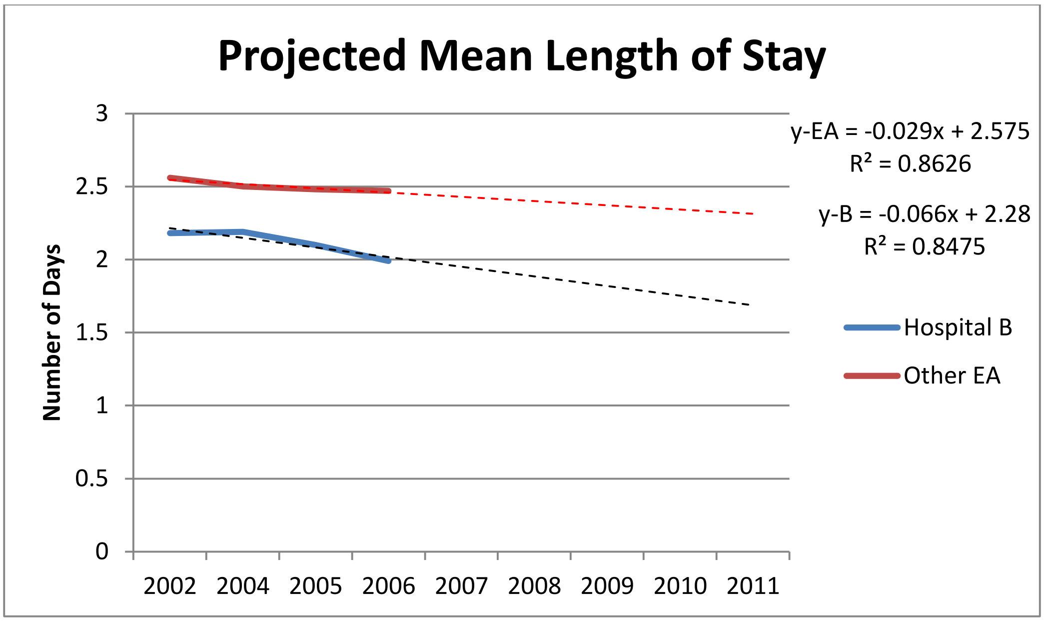


Figure 43: Projected mean Length of Stay at Hospital B and Early Adopters

In summary, Hospital B's obstetrics team's knowledge exam improved after each training module and was better than that of obstetrics teams at other Early Adopter hospitals. The C-section rate at Hospital B was both lower than projected as well as lower than the C-section rate at other Early Adopter hospitals. While the mean Length of Stay did not decline with respected to the projection, it remained lower than that at the other Early Adopter hospitals. Thus, overall, Hospital B's obstetrics team performed better than the teams at other Early Adopter hospitals.

6.3.6 Effects of the MORE^{OB} Training on Patient Safety Climate

Based on the emergent model of organizational culture and climate, a training intervention such as MORE^{OB} would be expected to improve patient safety climate. Specifically, the MORE^{OB} training was intended to produce a long-term change in the patient safety culture at the participating obstetrics units. Therefore, the patient safety climate scores before and after the MORE^{OB} training were analyzed to determine whether there was a significant difference in the scores.

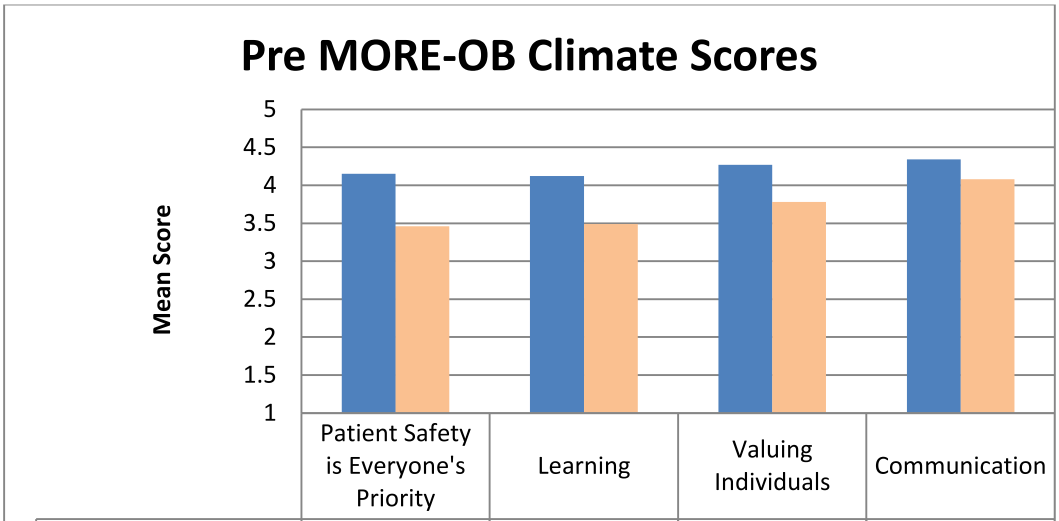
Before presenting the results of the patient safety climate survey, a mapping between shared organizational values at Hospital B and the six-factor patient safety climate model developed in Study #1 is presented in Table 79.

Table 79: Mapping between shared values and patient safety climate factors at Hospital B

Shared Organizational Values at Hospital B	Corresponding Patient Safety Climate Factors
Quality and Safety	Patient Safety is Everyone's Priority
Respect for Individuals	Valuing Individuals
Open Communication	Open Communication
Accountability	Learning or Continuous Improvement

Four organizational values mapped well with the patient safety climate factors: Quality and Safety, Respect for Individuals, Open Communication, and Accountability. Considering patient safety climate as a psychological response to the underlying safety culture, an assessment of pre-training scores on the corresponding patient safety climate factors was considered to be indicative of the underlying differences in the organizational culture at Hospital B versus other hospitals in the Early Adopter group.

Figure 44 illustrates the difference between the climate scores of members from Hospital B versus those from other Early Adopter hospitals.



	Patient Safety is Everyone's Priority	Learning	Valuing Individuals	Communication
Hospital B	4.15	4.12	4.27	4.34
Other Early Adopters	3.46	3.49	3.78	4.08

Figure 44: Pre-MORE^{OB} patient safety climate scores at Hospital B

Table 80 presents the results of the independent sample *t*-test of Hospital B's patient safety climate scores before the MORE^{OB} training. Overall, Hospital B's mean patient safety climate scores were higher than those of all other Early Adopter hospitals (n=38). Levene's test for equality of variances was not significant, p>.05; therefore, equal variances were assumed. All the differences in scores were significant. For Patient Safety is Everyone's Priority, F(2116)=1.659, p=.000; for Learning or Continuous Improvement, F(2116)=.081, p=.000; for Valuing Individuals or Respect, F(2116)=.260, p=.000; and for Open Communication, F(2116)=.280, p=.000. Therefore, even before the MORE^{OB} program began, the patient safety climate within Hospital B's obstetrics team was significantly better than within the obstetrics teams from the other Early Adopter hospitals.

Table 80: Results of the independent samples t-test on patient safety climate scores before MORE^{OB} training

Factor		t-test for Equality of Means F	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Patient safety is everyone's priority	Equal variances assumed	1.659	2116	.000	.69253	.09736	.50161	.88346
Learning	Equal variances assumed	.081	2116	.000	.62852	.10129	.42987	.82716
Valuing Individuals	Equal variances assumed	.260	2116	.000	.48408	.07534	.33634	.63183
Open Communication	Equal variances assumed	.280	2116	.000	.25903	.07131	.11919	.39888

Figure 45 illustrates the post-Module 1 comparison of patient safety climate scores for Hospital B versus all the other Early Adopters.

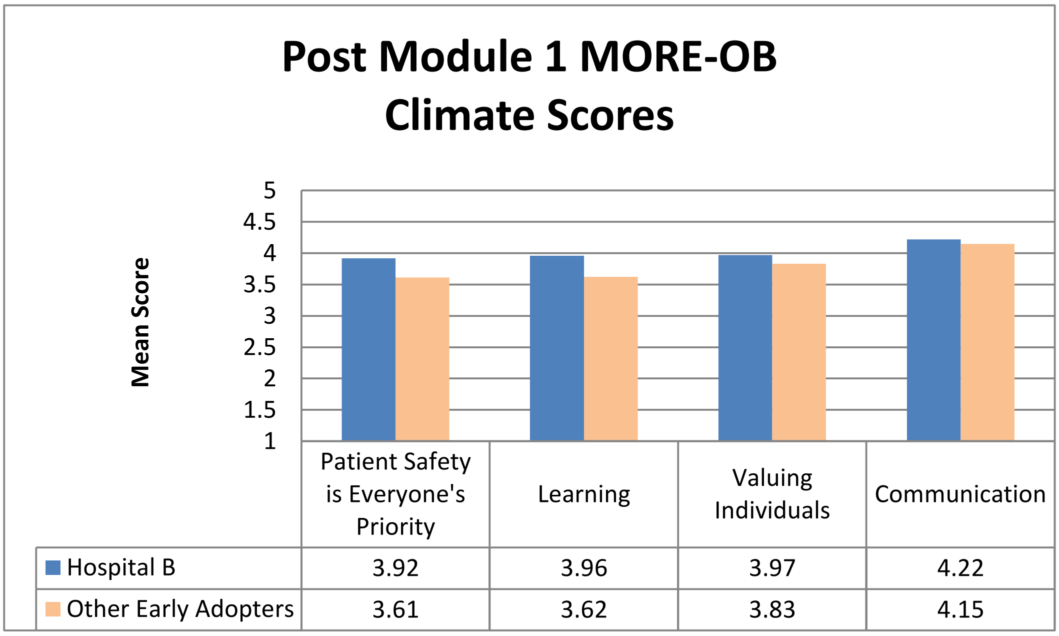


Figure 45: Post Module 1comparison of patient safety climate scores

Table 81 presents the results of the independent sample *t*-test of Hospital B's patient safety climate scores after Module 1. Overall, Hospital B's mean patient safety climate scores were higher than those of all other Early Adopter hospitals (n=38). Levene's test for equality of variances was not significant, $p>.05$, for three of the four factors; therefore, equal variances were assumed for those factors. For Learning, Levene's test for equality of variances was significant, $p<.05$; therefore, equal variances were not assumed for Learning. Differences in means scores of three of the four areas were significant. For Patient Safety is Everyone's Priority, $F(3170)=2.098$, $p=.000$; for Learning or Continuous Improvement, $t(185.054)=5.709$, $p=.000$; for Valuing Individuals or Respect, $F(3170)=2.743$, $p=.009$; and for Open Communication, $F(3170)=2.588$, $p>.05$. Therefore, after the first MORE^{OB} module, although Hospital B's patient safety climate scores remained higher than those at other Early Adopters for all four factors; the difference in the scores on Open Communication was not significant.

Table 81: Results of the independent samples t-test on patient safety climate scores after Module 1 of the MORE^{OB} training

Factor		t-test for Equality of Means: F or t value	df	Sig. (2-tailed)	Mean Differ-ence	Std. Error Differ-ence	95% Confidence Interval of the Difference: Lower	Upper
Patient safety is everyone's priority	Equal variances assumed	2.098	3170	.000	.31157	.06421	.18566	.43747
Learning	Equal variances not assumed	5.709	185.05	.000	.34116	.05975	.22327	.45905
Valuing Individuals	Equal variances assumed	2.743	3170	.009	.13460	.05123	.03415	.23505
Open Communi-cation	Equal variances assumed	2.588	3170	.082	.07811	.04485	-.00982	.16604

Figure 46 illustrates the post-Module 2 comparison of patient safety climate scores for Hospital B versus all the other Early Adopters.

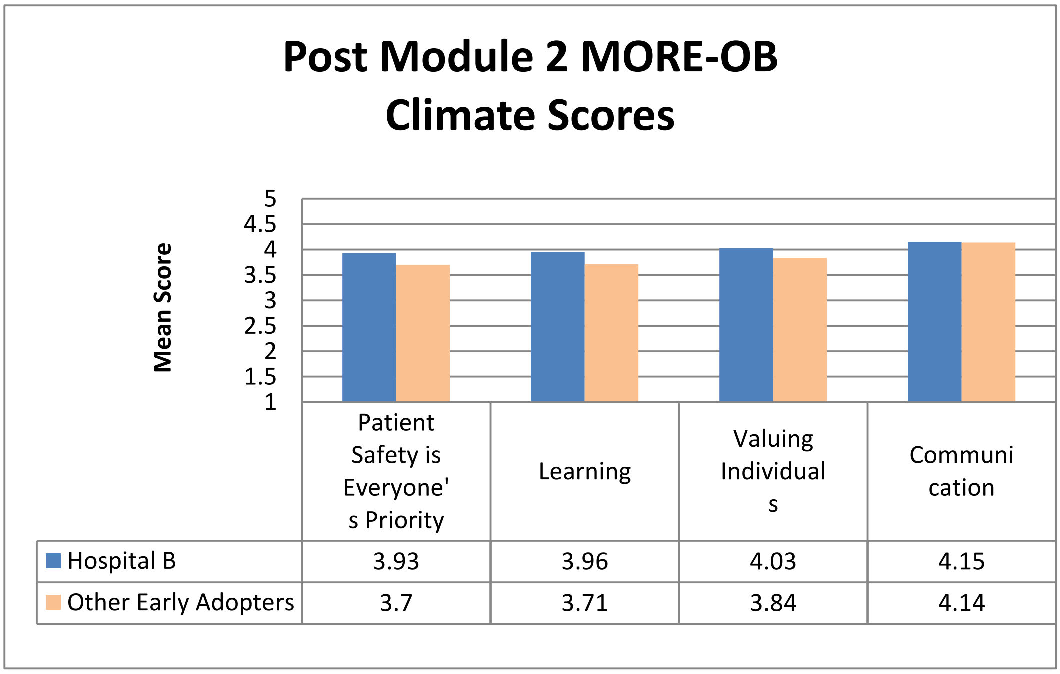


Figure 46: Post Module 2 comparison of patient safety climate scores

Table 82 presents the results of the independent sample *t*-test of Hospital B's patient safety climate scores after Module 2. Overall, Hospital B's mean patient safety climate scores were higher than those of all other Early Adopter hospitals (n=38). Levene's test for equality of variances was not significant, $p>.05$, for two of the four factors; therefore, equal variances were assumed for those factors. For Patient Safety is Everyone's Priority and Learning, Levene's test for equality of variances was significant, $p<.05$; therefore, equal variances were not assumed for these two factors. Differences in means scores of three of the four areas were significant. For Patient Safety is Everyone's Priority, $t(131.954)=3.519$, $p=.001$; for Learning or Continuous Improvement, $t(136.230)=3.961$, $p=.000$; for Valuing Individuals or Respect, $F(2259)=.947$, $p=.002$; and for Open Communication, $F(2259)=3.316$, $p>.05$. Therefore, after the second MORE^{OB} module, although Hospital B's patient safety climate scores remained higher in all four factors, there was no difference in the scores on Open Communication.

Table 82: Results of the independent samples t-test on patient safety climate scores after Module 2 of the MORE^{OB} training

Factor		t-test for Equality of Means						
		F or t value	df	Sig. (2-tailed)	Mean Differ-ence	Std. Error Differ-ence	95% Confidence Interval of the Difference	
							Lower	Upper
Patient safety is everyone's priority	Equal variances not assumed	3.519	131.95	.001	.2238	.06489	.10002	.35674
Learning	Equal variances not assumed	3.961	136.23	.000	.24862	.06276	.12451	.37273
Valuing Individuals	Equal variances assumed	.947	2259	.002	.18928	.05972	.07218	.30639
Open Communi-cation	Equal variances assumed	3.316	2259	.850	.01015	.05361	-.09498	.11528

Figure 47 illustrates the post-Module 3 comparison of patient safety climate scores for Hospital B versus all the other Early Adopters.

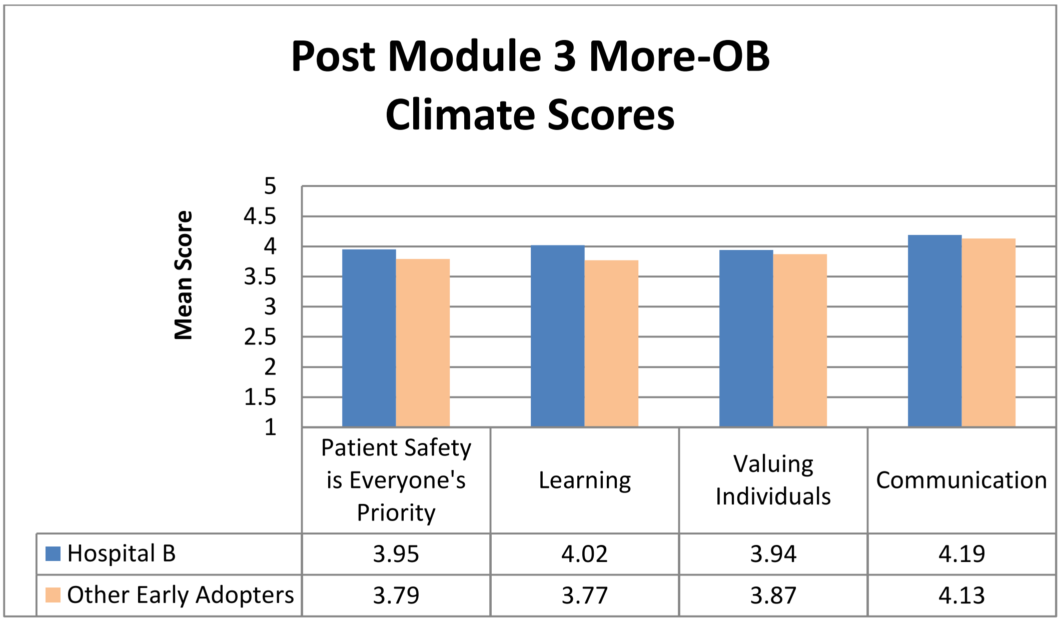


Figure 47: Post Module 3 comparison of patient safety climate scores

Table 83 presents the results of the independent sample *t*-test of Hospital B's patient safety climate scores after Module 3. Overall, Hospital B's mean patient safety climate scores were higher than those of all other Early Adopter hospitals (n=38). Levene's test for equality of variances was not significant, $p>.05$, for all four factors; therefore, equal variances were assumed. Difference in means scores of only one of the four areas was significant. For Patient Safety is Everyone's Priority, $F(1183)=1.536$, $p=.079$; for Learning or Continuous Improvement, $F(1183)=1.323$, $p=.012$; for Valuing Individuals or Respect, $F(1183)=3.667$, $p=.338$; and for Open Communication, $F(1183)=.001$, $p=.403$. Therefore, after the third MORE^{OB} module, although Hospital B's patient safety climate scores remained higher in all four factors, but only one factor—Learning or Continuous Improvement—scored significantly higher. Thus, the differences in safety climates between Hospital B and all the other Early Adopters narrowed substantially after the third module, indicating a positive influence of the MORE^{OB} program on all the Early Adopters.

Table 83: Results of the independent samples t-test on patient safety climate scores after Module 3 of the MORE^{OB} training

Factor		t-test for Equality of Means F	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Patient safety is everyone's priority	Equal variances assumed	1.536	1183	.079	.16204	.09203	-.01851	.34259
Learning	Equal variances assumed	1.323	1183	.012	.24847	.09833	.05556	.44139
Valuing Individuals	Equal variances assumed	3.667	1183	.338	.07861	.07861	-.07887	.22960
Open Communication	Equal variances assumed	.001	1183	.403	.07379	.07379	-.08301	.20655

Therefore, on the one hand, the MORE^{OB} training seems to have influenced patient safety climate at all participating hospitals; and on the other hand, since Hospital B's patient safety climate was already better and continued to better than that at the other Early Adopter hospitals on one scale, there must have been a much stronger emphasis on Learning within the underlying cultural elements at Hospital B. Also, similar to the results at Hospital A, there was a lag in noting improvements in the patient safety climate scores. Thus, the argument—that participants needed to experience the changes in underlying assumptions, role-modeling by leaders and key influencers, changes in workplace behaviors, effectiveness of new implementation mechanisms and incentives, and corresponding improvements in clinical outcomes before they would change their psychological response—still holds good.

Section 6.3.5 demonstrated a significant improvement in the participants' knowledge after the MORE^{OB} training modules. Since the patient safety climate also improved after MORE^{OB}, it seemed reasonable to investigate whether there was any relationship between level of knowledge and strength of the patient safety climate. Two topics in the knowledge exam were directly linked with the patient safety climate: Communication and Patient Safety. Since both these topics were specifically covered and tested in the MORE^{OB} training and subsequently measured as part of the Safety Climate Survey, it was reasonable to expect that an improvement in knowledge in these two areas would have a positive influence on the climate scores in the corresponding areas; thus, they would be positively correlated. Figure 48 illustrates both the knowledge exam scores and the safety climate scores. The knowledge exam scores are referenced to the left vertical axis and the safety climate scores are referenced to the right vertical axis.

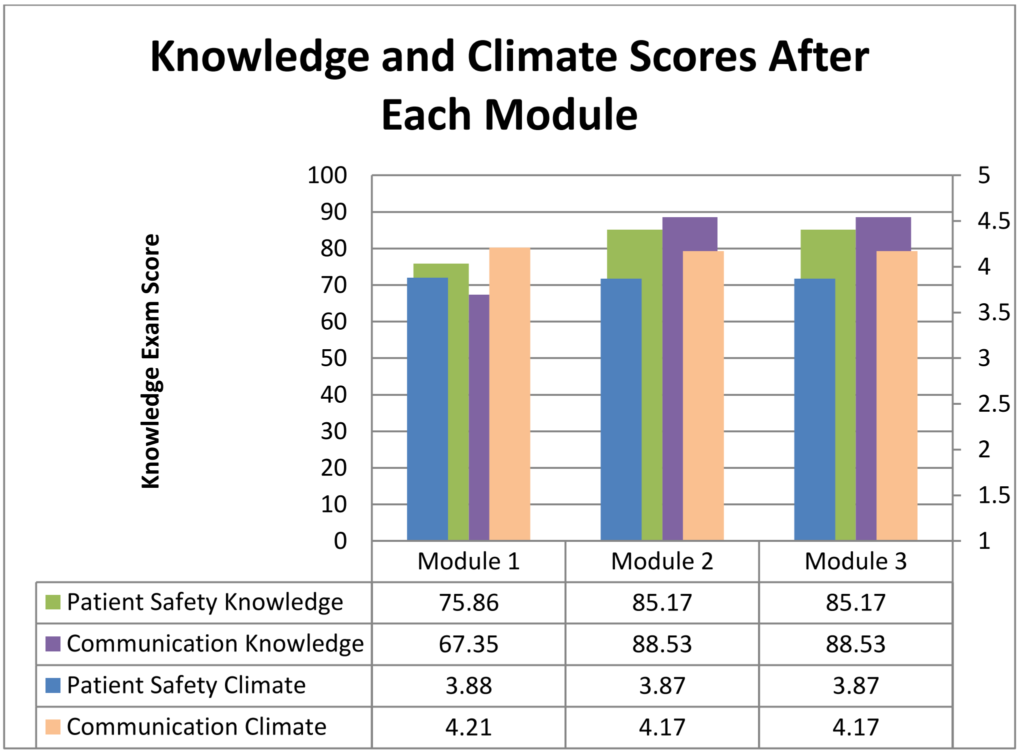


Figure 48: Comparison of knowledge exam scores and safety climate scores after each MORE^{OB} module

Pearson's Correlations between the knowledge and climate about patient safety was low after the first module ($r_1 = .10$), and progressively improved in direction, but remained moderate ($r_2 = .18$ and $r_3 = .25$). Correlations between knowledge and climate about open communication was reverse and moderate after the first module ($r_1 = -.29$), and progressively improved in direction, but remained low ($r_2 = -.18$ and $r_3 = .11$). Thus, patient safety climate scores and knowledge examination scores were low-to-moderately related. This finding further underscores the lead-lag phenomenon noted earlier: knowledge improvement tends to lead and climate improvements tend to lag. Also evident from this study is that success in improving clinical outcomes will fade when attention shifts to other priorities.

6.3.7 Integrated Review of Culture and Climate with Respect to the MORE^{OB} Training

The four environmental factors discovered through the participant interviews were applicable at the provincial levels and thus they were applicable to all the hospitals in the Province. Thus, it was not surprising that they were mentioned by the participants from Hospital B as well. However, the emphasis on Lean methodology to address economic concerns and the need to be more engaged and responsive to the ethnic diversity came through more strongly in Hospital B's interviews. Also, the role of legal factors was mentioned more repeatedly at Hospital B. At the shared experience level, the uniqueness of Hospital B was clear in the fact that they experienced supervisory oversight which resulted in a total change in senior management and strategic focus on quality and safety. Also, at an operational level, the Lean methodology resulted in integration and streamlining of services. When the obstetrics team experienced that such integration would improve quality of care without compromising safety, they were in full support of further alignment between MORE^{OB} and Lean. These experiences, along with several others reported by the participants, revealed the underlying shared values of Quality and Safety; Respect for the Individual; Open Communication; and Accountability. They also revealed some changes in unquestioned assumptions. For example, there was a shift in assumption from, “senior management would not be held accountable” to “senior management would be held accountable;” from “changes made during the supervisory control won’t last” to “our culture is totally transformed;” and from “organizational integration in the interest of efficiency would not work” to “the hospital has established a track record of successful integration of multiple services.”

The espoused values of Integrity, Compassion, Accountability, and Respect were closely aligned with the shared values of Quality and Safety, Respect for Individuals, Open Communication, and Accountability as well as patient safety climate factors like Patient Safety is Everyone’s Priority, Valuing Individuals, Open Communication, and Learning or Continuous Improvement. Hospital B performed significantly better on all four of these climate factors as compared to other Early Adopter hospitals, thereby indicating that Hospital B’s safety culture was stronger than that at the other Early Adopter hospitals.

After each the MORE^{OB} training module, there was a significant improvement in knowledge scores at Hospital B, and they were all better than those for the Early Adopter hospitals. With respect to the climate scores, after the first module, Hospital B’s climate scores remained higher than those at the Early Adopter hospitals on all four factors, but the difference in the Open Communication scores was not significant, and the same was true after the second module. After the third module, only the difference in scores on Learning or Continuous Improvement remained significant. Thus, the MORE^{OB} training was effective in narrowing the safety climate gap between Hospital B and all the other Early Adopter hospitals. The relationship between knowledge gained through the MORE^{OB} program and the improvement in safety climate was low-to-moderate, indicating that there was more to improving the safety climate than just providing knowledge training.

The review of clinical outcomes indicated that Hospital B had performed better than the other Early Adopter hospitals in terms of the actual C-section rate and kept the C-section rate much lower than predicted; however, the other Early Adopter hospitals were also able to maintain their rate (albeit at a higher value) below the predicted value. With respect to Length of Stay, Hospital B was able to maintain its Length of Stay consistent since the conclusion of the MORE^{OB} training, and lower than that at the Early Adopter hospitals; however, Hospital B was not able to bring the rate down lower than predicted.

There were two key feedback mechanisms that played a significant role in reinforcing the shared organizational values: the Lean methodology and the SAFE program. The Lean methodology was pervasive across the organization and was being used as an integrated tool for management, communication, and reinforcement. The SAFE program was essentially an event reporting program that recognized both opportunities for system improvements as well as successes in stopping errors from reaching the patient.

In conclusion, the inherent cultural elements make a definitive impact on the influence of planned culture-change interventions. A summary of observations noted in conjunction with the MORE^{OB} training implementation are as follows:

1. All four of the shared values resonated well with the goals of the MORE^{OB} program and the associated patient safety climate factors: Quality and Safety →Patient Safety is Everyone's Priority; Respect for Individuals →Valuing Individuals; Open Communication → Valuing Individuals and Open Communication; and Accountability → Patient Safety is Everyone's Priority and Learning or Continuous Improvement.
2. Leaders and influencers helped shape organizational values through two mechanisms: interpretation and operationalization. First, they committed to the MORE^{OB} program and next, they adopted Lean methodology as their hospital-wide quality improvement tool, thereby institutionalizing many aspects of the MORE^{OB} program across the hospital.
3. Improved clinical knowledge among all participants, and consistency of the knowledgebase between obstetricians, nurses, and midwives were critical to implement evidence-based practice.
4. Practice of teamwork, communication, and respect for individuals, as prescribed in the MORE^{OB} training helped flatten the hierarchy within the obstetrics team.
5. Improved clinical outcomes (particularly in reducing the C-section rate) resulted in improved support from management and heightened expectations from each other.

6.4 Conclusions from Study #3

Two comparable hospitals were selected for longitudinal studies. Hospital A was one of the Late Adopters and Hospital B was one of the Early Adopters. Both hospitals were subjected to similar environmental factors. Prior to implementing the MORE^{OB} program, Hospital A’s C-section rate was higher than that at the other hospitals in the Late Adopter group as well as all the hospitals in the Non Adopter group: 28.9 versus 25.4 and 27.5 per cent, respectively. However, the overall mean Length of Stay at Hospital A was 2.19 versus 2.43 days at the rest of the Late Adopters, 2.37 at the Non Adopters, and 2.45 days at the Early Adopters. Thus, the hospital seemed to be performing well on overall quality and efficiency, but there was some room for improvement in the C-section rate.

Over the course of the MORE^{OB} implementation, the obstetrics team discovered that there were clear opportunities for improvement and while compassion was important in healthcare, it was not a proxy for quality of care. The surrounding community’s sense of ownership of the hospital was leveraged to strengthen ties with the community and provide services reflective of the needs of the community.

Hospital A’s espoused values were healthy community, safe and high-quality care, talent development, and accountability. Its shared values were compassion, patient safety, quality of care, inclusion, talent development, and accountability. MORE^{OB}, as a training intervention, also served as an implementation mechanism, which reinforced all the shared values. The senior management was generally supportive of the MORE^{OB} program because it was credible, successful at other hospitals, and promised safety and cost savings. In mentoring new entrants, preceptors (influencers) played a critical role in transferring the shared organizational values and the MORE^{OB} training became the baseline expectation from new entrants.

Analysis of patient safety climate scores on four factors showed that Hospital A's patient safety climate was better than that at other Late Adopter hospitals even before the MORE^{OB} program was launched. Subsequent analysis of climate, knowledge, and clinical outcomes revealed that Hospital A performed significantly better than all the other Late Adopter hospitals. Also the gap in patient safety climate scores between Hospital A and the other Late Adopters declined after the third module of the MORE^{OB} program. The finding regarding lack of a relationship between the knowledge scores and patient safety climate scores was surprising. Since the MORE^{OB} program focused on improving the patient safety climate by improving the obstetrics team's clinical and non-clinical knowledge, it seemed logical that an improvement in knowledge levels would be related to improvement in the patient safety climate. However, the data showed that there was no relationship between these two factors. Thus, the improvements in patient safety climate and clinical outcomes after the MORE^{OB} program must be impacted by additional factors such as leaders and influencers, use of feedback mechanisms, and alignment of espoused and shared values—as evidenced through the qualitative analysis of interview data and supporting artifacts.

Analysis of Hospital B's shared experiences revealed two types of experiences: defining moments or the ones that had strategic impact and refining moments or the ones that had operational impact on a routine basis. The fact that Hospital B was placed under Supervisory control was most significant in its subsequent cultural transformation; whereas, the use of Lean methodology throughout the hospital was most influential in routine improvement of efficiency, quality, and safety.

Hospital B's espoused values were integrity, compassion, accountability, and respect. Applying the hierarchical value mapping technique the participants' shared experiences led to the following shared values: quality and safety, respect for individuals, open communication, and accountability. A review of several artifacts revealed that the community's perception of the hospital was positive and consistent with its shared organizational values. Three implementation mechanisms were noted as being most influential in reinforcing the shared organizational values:

1. The Lean Methodology;
2. Use of Multiple Communication Channels and Transparency with Data; and
3. Structured Operational Communication and Escalation Process.

The senior management played a distinctive role at Hospital B. They were highly consistent about their commitment to quality and safety through the Lean methodology overall and the use of the MORE^{OB} program in obstetrics. Since the MORE^{OB} program was implemented well before the Lean methodology, and it was consistent with the basic principles of Lean, it was regarded by many of the frontline personnel as "ahead of Lean." As a result of the MORE^{OB} program, the frontline personnel were already trained to look at systemic issues while reducing errors, and they were well-versed in the principles of high reliability organizations. These personnel served as role models and champions of key behaviors—such as evidence-based practice, assertiveness, structured debriefings, regular review of clinical skills, etc.—and modeled the desired behaviors themselves.

Overall, Hospital B’s pre-training mean patient safety climate scores for four factors were significantly higher than those of all other Early Adopter hospitals. Therefore, even before the MORE^{OB} program began, the patient safety climate within Hospital B’s obstetrics team was significantly better than within the obstetrics teams from the other Early Adopter hospitals. Subsequent analysis of post-training patient safety climate surveys revealed that Hospital B’s patient safety climate scores remained higher than those at other Early Adopters for all four factors; however, the difference in the scores on Open Communication was not significant after the first module. After the third module, only one factor, Learning or Continuous Improvement, scored significantly higher. Thus, the differences in safety climates between Hospital B and all the other Early Adopters narrowed after the third module, indicating a positive influence of the MORE^{OB} program on all the Early Adopters. However, Hospital B remained distinctively better at managing organizational learning or continuous improvement.

Slightly different from the results of Hospital A, there was only a low-to-moderate relationship between knowledge exam scores and patient safety climate. Thus, at Hospital B as well, MORE^{OB} training—by itself—did not influence the patient safety climate. However, the MORE^{OB} training appeared to have influenced clinical performance outcomes. For example, prior to the implementation of the MORE^{OB} program, the C-section rate was on the rise. After the implementation of the MORE^{OB} program, the actual C-section rate was consistently lower than the projected rate (without any interventions). Also, the Length of Stay declined since the implementation of the MORE^{OB} program.

In summary, there were four broad levels at which interventions can impact organizational culture and climate: (a) Environment, (b) Organization, (c) Work Group, and (d) Individual. Training, as a planned intervention, can complement and even enhance the effectiveness of change programs across all four levels. This finding is consistent with Birdi and Reid's Taxonomy of Training and Development Outcomes model (Birdi & Reid, 2013). On the other hand, if the culture-change intervention (training) is not complementary to the values and priorities of the extant mechanisms, it is not likely to succeed. A review of the two longitudinal cases presented in this study also provides insight into how these mechanisms could be used to cause a scalable and sustainable cultural change.

1. Environment-level Mechanisms: Both subject hospitals experienced external environmental impacts that triggered systemic shocks or defining moments. The actions required for the hospitals to thrive beyond these moments were complementary to the MORE^{OB} training intervention's tenets and practices. Thus, these mechanisms supported the success of the MORE^{OB} program. External influencers like the Society of Obstetricians and Gynecologists of Canada also played a critical role in encouraging hospitals to adopt the MORE^{OB} program.
2. Organization-level Mechanisms: Internal to the organization, both hospitals designed and implemented a variety of programs, some of them were beyond obstetrics (like the Lean program), while others were within

obstetrics (like the debriefing program), but they were all complementary to MORE^{OB} and therefore supported the success of the MORE^{OB} program.

3. Group-level Mechanisms: At the obstetrics group level, there was evidence of the use of incentives and disincentives, as well as coaching and mentoring that helped revise and reinforce the group's shared values, which were consistent with the attributes of the MORE^{OB} program. While the incentives were not part of the intervention, the group devised and used them in order to encourage and maintain the desired behaviors.
4. Individual-Level Mechanisms: At the individual level, the nurses showed great pride in learning through the MORE^{OB} program and high level of motivation to practice the skills taught in the program. Overall, they felt empowered by the new knowledge, and the MORE^{OB} manual provided them with an objective performance standard that they could enforce within their team. The obstetricians were incentivized to reduce the number of C-sections in order to increase their total patient volume; MORE^{OB} provided a proven path toward reduction in the number of planned C-sections. Thus, individual mechanisms also played a part in influencing the effectiveness of the MORE^{OB} program in improving the patient safety culture in obstetrics.

Chapter 7: Discussion and Conclusions

7.1 Introduction

This study developed a macro-level integrated theory of organizational culture and climate and focused it on the study of the ability of a training intervention to cause a cultural change in the context of patient safety in the obstetrics practice in Canada. The analysis of the data was organized into three studies: the first study was quantitative, the second study was qualitative, and the third study was mixed-methods. These studies responded to specific research questions and hypotheses and facilitated revisions to the emergent model.

Overall, this study was set within the context of the Canadian healthcare sector because even advanced countries like Canada are challenged to improve quality and reduce costs (Baker et al., 2008; Thomson et al., 2013). Concurrently, there is a general belief that both quality and affordability could be addressed by improving efficiencies of various processes as well as improving the overall culture of patient safety (Baker et al., 2008; Thomson et al., 2013). Specifically, the focus was on obstetrics care in Ontario because (a) Ontario accounts for about 37 per cent of total births in Canada; (b) both obstetrics trauma and Cesarean section rates are of great concern in Ontario; (c) the researcher had access to extensive qualitative and quantitative data related to a specific intervention (the MORE^{OB} program); and (d) the effects of the MORE^{OB} intervention had not been studied on a longitudinal basis. This chapter reviews the results from chapters 4, 5, and 6 in the context of broader implications to the advancement of theory as well as the practice of assessment and transformation of organizational culture. It starts with a brief review of the emergent integrated model and how it differs from other integrated models as well as those focused on safety.

The emergent integrated model of organizational culture and climate illustrated the relationship between three constructs: organizational environment; organizational culture; and organizational climate. The two broad propositions linking these constructs were as follows:

1. The environment in which an organization operates has an influence on the culture of the organization and
2. The internal organizational culture influences the organizational climate, which is the psychological response to the core cultural elements.

Of the many potential starting points to build an integrated model of culture and climate, the researcher chose Schein's model (1988, 2010, 2015)—culture as a pattern of shared basic values and assumptions based on shared experience—because more of the recent studies on culture seemed to converge the definition of culture on three dimensions: artifacts, values and beliefs, and underlying assumptions (Ployhart et al., 2014). This approach resulted in the following key elements of organizational culture:

1. Shared experiences and learning;
2. Organizational values and unquestioned assumptions;
3. Implementation mechanisms used to reinforce or renew organizational values;
4. Leaders and key influencers;
5. Individual-, group-, and firm-level performance outcomes; and

6. Feedback in response to individual-, group-, and firm-level performance outcomes;

A variety of physical artifacts (e.g., checklists, kits, value/belief statements, etc.) and narratives (e.g., stories, corporate histories, interview transcripts, etc.) could be used to develop a rich description of organizational culture along the above listed cultural elements.

Organizational climate, also a group-level construct, is the group's psychological response to the shared experiences, values, and implementation mechanism, as well as individual-, group-level outcomes (Ostroff, 1993; Sammer et al., 2010). In spite of this general agreement among researchers regarding the overall construct of climate, numerous variations on climate measures have emerged: some have been based on molar studies (Ehrhart et al., 2014; L. R. James et al., 2008; Ostroff, 1993) and many more have been based on focused studies (Flin, 2007a, 2007b; Flin, Mearns, O'Connor, & Bryden, 2000; Guldenmund, 2000, 2007; Jackson & Kline, 2014; Sammer, Lykens, Singh, Mains, & Lackan, 2010). Based on these studies, organizational climate could be regarded as an outcome measure (manifestation) of the underlying organizational culture, and it refers to members' attitudes and perceptions about shared experiences, organizational values, and implementation mechanisms, as well as reactions to observed behaviors of fellow-employees, leaders and key influencers. Depending on the context in which the focused studies were conducted, a variety of factors have emerged. However, in the context of safety as a focus area, there seems to be agreement on the following nine elements (Flin, 2007b; Flin et al., 2000; Guldenmund, 2000; Jackson & Kline, 2014; Sammer et al., 2010; Singer et al., 2007):

1. Safety as an organizational value;
2. Teamwork;
3. Respect for individuals;
4. Open communication;
5. Learning from experience;
6. Leadership or senior management commitment;
7. Alignment/availability of resources;
8. Mutual trust among colleagues/co-workers; and
9. The nature of response to unintentional errors.

The MORE^{OB} safety climate survey included six of the above nine climate factors:

1. Patient safety is everyone's priority (Safety as an organizational value)
2. Teamwork (Teamwork)
3. Valuing Individuals (Respect for individuals)
4. Open Communication (Open communication)
5. Learning (Learning from experience)
6. Empowering People (A combination of leadership commitment and resources)

The integrated model of culture and climate organized the six cultural elements at the core and the nine climatic elements as psychological responses to the underlying core elements. Previously, Patankar et al. (2012) saw climate as one of the components of culture, but the model used in this study is consistent with Patterson et al. (2005) and Schneider et al.'s (2011) conceptualization, which essentially positions culture influencing climate. Thus, in comparison to Patankar et al.'s pyramid model, climate is now separated out and presented as a psychological response to all the underlying cultural elements, including performance. Additionally, it also acknowledges and incorporates the influence of external business environment (Barney, 1986) and national and organizational environments (Ostroff et al., 2012). The integrative model developed and tested in this study fills the deficiencies noted in the earlier versions of integrative models by incorporating the influence of the external environment within which a firm operates, the role of shared experiences and learning in forming the core organizational values and unquestioned assumptions, and the role of feedback mechanisms that are used to interpret performance outcomes and create new meanings of shared experiences. It also acknowledges the bi-directional influence between values and practices and it highlights the role of leaders and key influencers in both influencing organizational values and being influenced by them, as well as in influencing various implementation mechanisms.

7.1.1 Research Question #1: How did environmental factors influence the patient safety culture in the obstetrics practice in Ontario?

Most integrative models/studies of organizational culture and climate focus on the characteristics or observations within an organization (e.g., Ostroff et al., 2012; Patankar et al., 2012; Patterson et al., 2005; Schneider et al., 2011; Zohar & Hoffman, 2012). However, there have been claims to the role of external, environmental factors on the formation of internal organizational culture (Barney, 1996; Ostroff et al., 2012). Thus, a qualitative approach was used to explore this question, and narrative and artifact data from two subject hospitals were used for analysis. In total, 41 individuals participated in this study (20 from Hospital A and 21 from Hospital B). These individuals were asked to talk about their general experience of changes in Canadian healthcare sector, the local area, their specific hospital and finally their unit and describe “what has changed” and how these changes might have influenced the patient safety culture in the obstetrics practice at their hospital. Based on the analysis of interview and focus group transcripts, the four factors were identified: economic, geo-social, legal, and professional. A summary of how each of these factors influenced the patient safety culture in the obstetrics practice at the participants’ hospital is presented below.

1. Economic: Generally, most participants agreed that the economic model of healthcare in Canada had changed. The old assumption of receiving resources commensurate with patient volume alone was not true anymore and there was a much stronger emphasis on quality, patient safety, and accountability. With multiple years of flat budgets, hospitals were forced to be creative in identifying efficiencies within their existing budgets and providing continued or enhanced services to their communities.
2. Geo-Social: The specific communities of the two sample hospitals had experienced growth in the total population as well as a sharp increase in diversity. Thus, their respective community’s needs had changed dramatically and they had to adapt by providing translation services, culturally-sensitive clinical support, and address different patient risk factors such as risks associated with late pregnancies.
3. Legal: Two legislative actions influenced the patient safety culture at both hospitals. First, the Quality of Care Information Protection Act (QCIPA) of 2004 legislation protected from discovery any information that was shared in a critical incident review meeting. Over the years, the practice of

incident reviews under this protection made the clinical teams at Hospital B more comfortable with the general notion of non-punitive reviews. Second, the Excellent Care for All Act (ECFAA) of 2010 legislation required every hospital to develop a strategic plan with quality improvement goals and expected the respective governing boards to tie executive compensation to the accomplished quality improvement goals. Consequently, there was a clear alignment of performance goals from clinical frontlines to senior management.

4. Professional: Concerted efforts from four professional bodies had a significant influence on the patient safety culture at the subject hospitals. First, the Society of Obstetricians and Gynecologists of Canada (SOGC) endorsed the MORE^{OB} program and therefore helped establish its credibility. Second, the Healthcare Insurance Reciprocal of Canada (HIROC) offered discounts in insurance premiums based on the implementation of the MORE^{OB} program. This collateral endorsement and financial incentive further strengthened the credibility of the MORE^{OB} program. Third, Accreditation Canada and fourth, Ontario Hospital Association created guidelines and requirements consistent with the ECFAA legislation and tied quality improvement expectations with certification of hospitals. Thus, the entire hospital team became firmly committed to quality improvements and MORE^{OB} was seen as one of the quality enhancement initiatives. Finally, the Canadian Institute for Health Information (CIHI) made a number of datasets available to the general public, which resulted in webpages and news articles announcing improvements in specific safety and quality metrics such as the Low-Risk

> C-section rate. Thus, there was public attention to these metrics and therefore there were several hospital-wide initiatives linked with the key quality and safety metrics.

The pursuit of this research question and the resultant analysis led to not only the confirmation of the role of environmental factors in shaping internal organizational culture, but also to the development of a secondary coding scheme. Environmental factors can now be categorized further as either economic, geo-social, legal, or professional. In practical terms, one could consider a combination of these factors as levers for large-scale cultural transformation.

7.1.2 Research Question #2: How did leaders and influencers shape shared organizational values at the subject organizations?

The role of leaders in shaping organizational culture has been widely acknowledged in the literature (e.g., Erhart et al., 2014; Pettigrew, 1979; Schein, 2010, 2015; Waterson, 2014). However, the role of key influencers, those not holding any formal management positions in the organization, is relatively under-represented (Davenport, 2005; McDonald, 2005). Therefore, the emergent model used in this study specifically included both leaders and key influencers in the study and the research question sought to determine how both these groups might have shaped the shared organizational values within the subject organizations.

Based on the hierarchical value mapping of the interview narratives, the following shared values were identified: Patient Safety; Quality of Care; Inclusion; Mutual Respect; Accountability; and Continuous Improvement. Formal leaders and informal influencers, within each of the hospitals, as well as influencers from outside the hospitals played a critical role in shaping these values. When asked about how specifically leaders and influences might have shaped the shared organizational values, the participants shared several stories and anecdotes. For example, the Ministry of Health and Long-term Care took a leadership role when they placed Hospital B under supervision, changed all the senior management, and made patient safety and quality their priority. At that point Patient Safety and Quality was an aspirational value, but at the time of Study #2, it was clear that it had become a shared value at Hospital B. Also, the consistent use of the Lean methodology across the organization enabled operationalization of two key values: inclusion and accountability. Practice leaders such as obstetricians, nurses, and midwives, as well as risk management personnel served as informal leaders or peer leaders who supported and modeled the desired behaviors such as non-punitive critical incident reviews and open communication across the four professional groups (obstetricians, nurses, midwives, and family physicians). Externally, leading researchers like Dr. Ross Baker championed patient safety as a national concern and renowned obstetricians like Dr. Ken Milne developed specific programs to improve patient safety. Thus, there was a concurrent rise in awareness among clinical practitioners and hospital management as well as rising evidence of successful best practices in obstetrics. Taken together, the external leaders and influencers raised awareness among hospital leaders and practitioners and they also provided examples of best practices that could be adopted by the hospitals. The internal leaders, on the other hand, considered the broad environmental factors as well as guidance from the external influencers and professional organizations and reframed them into the local context. Practice leaders and influencers then focused on modeling the desired behaviors and holding each other accountable.

The pursuit of this research question and the resultant analysis led to not only the confirmation of the role of formal leaders in shaping internal organizational culture, but also highlighted the role of informal leaders or key influencers. The role of leaders and key influencers can now be categorized in accordance with a 2x2 matrix with leaders versus influencers on one axis and internal versus external on the other. Thus, the internal organizational culture could be influenced by external influencers, external leaders, internal influencers, and internal leaders. In practical terms, one could consider a combination of these factors as levers for cultural transformation within workgroups or organizations.

7.1.3 Research Question #3: How did shared experiences, through implementation mechanisms, help revise and reinforce organizational values at the subject organizations?

The role of shared experiences is fundamental to the formation and maintenance of shared values (Schein, 1988, 2010, 2015); however, most of the empirical studies of culture and climate have not been explicit about the role of shared experiences as antecedents to value formation and maintenance (e.g., Clarke, 2000; Cooper, 2000; Geller, 1994; Komacki et al., 1978; Krause, 1997; Patankar et al., 2012; Patterson et al., 2005; Zohar, 2014; Zohar & Fussfeld, 2008; Zohar & Hoffman, 2012). Therefore, the emergent model is centered around the role of shared experiences and this research question sought to determine how shared experiences might have shaped organizational values.

The analysis of interview narratives provided two types of shared experiences: defining moments and routine, refining moments. Defining moments were abrupt and impactful for the entire organization. For example, at Hospital A, almost every participant commented on the sudden population growth (and change in diversity) and how it impacted every aspect of the organization and also threatened its ability to maintain its original, deeply-held values. On the other hand, Hospital B was dramatically impacted by the appointment of an external Supervisor by the Ministry of Health—it resulted in a chain reaction of changes and brought into focus safety and quality as institutional priorities. Routine shared experiences included non-punitive error reporting programs, the Lean methodology, and clinical debriefings or incident reviews. Both types of experiences led to shifts in unquestioned assumptions and revision or reinforcement of values. The implementation mechanisms included not only organizational policies, but also role modeling of the desired behaviors. Several artifacts or attributed, espoused, and shared values were noted. Generally, a synthesis of value statements, shared experiences, shifts in assumptions and accompanying artifacts consistently supported three fundamental values: Accountability, Inclusion, and Excellence. Thus, shared experiences—through implementation mechanisms—helped revise and reinforce organizational values.

While the defining moments identified in this study were external to the organization or triggered by external actions, there was support in the literature for defining moments to arise out of seminal organizational outcomes such as accidents (Knowles, 2002; Patankar et al., 2012). Thus, the revised model of culture and climate should consider multiple pathways to a defining moment. Also, based on the findings regarding the role of leaders and key influencers, by virtue of how the routine work is handled, leaders and key influencers have the opportunity to reinforce the desired values in practical terms. This finding is consistent with Clarke's (2000) claim that safety behaviors are influenced by the safety climate at the workplace, as well as Zohar's (2014) claim that symbolic interaction is an antecedent to workplace safety climate.

7.1.4 Research Question #4: How does feedback from group-level performance influence learning derived from shared experiences at the subject organizations?

Feedback mechanisms are widely acknowledged as fundamental to organizational learning (e.g., Senge, 1990), but their study in the context of organizational culture and climate has been limited. For example, there is no explicit mention of feedback mechanisms in most of the integrated models of culture and climate or those of safety culture and climate (e.g., Clarke, 2000; Cooper, 2000; Geller, 1994; Komacki et al., 1978; Krause, 1997; Patankar et al., 2012; Patterson et al., 2005; Zohar, 2014; Zohar & Fussfeld, 2008; Zohar & Hoffman, 2012). Therefore, the emergent model sought to bridge this gap and incorporate the role feedback mechanisms in shaping organizational culture and climate.

The fourth research question sought to determine the role of feedback from group-level performance in influencing learning derived from shared experiences. Based on the interview narratives, there were four types of feedback mechanisms on a 2x2 matrix consisting of either informal or formal and either external or internal. The external, informal mechanisms like the BORN database served as passive awareness tools that were available for the general public. On the other hand, the external formal mechanisms were mandatory processes that could have an impact on the hospital's operating status, budget, or patient volume. Senior management was well aware of these mechanisms and used them regularly to drive organization-wide improvements. The internal, informal mechanisms were active at the unit level and served as that community's standards of practice. Although, they were informal, they played a critical role in establishing norms of acceptable behavior and thereby influenced organizational culture and climate. The internal, formal mechanisms had serious implications for individuals and/or groups. A typical internal formal mechanism would be a safety and quality report originating at the operating unit level and getting rolled up all the way to the Safety and Quality Committee of the Board of Directors. These findings were consistent with the notions of organizational learning (Senge, 1990) and sensemaking (Weick, 1995); thus, to better represent the functional role of such mechanisms, their name was changed to "learning and sensemaking loops." These findings are also consistent with the Reciprocal Safety Culture Model (Cooper, 2000) and behavioral safety culture models (Geller, 1994; Komaki et al., 1978; Krause, 1997; Zohar & Fussfeld, 2008). Furthermore, the formal versus informal and internal versus external functions of such loops provided new insights into how cultural transformation could be influenced. For example, when internal-formal feedback is consistent with the external-informal feedback, it is likely to produce a much more effective reinforcement or change in organizational culture. On the other hand, if the internal-formal feedback is inconsistent with the internal-informal feedback, the change efforts are likely to languish.

7.1.5 Research Question #5: How do inherent cultural elements influence the effectiveness of a planned culture-change intervention?

There was strong support in the literature for the role of organizational culture/climate in the effectiveness of transfer of training skills to workplace behaviors (Alvarez et al., 2004; Birdi, 2007; Holton, 2005). If the goal of the training program is to change the organizational culture, and the extant culture is a likely barrier to the transfer of training skills, the research question was to determine how the inherent cultural elements influenced the effectiveness of a planned culture-change intervention. The emergent model identified seven elements of organizational culture: (a) Shared Experience, (b) Learning, (c) Organizational Values, (d) Implementation Mechanisms, (e) Leaders and Key Influencers, (f) Individual, Group, and Firm-level Outcomes; and (g) Learning and Sensemaking Loops. The goals of this research question were to first determine whether the subject hospitals performed any better than their peer group (to establish the preliminary evidence of differentiation between these hospitals and their peers) and then determine how the seven cultural elements supported or inhibited the culture change efforts promoted through the MORE^{OB} training intervention.

The findings from study #3 indicate that the obstetrics workgroups at both subject hospitals performed better than their peer groups on key measures such as knowledge gained after the MORE^{OB} training, safety climate scores, and clinical outcomes. Further investigation of the role of various cultural elements revealed that (a) the attributes of the training intervention were well-aligned with the shared organizational values; (b) the training itself provided a distinctive shared experience and the experience of changes in workplace behaviors in terms of how new policies and practices were implemented and supported created new shared experiences; (c) the participants learned not only from the training program, but also from their workplace experiences and feedback received in conjunction with their clinical outcomes; (d) other implementation mechanisms such as clinical reviews, safety reporting systems, and alignment of incentives played a complementary role in reinforcing the shared organizational values and expectations of the MORE^{OB} training; (e) leaders and key influencers translated the broad external influences into local significance and they also supported appropriate incentive structures and served as role models for the desired behaviors; (f) individual-, group-, and firm-level outcomes were discussed with respect to the desired clinical and operational goals of the organization and transparency and mutual accountability were fundamental in this process; (g) learning and sensemaking occurred at all levels of the organization as increased awareness led to shifts in fundamental assumptions and an interest in behavioral change, the training intervention was consistent with the shared organizational values and its implementation created a new shared experience, a supportive leadership and role-modeling by key influencers led to successful transfer of training to workplace behaviors, positive outcomes from the new behaviors led to new shared experiences, and these shared experiences led to value-level changes. In summary, all the cultural elements were well-aligned with the goals of the training intervention. The antecedents for successful transfer of training were found to be essentially the same as those found by studies in other domains (e.g., Arthur et al., 2003; Birdi, 2007; Warr et al., 1999). Practically, this finding reinforces the need for a multi-level perspective in seeking alignment of goals, processes, and incentives for a cultural change through training programs (Birdi & Reid, 2013; Cooper, 2000; Holton, 2005).

7.1.6 Hypothesis #1: MORE^{OB} training improves group-level outcomes.

Since the MORE^{OB} program was a training intervention aimed at improving the safety culture in obstetrics units, its effectiveness could be evaluated in terms of knowledge gained by the participants (Level 2), clinical outcomes and patient safety climate (Level 4) (Kirkpatrick, 1979, 1998). While Kirkpatrick's model does not specifically include changes at the organizational level, Birdi and Reid's model (Birdi & Reid, 2013) offers a multilevel perspective ranging from individual through societal levels.

The first hypothesis was that the MORE^{OB} training, as a planned intervention improved group-level outcomes. Aggregation of individual level knowledge exam scores after each of the MORE^{OB} training module served as one measure of group-level outcomes, and performance on clinical outcomes after the MORE^{OB} modules served as another measure of group-level outcomes. Before the MORE^{OB} training began, the knowledge exam scores among both groups were normally distributed and the mean score of the Late Adopter Group was significantly higher than that of the Early Adopter Group. Both groups showed significant improvement after each module and thereby partially supported the hypothesis that training would improve group-level outcomes. Even after the third module, the mean knowledge exam score for Late Adopters remained significantly higher than that of the Early Adopters. The post-training knowledge exam scores for Hospital A were significantly higher than those for all the other Late Adopters; similarly, the post-training knowledge exam scores for Hospital B were significantly higher than those for all the Early Adopters. Thus, both Hospital A and Hospital B were leaders among their respective peer groups.

With respect to group-level clinical outcomes, two metrics were chosen: C-section rates and mean Length of Stay. Three groups of hospitals were used for comparison: Early Adopters, Late Adopters and Non-Adopters (Ones that did not implement the $MORE^{OB}$ program). A comparison of actual versus projected C-section rates was surprising: all three groups were able to demonstrate a lower-than-projected C-section rate. Thus, it appeared that the $MORE^{OB}$ program may not have had any impact on reducing the C-section rate; yet, there was ample qualitative evidence to support genuine efforts at both subject hospitals (A&B) to reduce their respective C-section rates. Therefore, a secondary analysis of reduced-risk C-section rates was conducted. Since the qualitative evidence was more aligned with elective C-section rates, the comparison of reduced-risk C-section rates was more reasonable. This comparison revealed that (a) both Early Adopters and Late Adopters were able to reduce their rates after the $MORE^{OB}$ training, while the corresponding rates at the Non-Adopters remained steady, but higher. The reduced-risk C-section rate at Non-Adopters was significantly higher than that at the Early or Late Adopters. A comparison of mean Length of Stay across the three groups revealed that the differences in the mean Length of Stay between the Non-Adopters (2.39 days), Early Adopters (2.36 days), and Late Adopters (2.31 days) were significant. When focused on the two subject hospitals, the C-section rate and the mean Length of Stay at Hospital A were lower than those at all the other Late Adopters. In the case of Hospital B, the C-section rate was lower than both the projected and the comparative rate at all the other Early Adopters, but the mean Length of Stay, although lower since the

MORE^{OB} program, was higher than the projected rate. The mean Length of Stay for all the other Early Adopters, however, continued to decline after the MORE^{OB} program and remained lower than the projected rates. In conclusion, there was evidence to support that the reduced-risk C-section rate declined after the MORE^{OB} program. With regard to the mean Length of Stay, there was evidence to support that the mean Length of Stay declined after the MORE^{OB} program and stayed lower than project at all the other Early Adopter hospital. But the same cannot be said for Hospital B. Nonetheless, there was evidence to support the hypothesis that the MORE^{OB} training, as a planned intervention, improves group-level outcomes. While the finding of improvement in individual-level knowledge is consistent with findings from a vast array of other studies, the lead-lag phenomenon noted between the improvements in knowledge (immediate) and improvement in outcomes (longer-term) is consistent with the studies on training transfer (Griffin & Neal, 2000; Warr et al., 1999).

7.1.7 Hypothesis #2: MORE^{OB} training improves patient safety climate.

The literature on training and organizational climate generally supports the notion that safety-related training improves safety climate within specific workgroups (e.g., Patankar & Taylor, 2008; Singer et al., 2007). Therefore, the second hypothesis was that the MORE^{OB} training, as a planned intervention, improves group-level patient safety climate. Over the past three decades, several multi-factor models of patient safety climate have emerged; however, there seemed to be an agreement on nine elements (Flin, 2007b; Flin et al., 2000; Guldenmund, 2000; Jackson & Kline, 2014; Sammer et al., 2010; Singer et al., 2007). Of these nine elements, six were represented in the MORE^{OB} patient safety climate survey:

1. Patient Safety is Everyone's Priority
2. Learning
3. Valuing Individuals
4. Empowering People
5. Open Communication
6. Teamwork

Of the 68 hospitals that implemented the MORE^{OB} program as a training intervention to improve the patient safety culture in obstetrics, 39 were considered Early Adopters (because they implemented the program in the 2006-2008 timeframe) and 29 were considered Late Adopters (because the implemented the program in the 2009-2011 timeframe). At the pre-training level, the Early Adopters performed significantly better than the Late Adopters on all six factors. Post training, Latent Growth Curve Modeling yielded slope ranging from a low of .058 for open communication to .507 for teamwork. Thus, there was sufficient support for the hypothesis that training, as an implementation mechanism, improves organizational climate. In this case, it seems to have the greatest effect on teamwork.

Two hospitals, Hospital A from the Late Adopter group and Hospital B from the Early Adopter Group were selected for a longitudinal analysis. With respect to Hospital A, four shared organizational values mapped very well with four patient safety climate factors: Patient Safety is Everyone's Priority; Valuing Individuals; Empowering People; and Learning. A comparison of Hospital A's performance on these four factors with that of all other Late Adopters indicated that before the training began, Hospital A's patient safety climate was stronger than that of all the other Late Adopters. After each of the first two modules of MORE^{OB} training, Hospital A outperformed all the other Late Adopters; however, after the third module, the gap seemed to narrow and Hospital A was stronger in only two of the four factors: Patient Safety is Everyone's Priority and Learning.

In the case of Hospital B a slightly different set of four shared values mapped with the four patient safety climate factors. Open Communication mapped more strongly than Empowering People; the remaining three factors were the same. Similar to Hospital A, Hospital B outperformed all the Early Adopter hospitals on all four factors before the MORE^{OB} training began. After the first and the second modules, the differences in Open Communication scores were not significant. After the third module, only scores for only one factor— Learning or Continuous Improvement —was significantly different.

Thus, the MORE^{OB} training was successful in improving the patient safety climate scores at both Early Adopters and Late Adopters, and since the difference in the climate scores between the subject hospitals and their peer groups narrowed after the third module, there was evidence to suggest that over time, the MORE^{OB} training could improve the underlying patient safety culture at all hospitals. Furthermore, the lag in improvement in patient safety climate is indicative of the role of organizational culture in mediating the transfer of training knowledge to workplace behaviors. The overall results of this analysis are consistent with safety climate studies across multiple domains (e.g., Guldenmund, 2000; Patankar & Taylor, 2008; Zohar, 1980, 2014).

7.1.8 Revised Model of Organizational Culture and Climate

Based on the results of the three studies presented in this thesis and learning derived from these results, a revised model of organizational culture and climate is presented. See Figure 49 for the illustration and Table 84 for the rubric to assist in the interpretation of the illustration. As in Model 7, organizational culture and climate are presented as nested constructs with culture (represented by blue blocks) at the core and climate (represented by the black dashed box) as the psychological response to the underlying culture. Culture itself comprises of seven constructs: (a) Shared Experience; (b) Values, Beliefs, and Assumptions; (c) Leaders and Key Influencers; (d) Implementation Mechanisms; (e) Workplace Behaviors and Shared Experience; (f) Individual, Group, and Firm-Level Performance Outcomes; and (g) Learning and Sensemaking Loops.

Treating an organization as a system of interconnected constructs, one could describe how an organization reinforces and revises its culture from a longitudinal progression perspective as follows:

> At Time 0 (the hypothetical beginning of the process), the members of the organization have some baseline shared experience (say, the general nature of the healthcare industry in Canada based on their individual professional experience), which is depicted by the blue "Shared Experience and Learning" box at the bottom of the model (Box #0). This shared experience (the degree to which the group's experience can be aggregated) contributes to the group's shared values, beliefs, and assumptions (Box #1). In developing Model 7, there was theoretical support to focus on values alone rather than include beliefs and unquestioned assumptions; however, narrative analysis from studies #2 and #3 demonstrated how external environmental factors as well as post-intervention workplace behaviors and resulting experience shifted the beliefs and assumptions of the participants. Thus, in this revised model,

values, beliefs, and assumptions are presented together. Consistent with Model 7, Leaders and Key Influencers (Box #5) continue to both be influenced by the existing values, beliefs and assumptions, as well as tend to reinforce or revise those values, beliefs, and assumptions. In addition to influencing the Implementation Mechanisms and Incentives (Box #2), as presented in Model 7, results of studies #2 and #3 highlight the role played by leaders and key influencers in developing, maintaining, and role-modeling workplace behaviors, thereby influencing the workplace shared experience (Box #3). Thus, Model 7 explicitly incorporated the role of individual behaviors at the workplace. As presented in Study#1, the expected workplace behaviors have a direct impact on the individual, group-level outcomes. Thus, in this revised model, workplace behaviors and shared experience of those behaviors is explicitly identified. Two feedback loops (#3a and #4a) are used to illustrate the learning and sensemaking that was discovered to take place among the group as they experienced new workplace behaviors and improved outcomes. These two learning and sensemaking loops tend to influence organizational values, beliefs, and assumptions, as well as actions of leaders and influencers.

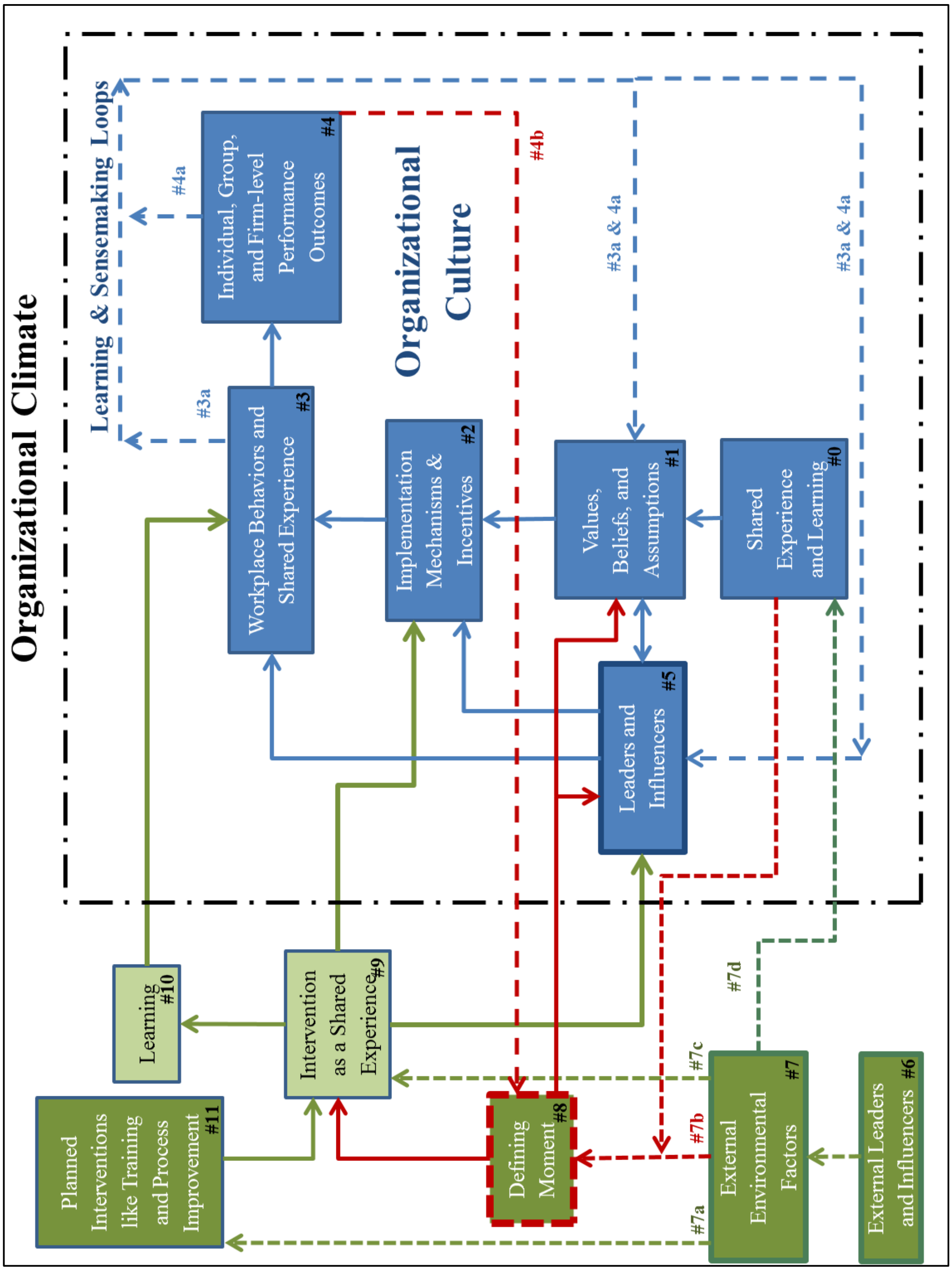


Figure 49: Revised model of organizational culture and climate

Table 84: Rubric to interpret the illustration of the revised model

Illustrative Element	What does it represent?	What numbers or colors are used to differentiate?
Numbers	Sequential steps illustrating the procedural order of influence	Numbers are used to illustrate sequential steps: • Step #0 through Step #5 represent the typical sequence of events that tends to reinforce the extant organizational culture • Step #6 through Step #10 represent typical sequence of events that tends to revise the organizational culture
Boxes	Represent specific elements of the integrated model	Blue: Elements of organizational culture (#0, #1, #2, #3, #4, #5) Green: Elements of external influence (#6, #7, #8, #9, #10, #11)
Lines with arrows	Represent direction of influence • Solid: direct influence • Dashed: indirect influence	Blue: influence among the cultural elements (#3a, #4a, #4b) Green: influence among the external elements (#7a, #7b, #7c, #7d) Red: critical influences (#4b, #7b, #7a, #7b, #7c, #7d)
Boxes and Lines	Represent clusters of constructs	Blue: Elements of organizational culture Black: Elements of external influences
Dash-dot-dash Box	Represents psychological responses to all the cultural elements	Black

Furthermore, the learning and sensemaking loop arising out of seminal events (represented by #4b) has the potential to qualify as a defining moment. Thus, these two learning and sensemaking loops represent the essence of organizational learning and play a critical role in reinforcing and revising organizational values, beliefs, and assumptions. As depicted in this model, leaders and key influencers have direct impact on (a) the organizational values (Box #1) and (b) implementation mechanisms (Box #2) and workplace behaviors and shared experiences (Box #3), which determine how espoused values are enacted; they also learn from routine shared experiences and performance outcomes (Loops #3a and #4a).

Thus, leaders and key influencers bear the brunt of the responsibility for maintaining as well as transforming organizational culture.

Organizational climate (depicted in the black dashed box) continues to be the psychological response to the underlying culture. Thus, it is a response of the group regarding their shared experience, their perception of their leaders and key influencers, the degree to which espoused values are enacted, the effectiveness as well as affective appeal of the implementation mechanisms, workplace behaviors of their group members and the degree to which desirable behaviors are rewarded and undesirable behaviors are discouraged, the affective reaction to the performance outcomes, and ultimately the overall learning and sensemaking—a measure of a general feeling of wellbeing at the workplace.

This revised model presents planned interventions, such as training and process improvement programs, as well as external factors (depicted by the green blocks) as factors acting *on* the internal organizational culture. The MORE^{OB} program, as a planned training intervention (Box #11), created a new shared experience (Box #9) in how the training was delivered, impacted the implementation mechanism (Box #2) by establishing enhanced performance standards (e.g., “41+3” on determination of eligibility for a planned C-section), and influenced leaders and key influencers (Box #5) regarding both the significance of the patient safety challenges in obstetrics as well as clinical and operational best practices. Learning (Box #10) derived from the MORE^{OB} training influenced workplace behaviors created a new shared experience

(Box #3), and eventually impacted performance outcomes (Box #4). External factors (Box #7), on the other hand, have four parallel pathways (#7a, #7b, #7c, and #7d), albeit through shared experiences, to influence organizational culture. One pathway is through defining moments or shocks to the system (Box #8) such as those experienced by Hospital B when it was placed under supervisory control. The other three pathways are more subtle: path #7a could influence through training or process improvements; path #7c could create new shared experiences like exposing leaders and influencers to new paradigms or best practices from other industries; and path #7d could facilitate a gradual shift in the participants' deeply held assumptions by virtue of living in the environment—e.g., declining budget allocations. Also, external factors could trigger particular planned interventions, such as the Lean methodology that was encouraged by Hospital B's board or the external expectation that quality improvement plans be tied to executive compensation.

This model is a macro-level integration of environment, culture, and climate, and it helps describe how, when, and why these elements interact with each other to maintain or transform group-level culture. Based on the scope of the empirical evidence presented in this study, this integrated model of culture and climate is bounded at the macro level by the following four factors: (a) geographic location; (b) professional practice; (c) safety focus; and (d) impact of training interventions.

7.2 Research Implications

7.2.1 Theoretical Implications

This research makes an integrative contribution by building on past research efforts from a broad range of disciplines and domains. There is a long history of such borrowing and building in organization and management studies (Corley & Gioia, 2011; Oswick, Fleming, & Hanlon, 2011). A fresh attempt at building the theoretical structure of organizational culture also presents opportunities for insightful contributions as a result of causal mapping proposed in the model (cf. (Whetten, 1989). The unique insight revealed through this model is about the nature of interaction amongst the various units of the theory. For example, while it may not be surprising that an organization tends to change when its survival is at stake (cf. Wheatley, 1999), the explanation about how various elements of the external environment as well as the organization's internal culture might interact to produce a sustainable cultural transformation is different. From a practical perspective, this knowledge could be used develop more effective, sustainable, and scalable transformation programs.

The core phenomenon under consideration in this research was that of cultural transformation. The integrated model of culture and climate, as illustrated in Figure 7, was used to conceptualize how three broad constructs—environment, culture, and climate—interact and contribute toward both maintenance as well as transformation of organizational culture. The specific elements within each construct could qualify as "units" (Dubin, 1969, Chapter 2) of the overall theory. Corley and Gioia (2011) classify theoretical contribution in the field of organization and management along two axes: originality and utility. Originality is further stratified from incremental to revolutionary, and utility ranges from practical usefulness to scientific usefulness. This research contributes along both originality and utility dimensions. Specifically, it offers six theoretical implications:

1. At the macro level, the phenomenon of cultural transformation is a function of the relationship between three broad constructs (units of theory): the external environment within which an organization operates; the internal organizational culture; and the organizational climate. Thus, there are two broad propositions describing the relationship between these constructs:
    a. External environment influences internal organizational culture and
    b. Internal organizational culture influences the participants' psychological response or organizational climate.

    Based on the findings reported in this study, the environmental factors could be further classified as follows: (a) Geo-social, (b) Economic, (c) Legal, and (d) Professional. Of these four categories, the geo-social influence is most similar to the characterization of cultures by national boundaries—the national culture—in the landmark study by Hofstede (1984) and the subsequent groundswell of cross-cultural studies such as the Globe Project (House, Hanges, Javidan, Dorfman, & Gupta, 2004). However, most of these studies view individually-held values that can be aggregated at the national level as stable and latent influencers of organizational cultures within the defined national boundaries. On the other hand, the emergent integrated model of culture and climate reframes environmental factors as active influencers or even drivers of organizational culture. Such a reframing was based on the interview data collected in studies #2 and #3; thus, this insight gained from case-level analysis opens new opportunities for the study of role of environmental factors, beyond national factors, in causing internal adaptation among organizations that thrive. From a systems perspective, this reframing changes the notion of organizational culture from a construct defined within the boundaries of the organization to a construct that is actively influenced by external factors, such as geo-social, economic, legal, and professional, within which the organization must thrive. Alternately, it also presents a proposition that organizations that fail to convert external environmental changes into internal adaptation will fail.

By positioning organizational climate as a symptomatic measure of the underlying culture, the emergent model seeks to advance the assertion that climate measures must be two-tiered: the molar measures must be linked with the underlying cultural elements at a general level and the focused measures must be clearly linked with the specific area of focus like safety, quality, service, or innovation. The extent to which the climate factors are consistent with the underlying cultural factors, they may be used as proxy measures for cultural assessment. Consistent use of this approach to the development of climate survey instruments will lend both scientific credibility as well as practical authenticity for the use of survey instruments to assess organizational culture. Also, sustained use of such instruments across multiple populations will likely generate a new set of climate categories focused on psychological responses to (a) the shared experiences, (b) organizational values, (c) leaders and key influencers, (d) implementation mechanisms, (e) individual behaviors, (f) group-level performance outcomes, and (g) learning and sensemaking loops. Thus, this study contributes to the advancement of Schein's (1988, 2010, 2015) theory of organizational culture by explicitly incorporating the influence of external environmental factors and positioning climate as a symptomatic measure of the underlying culture. Furthermore, this study positions artifacts as outcomes of culture rather than integral elements of culture, enabling study of artifacts to describe the underlying values and potentially the experiences that may have led to the development of those values. Such positioning of artifacts is different from that claimed in Schein (2015) and Rousseau's (1990) models.

2. Based on a number of studies on effects of training on culture or effects of climate on performance (Beus et al., 2010; Clarke, 2006; Pratt et al., 2007), there was support for the general hypothesis that training could be used to influence organizational culture. However, if the core of an organization's culture is represented by its set of deeply held values (Helmreich & Merritt, 1998; Hofstede, 1984; Rochon, 1998; Schein, 1988, 2010, 2015), then, it was not clear as to how a training intervention tends to influence individually-held and shared organizational values. Schein's model of culture (Schein, 1988, 2010, 2015), which is rooted in shared experience, served as the starting point for the development of a comprehensive model of organizational culture and subsequent enquiry about the role of training in influencing values.

Past models of training evaluation have not fully explored the relationship between training and organizational culture. On the one hand, Kirkpatrick's four-level model of training evaluation (Kirkpatrick, 1998; Kirkpatrick & Kirkpatrick, 2006) has been used extensively to demonstrate the effectiveness of a variety of training programs in a number of domains (Salas & Cannon-Bowers, 2001), and meta-analytical studies in healthcare have noted that there is a sequential pattern among the various levels of training evaluation, which starts with reactions, and then moves on to learning, transfer, and results, and the relationship between these stages grows stronger along the sequence (Hughes et al., 2016). On the other hand, comprehensive models of training evaluation like Alvarez et al.'s (2004) integrated model of training evaluation and training effectiveness as well as Spitzer's Learning Effectiveness Measurement (LEM) methodology (Spitzer, 2005) take a more active stance on transfer of learning into workplace behaviors and incorporate the role of extant organizational culture. However, even these models tend to consider various elements of organizational culture ranging from leadership to prevailing climate as enablers or barriers to transfer of training. The emergent model, on the other hand, focuses on the role of training in changing the organizational culture itself. Specifically, it seeks to identify the mechanisms by which training tends to influence culture.

For example, the MORE^{OB} training was designed to cause cultural change through change in participants' knowledge, which was then expected to result in changes in their on-the-job behaviors and those changed behaviors, in turn, were expected to improve the individual-, group-, and firm-level performance outcomes. If this influence trajectory was successful, then the participants had a higher probability of believing in the new behaviors, thereby contributing toward changes in their deeply held values and causing a value-level change in the long run. The pre-post assessment of knowledge clearly demonstrated that the training improved the participants' knowledge, and the analysis of clinical outcomes revealed that there was improvement in some of the clinical performance measures. Interviews with the participants and hospital administrators revealed that new shared experiences at the workplace, role modeling by the leaders, and effective adherence to new policies and standards led to clinical performance improvements, which in turn influenced their confidence in the training program and caused a shift in their assumptions and impacted their shared values. Based on the lead-lag phenomenon noted in studies #1 and #3, it is acknowledged that the most proximate impact of a training program is the improvement in participants' knowledge. Thereafter, it may take some time for the improved knowledge to result in behavioral changes. Furthermore, while transfer of training into workplace behavioral change is a function of the extant organizational climate (as supported by Birdi (2007) and Holton (2005)), a shift in participants' behaviors, supported by feedback focused on task performance (Senge, 1990), can bring about a change in organizational climate and culture. There are three parallel, mutually reinforcing pathways to influence shared values through training interventions:

a. Practice of knowledge gained through training creates new shared experiences;

b. Implementation of policies, procedures, and incentives, consistent with training goals, results in new shared experiences; and/or

c. Training impacts the behaviors and expectations of leaders and key influencers.

Thus, one could argue that this model takes a learning-in-working perspective (Easterby-Smith et al., 2000) on organizational culture and seeks to advance the knowledge about how organizations learn—to change or reinforce their shared values—through internal experiences or external influences (Bapuji & Crossan, 2004). The training intervention serves as a specially designed shared experience, which could employ Spitzer's LEM, to identify specific operational goals as well as value-based goals. Birdi and Reid's (2013) Taxonomy of Training and Development Outcomes would be particularly helpful in formulating training outcome goals at the individual, group, organization, as well as the entire healthcare industry level. Therefore, the emergent model opens the door for development of large-scale culture change strategies that could be fully scalable from an obstetrics team (group or community of practice) level to the entire healthcare sector.

3. Building on the previous research on shared experience, this study focused on the premise that shared experience could be engineered through training. However, shared experience is necessarily a group-level phenomenon and thus, the groups can be defined based on the type of membership. For example, there could be a work team (obstetrics), professional group (obstetricians, nurses, midwives, etc.), organizational

group (hospital level), and community (the region and nation within which the organization operates). The MORE^{OB} training was engineered to shape the shared experience of the obstetrics work group, but the attributes of the training program were consistent with the values shared by the professional groups (e.g., the Society of Obstetricians and Gynecologists of Canada), subject hospitals (as in the longitudinal case studies of hospital A and hospital B), as well as the local community (as the community's demographics changed, the hospitals had to adapt to the new needs of that community). Thus, one could deduce that the capacity of a training program to have a long-term cultural impact increases if its attributes are aligned with the shared or aspirational values of the work team, professional group, organization, and the community. Furthermore, one could hypothesize that over time, the membership requirements for these groups will change and thus, what constitutes as acceptable standard of behavior or performance will progressively improve, thereby causing a cultural change over the long term. Thus, this study strengthens Birdi and Reid's (2013) multi-level model of training outcomes by highlighting the need for value-level alignment in order for a training intervention to be successful at reaching its full potential of impact as suggested by Birdi and Reid.

4. The concepts of transactional and transformational leadership were first introduced by Burns (1978), categorizing leadership as either transactional, which would be task-oriented and tied to personal motivations and interests of both the leader and the follower or transformational, which would necessarily focus on the higher moral

ground and tend to consider the broader organizational or societal implications and aligning ones individual behaviors and choices to seek outcomes that are in the best interest of the organization (Bass, 2010). There are many aspects of transformational leadership that are well aligned with the emergent, integrated model of culture and climate. For example, Bass (2010) characterizes transformational leadership as follows:

a. Moves the followers forward through idealized influence, inspiration, intellectual stimulation or individualized consideration;
b. Develops teams that are high-performing, promotes employee empowerment, practices creative flexibility, and builds *espirit de corps*; and
c. Helps move along the leader-member-exchange continuum from transactional to transformational by progressively building trust, loyalty, and mutual respect.

In this study, findings related to the role of leaders and influencers revealed four different mechanisms of influence: (a) External leaders tend to influence organizational cultures by setting performance standards and expecting public accountability; (b) External influencers tend to be at the leading edge of problem identification and definition, solutions development, and standardization of key performance metrics; (c) Internal leaders have a more direct influence on organizational culture through strategic interventions, policy development, and alignment of incentives in support of the desired behavioral changes; and (d) Internal influencers are primarily entrusted with modeling of behaviors expected in accordance with the new policies or training—their daily actions shape the shared experience and therefore these internal influencers are most impactful in changing the organizational culture. Thus, this study enables blending of organizational learning and leadership literatures. The internal versus external perspective enables the incorporation of organizational learning from either internal sources (endogenous) or external sources (exogenous); while the fuller range of leadership roles—from frontline practitioners (peers) to formal leaders (physicians, charge nurses, or administrators) within the organization as well as informal leaders outside the organization—enables the incorporation of transactional and transformational leadership styles. While most of the leadership literature is focused on formal roles, whether they are executed in the form of—broadly speaking—transactional or transformational styles, (e.g. Pettigrew, 1979; Schein, 2010, 2015; Waterson, 2014), the role of external, informal leaders and leaders not just as individuals but leaders as standard-setting professional bodies has been left out or underdeveloped. In pointing at the future focus needed in the study of transactional leadership, Avilio et al. (2009) encouraged further studies in understanding the "underlying psychological processes, mechanisms, and conditions" through which transformational leaders motivate higher levels of performance. Specifically, with respect to the interaction between transformational leadership and organizational culture, Hartnell and Walumbwa (2011) claim that such interaction would advance leadership theory by raising the understanding of how leadership influences the social context in which organizational effectiveness can be fostered. This study identifies the use of role modeling, mutual accountability for community-based standards of practice, and translation of broad national issues to local context as some of the mechanisms for the exercise of transactional leadership to effect the higher-level goal or organizational cultural change. Interestingly, Hartnell and Walumbwa's framing of "transformational behavior affects culture, whereas, transactional behavior is affected by culture" (p.226) is consistent with the emergent model's notion of mechanisms that revise shared values versus those that reinforce shared values. Since the transformational leadership style has already been demonstrated to be effective in the healthcare sector (Spinelli, 2006), this study opens new opportunities to further advance the understanding of the role of leaders and influencers, internal and external, in the healthcare sector and beyond.

5. Majority of the literature on feedback is focused on evaluation of workplace behaviors of employees and aimed at correcting the behavior to align with the desired safety or operational performance goals (Clarke, 2006; Freiberg & Freiberg, 1996; Putter, 2010; Reason, 1997; Senge, 1990). On the other hand, learning can be mapped along the dimensions of cognitive, skill-based, and affective (Kraiger et al., 1993). Thus, if the intention of the feedback is to effect learning, it will aim at causing a cognitive, skill-based, or behavioral change, thereby making feedback a training mechanism. However, in order to reach deeper into an individual or group's philosophical, social and cognitive makeup, the feedback must also make sense; i.e., it must become meaningful by making logical and

emotional connection of new information, including observation, with previously held values and unquestioned assumptions: it must follow the perception-cognition-action-memory process (Weick, 1995). Accordingly, the sensemaking process is triggered by perception of new information or observation, followed by cognitive analysis of its significance to previous knowledge held in the memory, followed by a cognitive, affective, or behavioral response in the form of an action (e.g., process the new information based on existing rules, modify the existing rules, make new rules, associate with previous positive or negative feelings, and/or generate a physical response), and concluded with a memory step (add to the memory or modify the previous memory in terms of data, rules, and/or emotional experience). While this process allows for consideration of new information or observation that is inconsistent with the previously held values, such a contradiction is likely to be rejected or at least treated as non-critical. Yet, from a culture-change perspective, the new information, experience, or observation is intended to change previously held values and unquestioned assumption. A few emerging studies are providing ways in which this paradox could be addressed (Luscher & Lewis, 2008). Specifically, there seems to be a growing interest in studying how managers can make sense of paradoxical information or observations in order to translate it into meaningful and lasting changes. This study advances such research by illustrating how leaders can adopt a learning orientation and treat the internal feedback mechanisms as sensemaking opportunities and also use external, informal feedback mechanisms as opportunities to explore innovation, particularly when the new information is inconsistent with the previously held values and unquestioned assumptions (Coopey, Keegan, & Emler, 1997).

In this study, findings related to the role of learning and sensemaking loops revealed four different mechanisms of influence: (a) External, formal feedback tends to influence organizational culture through changes in compliance requirements such as accreditation standards, legislative changes, and/or changes in funding models or budget restrictions (particularly if the organization is publicly funded); (b) External, informal feedback tends to come through publicly available databases and reports that may not identify specific institutions, but provide authentic trends of general interest and concern, thereby raising awareness among policy makers and formal leaders so that appropriate formal mechanisms for cultural change could be developed; (c) Internal, formal feedback tends to come most often in the form of individual or unit-level performance appraisals and quality/safety investigation reports, which could translate into positive or negative incentives; and (d) Internal, informal feedback tends to be delivered on a routine basis to maintain the community's standards of practice. The incorporation of training in the integrated model of culture and climate enabled the identification of sensemaking as the critical link between training and cultural change. While sensemaking is triggered and influenced by a variety of routine and episodic factors (Battles et al., 2006), for training to be effective in causing a cultural change, it has to be both timely and make sense at individual and group levels (cf., Luscher & Lewis, 2008). Thus, from a theoretical perspective, one unique insight is that sensemaking—from frontline personnel to management—should not only be viewed as an essential internal mechanism at the individual and group level, but also as an active skill for leaders to exercise as they receive and interpret external information and translate it to local situations and opportunities. This perspective on sensemaking advances the understanding of the role of feedback loops as sensemaking loops as well as the expectations from transformational leaders in effecting cultural change.

6. Ehrhart, Schneider, and Macey (2014) provided a strong theoretical foundation for further development of the construct of organizational climate, particularly in the context of safety. According to Ehrhart et al., the construct of organizational climate is rooted in the experiences of workgroups as a result of their interaction with their environment, and the meaning attached to those experiences. Thus, they define organizational climate in terms of "shared meaning" (p.69). Although some scientists argued that climate was an individual level construct (Rousseau, 1990; Virtanen, 2000), this study demonstrated that individual-level survey responses could be aggregated at the group level and thus climate could be measured at the group level. Next, Schneider and Barbera (Schneider & Barbera, 2014b) classified organizational culture at two levels: molar and focused. Molar studies refer to general organizational climate and focused studies refer to climate in the context of specific performance outcomes such as safety, quality, and service. Since this study was focused on patient safety, the survey instrument used in this study provided a means to test the key components of both the molar-level organizational climate and focus-level patient safety climate.

Most safety climate studies use survey questionnaires that have been derived from other studies in High Reliability Organizations (La Porte & Consolini, 1991), differences in worker values based on national origin (Hofstede, 1984), differences in values and work habits based on professional or organizational differences (Helmreich & Merritt, 1998), differences in worker adherence to safety procedures in industrial settings (Zohar, 2002a, 2002b), differences in how safety-critical information flows through an organization and affects safety performance (Westrum, 1995), and how an organization learns from undesirable outcomes (Senge, 1990). In contrast, this study uses an integrated model of culture and climate and re-positions organizational climate as a psychological response to the underlying cultural elements. Such integration and repositioning is different from previous integrative models. For example, the integrated approach used by Patterson et al. (2005) in overlaying climate dimensions on the competing values framework of culture, focuses mostly on shared values, while the emergent model presents a more comprehensive perspective that not only includes shared values, but also includes psychological responses to other cultural elements such as leadership, communication, and teamwork. The addition of these components is supported in the literature, (e.g. Guldenmund, 2000; Sammer et al., 2010; Singer et al., 2007); however, heretofore, it was not presented in the form of a consistent, comprehensive, and integrated model. Ultimately, the theoretical model used in this study provided for a six-element, generic structure of organizational climate, with additional focus-specific elements for patient safety. The nine elements of safety climate are as follows: (a) Safety as an organizational value; (b) Teamwork; (c) Respect for individuals; (d) Open communication; (e) Learning from experience; (f) Leadership or senior management commitment; (g) Alignment/ availability of resources; (h) Mutual trust among colleagues/co-workers; and (i) The nature of response to unintentional errors. This nine-element structure is supported in the literature (Flin, 2007b; Flin et al., 2000; Guldenmund, 2000; Jackson & Kline, 2014; Sammer et al., 2010; Singer et al., 2007). However, since the safety climate survey instrument used in this study was developed prior to the development of the above nine-element structure, the data from the administration of the survey instrument was analyzed from both exploratory and confirmatory factor analyses. These analyses yielded a six-factor model for safety climate consisting of the following: (a) Patient Safety is Everyone's Priority; (b) Learning; (c) Valuing Individuals; (d) Empowering People; (e) Open Communication; and (f) Teamwork. This six-factor model was consistent with the broader, nine-factor model developed earlier in the study and also consistent with Singer et al.'s (Singer et al., 2007) model of safety climate. Therefore, this study confirmed a basic, six-factor model of safety climate and laid the foundation for the development of a more inclusive, nine-factor model that is strongly linked with the underlying model of organizational culture.

7.2.2 Methodological Implications

This study has many methodological attributes: it is a quasi-experimental study; it is a case study; it is a mixed-methods study; and it is a longitudinal study. It also offers a pre-post comparison, as well as a control group versus experimental group comparison. In leveraging the strengths of qualitative methods, it uses narrative analysis and artifact analysis. While triangulation and corroboration through a mixed-methods approach has been recommended, developed, and supported previously (Creswell & Clark, 2007; Curry, Nembhard, & Bradley, 2009; Driscoll et al., 2007; Jick, 1979), this study presents an insightful contribution toward the integration of qualitative and quantitative methods as well as incremental contributions toward the refinement of specific tools. Five methodological implications are presented:

1. Since the theoretical model integrates culture, a construct generally studied by qualitative methods, and climate, a construct generally studied by quantitative methods, it was essential to use a mixed-methods approach, incorporating qualitative and quantitative methods, for this study. As a result, this study was able to leverage the strengths of each approach and seek corroborating evidence. Reflecting on the use of qualitative and quantitative data, it seems that the use of these data could be classified in terms of direct and indirect measures of cultural transformation. This approach would lead to the integration of interview narratives (qualitative) and knowledge exam scores (quantitative) as direct measures, and that of artifacts (qualitative), climate survey data (quantitative), and clinical outcomes data (quantitative) as indirect

measures of cultural transformation. In the future, corroboration between direct and indirect measures could serve as the standard for empirical validation of cultural transformation.

2. Semi-structured interviews were conducted within the narrow context of the MORE^{OB} program; however, they revealed four categories of environmental influences on organizational culture. In the future, these four categories could be intentionally incorporated in studies of environmental impact on organizational culture. This is a case of theoretical reframing resulting in opportunities for methodological contributions. In the future, interviews could be refined to further develop (a) the four categories of environmental influence on organizational culture and (b) mechanisms of influence associated with each environmental category.
3. The use of training intervention in influencing organizational culture essentially followed Kirkpatrick four-level model and noted reactions to the training (Level 1) through interviews, improvements in knowledge (Level 2) through knowledge exam scores, changes in workplace behaviors (Level 3) through recollection of pre/post training experiences (in terms of participant stories), and clinical outcomes (Level 4) through external reports of clinical performance (Kirkpatrick & Kirkpatrick, 2006). The integrated model of culture and climate, however, offers the potential for a fifth level of assessment: impact on group or organizational culture. Impact of training on organizational values could be used as a measure of the fifth level of impact. This is both a theoretical contribution—because it extends the traditional four-level model of

training assessment—as well as a methodological contribution because it suggests survey-based assessment of impact on the shared values.

4. Artifacts, generally defined as human-made products and broadly inclusive—from items like logos and symbols to stories—can be used as indirect measures or representations of organizational culture. In the emergent model of culture and climate, artifacts are considered products or manifestations of culture and not culture itself. Artifacts could be categorized as addressing one or more of three qualities: instrumentality, aesthetic appeal, or symbolic significance. The examples of artifacts analyzed in this study were generally high on instrumentality or utility, moderate on symbolic significance, and low on their aesthetic appeal. Also, the possibility of a symbolic conflict between what is intended and what is perceived was raised in the literature. While no such conflicts were noted in this study, potential for such a conflict could be determined while designing new artifacts. Other tangible artifacts such as toolkits were found to serve a high utilitarian function and also aid in routine reinforcement of shared organizational values. Thus, the use of artifact analysis in studies of organizational culture is a methodological contribution.
5. Over 200 survey-based organizational climate instruments were noted in the literature. In the future, a survey instrument that is directly aligned with the six-element structure of organizational culture would help standardize and authenticate the use of survey instruments as proxy measures of the underlying culture. Furthermore, additional questionnaire items could be developed to address the particular focus areas such as

safety, quality, service, or innovation. Such a tiered approach to organizational climate assessment would incorporate both molar and focused aspects of organizational climate.

7.2.3 Practical Implications

Considering that improving patient safety culture is an international priority, this study presents six practical implications ranging from national public policy to individual actions that healthcare practitioners can take to influence the patient safety culture in their practice unit.

1. Overall, the alignment of professional standards and national policies with societal expectations is an important lesson for other countries and across other professional domains. For example, according to a May 3, 2106 article in *The Washington Post*, in the United States, medical errors are now the third leading cause of death, “claiming 251,000 lives every year” (Cha, 2016). Yet, in response to such reports, the administration seems to be focused on replacing senior management like in the case of the National Institutes for Health Hospital (Sun, 2016). The Joint Commission on Accreditation of Hospitals has already taken a leadership role in advancing the quality and safety agenda across hospitals in the United States, but that is not enough. Based on the Canadian approach reported in this study, at least two other drivers need to be considered in order to achieve a cultural shift in the U.S. healthcare system. First, the Patient Safety and Quality Improvement Act of 2005 should be amended to require hospitals to demonstrate quality improvements and tie executive compensation to such improvement efforts. Second, the Center

for Disease Control already collects data on patient safety metrics such as healthcare-acquired infections. These data should be made public similar to those made available by the Canadian Institute for Healthcare Information. Such transparency will raise both public awareness and internal vigilance about improving the overall quality of care. In the United Kingdom, the Healthcare Quality Improvement Partnership is a step in the right direction. Support from professional groups such as the Academy of Medical Royal Colleges and the Royal College of Nursing will help bring professional credibility to patient safety and quality initiatives like the SOGC did for MORE^{OB}. Also, since April 1, 2016, patient safety has become part of the NHS Improvement group. At this early stage, the focus seems to be on collaborative awareness-type initiatives that rely on voluntary reporting systems and hospital-level improvement programs. The NHS would benefit from considering two critical elements: (a) transparency in clinical outcomes at hospital level and (b) regulatory expectation of quality improvements at each hospital.

2. Emerging from this study, there is recognition of specific roles that different leaders and influencers might play in shaping organizational cultures. External, national-level policymakers and thought leaders have the opportunity and the responsibility to drive the safety agenda by expecting transparency of key performance outcomes. Internal leaders, on the other hand, have the responsibility to use the broad performance metrics as well as their discipline-specific metrics to drive internal quality improvements. Together, they can cause long-term systemic improvements, effecting transformational change. Thus, external

influencers can (a) define and validate the problem and (b) develop credible solutions. Internally, formal leaders have to translate the externally-defined problem into local significance. Additionally, insurance companies, who tend to be key stakeholders in any safety-related program, could fund regional, national and international studies that focus on quantifying the scope of various patient safety challenges. Similarly, large hospital systems could fund internally-focused studies to develop and test best practices. Results from these types of studies will further enhance the ability of professional societies as well as hospital-level leadership to advance the patient safety agenda.

3. A meta-observation of the review of shared experiences and resultant values revealed a three-tiered priority system: the senior management seemed to be most interested in organizational reputation and financial success; the frontline management seemed to be most interested in operational efficiency; and the frontline clinicians seemed to be most interested in the quality of care and patient safety. Hospital A was relatively more successful at aligning these three interests, while Hospital B's frontline staff struggled to align their patient safety interests with the hospital-wide Lean methodology, which seemed to be the core, top-down operational management and communication methodology. Ultimately, senior leadership has the responsibility to engineer shared experiences such that the desired organizational values will be intentionally reinforced, while frontline leaders and key influencers have the responsibility to serve as role models and enforcers of their professional community's standards of practice.

4. In the future, fresh development of a safety climate survey instrument based on the nine overall climatic elements would serve both scientific and practical utility. The literature review noted that most safety climate instruments have not been psychometrically validated; thus, a more robust and appropriately validated (as illustrated in this research) instrument, would support scientific utility. Also, a standardized instrument would serve as a valid and practical diagnostic measure of cultural attributes.
5. A comparison of knowledge scores, patient safety climate scores, and clinical outcomes revealed a lead-lag phenomenon. While an improvement in knowledge scores could serve as an early indication of the positive influence of a training program, the transfer of that training into workplace behaviors, group/firm-level performance outcomes, and organizational climate may take time. Thus, it would be essential for senior management to make a long-term commitment to the selected intervention program, ensure that appropriate metrics are tracked regularly, and strive to manage the organizational resistance to change.
6. Finally, training alone is not sufficient in causing a cultural change; it has to be complemented with alignment between shared organizational values, implementation mechanisms, leadership support, and appropriate use of feedback mechanisms, including incentives. Thus, any attempts at changing organizational culture should not be partitioned-off from the core business. All levels of management and frontline personnel need to collectively and cohesively commit to the intended cultural change and remain open to changes in their own behaviors as well as changes in long-standing corporate practices.

7.3 Limitations of the Study

Overall, qualitative studies tend to be narrow and deep and quantitative studies tend to be broad and shallow. This research attempted to provide a combination of breadth and depth; however, there were limitations. First, the limitations with the quantitative data revolved around access and quality; and second, the limitations with qualitative data revolved around breadth and confidentiality. Also, since the quantitative data were collected by multiple entities, and for a different purpose, the researcher had to restructure the available data to suit his formatting and analytical needs. As a retrospective study, the researcher had to rely more heavily on the participants' memory and their ability to isolate the impact of the training intervention versus other concurrent or subsequent factors. Nonetheless, this was a unique opportunity to apply one coherent case-study of a planned intervention across all aspects of culture and climate.

7.3.1 Access and Quality of Data

This research relied heavily on access to archival data. The clinical outcomes data (C-section rates, postpartum hemorrhage rate, length of stay, etc.) were provided by the Canadian Institute for Healthcare Information (CIHI). Since these data were collected and managed by CIHI, access had to be obtained and secured through a Canadian organization and the data had to be retained within Canada. The Salus Global Corporation worked closely with CIHI to convince them of both the need to conduct this research as well as their commitment to retain the data on a secure computer within Salus Global. Once the data were obtained, they had to be restructured to suit the analytical needs, which involved conversion of file formats; conversion from rows to columns; conversion from axial coding (one, alphanumeric code representing multiple conditions) to discrete binary codes; and elimination of extraneous data fields. With over 1 million cases across 10 years, the task of cleaning and customizing the available data was daunting. However, the biggest issue with these datasets was that they were originally designed from a billing perspective and not from safety or quality perspective. Thus, there were two sets of coding schemes applicable in every case: one for diagnostic conditions and one for interventions. Every case had to be restructured to couple the diagnostic and intervention codes. Needless to say that this was a very laborious process and the scope of clinical outcomes analysis had to be limited. With a simpler, integrated coding structure, it would have been possible to analyze many more maternal health conditions as well as fetal/neonatal conditions and provide a more comprehensive report of the influence of the intervention on a broader set of clinical outcomes.

7.3.2 Patient Safety Culture Survey data

The Patient Safety Culture Survey (it should have been called a *climate* survey), was designed and administered by the Salus Global Corporation. Salus Global had collected over 12,000 individual surveys comprising of pre- and post-training responses. While this was a very strong dataset, it had to be scrubbed and structured in order to conform to the researcher's analytical needs. There were two key limitations in using this survey instrument: first, it was pre-designed and therefore the researcher did not have any opportunity to revise or improve the design; and second, it aligned with only six of the nine desired climate elements. Given the opportunity to redesign the survey instrument, the researcher would have been able to present analysis that was more consistent with the integrated model of culture and climate.

7.3.3 Participation in the Interviews

Initially, the Salus Global Corporation staff was quite confident that they would be able to provide access to ten hospitals (5 from the Early Adopter group and 5 from the Late Adopter group) in order to conduct interviews and focus groups. In spite of numerous and varied attempts to recruit these hospitals in the study, only one hospital from each group participated to the full extent. If at least two more hospitals from each group had participated, the researcher would have been able to provide a more comprehensive qualitative analysis. Furthermore, considering that the interviews were conducted 3-6 years after the intervention, the participants' memory regarding the intervention may have been jaded by their personal bias toward the program (those that liked the program are more likely to remember their positive experiences), and may have been confounded by other concurrent or intervening initiatives with similar goals and objectives.

7.3.4 Confidentiality of the Participating Organizations

Artifact analysis is an impressive technique to illustrate the underlying cultural attributes; however, it is almost impossible to present such analysis without compromising the confidentiality of the subject organization. Thus, although the researcher collected and analyzed additional cultural artifacts, he was not able to include them in this document. In the future, it would help to secure approval from the subject organizations to identify them and their artifacts.

7.3.5 Limited to a Single Intervention

This research provided an opportunity to conduct in-depth research on a single intervention. Since the overarching theoretical model is not limited to any particular intervention or domain, it would have been useful to conduct studies of other interventions and/or in other domains to fully test the model.

7.3.6 Limitations of the Interview Instrument

One of the limitations of a semi-structured interview protocol used in Study #2 is that the questions were developed based on the integrated model of culture and climate; thus, information beyond the pre-developed questions was not easily accessible. Nonetheless, some questions enabled opportunities for open conversations and exploration of details. Thus, it was possible to add empirical context to the theoretical relationship between the constructs under review.

7.4 Recommendations for Future Research

7.4.1 Redesign and Validate a New Organizational Climate Survey Instrument

One challenge in this study was that the researcher did not have the opportunity to design or improve the safety climate survey instrument. In the future, a new organizational climate instrument should be developed in accordance with the six-element, molar structure of organizational culture presented in this study and/or the nine-element safety climate structure. The three additional scales that need to be developed are as follows: (a) alignment/availability of resources; (b) co-worker trust; and (c) response to unintentional errors.

7.4.2 Integrate Robust Measures for Behavioral Change at Individual and Group Levels

In the absence of robust measures for behavioral change at the individual and group levels, this study relied on stories and artifacts as means to draw out the participants' experiences about changes in individual and group level behaviors. In the future, measures similar to the ones used in the Line Operations Safety Assessments (Thomas et al., 2004), those used by Holton (2005) or Cooper's (2000) Reciprocal Safety Culture Model should be developed to collect robust measures of behavioral changes at both individual and group levels.

7.4.3 Conduct Similar, Integrative Studies in Other Domains

This study demonstrated how culture and climate studies, and their respective methodologies, could be integrated to produce more comprehensive understanding of the association between organizational culture and performance outcomes. The next step along this line of enquiry would be to conduct similar studies in other healthcare disciplines. For example, participants in Study #3 noted opportunities to transfer best practices from obstetrics to neonatal care; similar opportunities exist in general surgery, orthopedics, cardiology, etc. Additionally, it would be important to conduct similar studies in other high-consequence industries like aviation, off-shore oil exploration, and nuclear power, as well as across other shared values such as quality, innovation, and service. Such studies, over a period of time would produce a rich body of empirical evidence regarding the transferability of the integrated model of culture and climate and identify other potential limitations.

7.4.4 Conduct Studies of Non-Training Interventions

Beyond knowledge or skills training, many other interventions such as planning-based approaches or process-based approaches to organizational change have been attempted (Alvesson & Sveningsson, 2016). While some of them have been successful, most organizational change efforts seem to fail (Beer & Nohria, 2000). Thus, it would be interesting to use the proposed integrated culture and climate model to determine the capacity of other interventions to bring about a lasting cultural change or to compare and contrast the same intervention but one successful implementation and one unsuccessful implementation. For example, studies could investigate the impact of strategic planning (example of a planning-based approach) and Lean or Six Sigma (examples of process-based approaches) in achieving a cultural transformation.

7.4.5 Disprove the Theory or Test its Boundaries

In disproving a theory, one could attempt to disprove the theory in its entirety or certain parts of it. Since the proposed theory takes a macro-level systems perspective, interactions between each of the component constructs could be tested in different domains and with different interventions methods. Another aspect of trying to disprove a theory is to test its boundaries. For example, since this study was conducted in the context of a training intervention within obstetrics practice in Ontario, this context forms the boundaries of this model. Thus, some of the research questions could explore the applicability of this theory in different environmental contexts, professional disciplines, and non-training interventions. Some of the suggested research questions are as follows:

1. Is there a significant difference in the relative influence of various environmental factors with respect to different political or economic models of the region? For example, this model did not consider external political interference in organizational governance. In that context, it would be interesting to understand the role played by political parties, appointed agents, or elected officials on the internal organizational culture. Such an understanding would provide new insights into the feasibility of applying such a model to other regions of the world.
2. This model assumes that the formal leadership of an organization is in complete control of their ability to change the organizational policies; however, such a control may not be possible. For example, in the case of a typical airline merger in the United States, union contracts play a significant role in determining how the employee groups are integrated in the merged entity. It would be interesting to explore how this model could be further developed to facilitate organizational unlearning and re-learning under different labor-management relationships.
3. This model presents environmental factors as factors acting *on* the organization, thereby placing the organizational culture in a reactive mode. On the other hand, one could study organizations that are known to lead their industry segment and serve as the influencers *of* the environment by creating an ecosystem of products and services. In this context, the goal would be to understand how internal organizational cultures of industry-leading organizations shape their external environment, which in turn leads to widespread cultural change across a particular industry sector.

7.5 Chapter Summary and Conclusions

The focus of this research study was on patient safety in the obstetrics practice in Ontario, Canada, because (a) the overall healthcare sector is faced with the dual mandate to improve quality of care and affordability; (b) Ontario represents 37 per cent of the births in Canada; (c) the researcher had access to extensive quantitative data as well as key personnel for interviews and focus group discussions; and (d) there was a unique opportunity to develop and test an integrated model of organizational culture and climate. The underlying assumption was that an integrated approach to the study of organizational culture and climate might produce some unique insights that offer not only practical guidelines to improve the quality and affordability in healthcare, but also inspire innovative advances in the theories of organizational culture and climate.

Collectively, the three studies provided a combination of etic and emic analyses and responded to all the research questions and hypotheses, generating a revised integrated model of organizational culture and climate. Ultimate, while training intervention can be effective in producing climatic changes, true cultural changes require alignment of shared values, implementation mechanisms, leadership commitment, role modeling by key influencers, consistent use of feedback from performance outcomes, and creation of a series of new shared experiences.

This study offered six theoretical implications, five methodological implications, and six practical implications. Future studies should consider different domains and different types of interventions in order to test the validity of the proposed model and determine the limits its transferability beyond the narrow focus of obstetrics practice in Ontario.

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Appendices

Appendix A: Ethics Approval

The University Of Sheffield.

Downloaded: 01/06/2015
Approved: 01/06/2015

Manoj Patankar
Registration number: 140265019
Management School
Standard Ph.D., Part Time, Remote Location

Dear Manoj

PROJECT TITLE: Safety Culture: A Mixed-Methods Approach to Describing and Analysing Organizational Culture
APPLICATION: Reference Number 003587

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 01/06/2015 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 003587 (dated 27/04/2015).
- Participant information sheet 007163 (13/04/2015)
- Participant consent form 007164 (13/04/2015)

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Yours sincerely

Mark Latham
Ethics Administrator
Management School

University of Sheffield, United Kingdom
Research Information Sheet
April 9, 2015

1. Manoj S. Patankar, a doctoral student in the School of Management at the University of Sheffield is inviting you to participate in this research study.

2. The title of this study is "*Safety Culture: A Mixed-Methods Approach to Describing and Analysing Organizational Culture.*" The overall purpose of this study is to determine the influence of the following four factors on each other: organizational values, strategies, employee attitudes, and clinical outcomes. Furthermore, it is believed that these four factors could collectively describe a particular organization's safety culture in a more holistic manner. The scope of this research is limited to those hospitals across Canada who have participated in the MORE-OB program (n=70).

3. The researcher obtained access to the safety culture survey and relevant clinical outcomes data from the Canadian Institute for Healthcare Improvement. These data were fully de-identified, but they provide valuable information regarding potential influence of the MORE-OB program (Managing Obstetrical Risks Efficiently) on the overall safety culture of the organization. Analysis of these data has enabled the researcher to develop specific interview questions for champions and implementers of the MORE-OB program. This research project is not so much of an analysis of the MORE-OB program, but more about how a specific intervention program may influence the safety culture in an organization.

4. Your participation in this study is requested to gather qualitative insight into the circumstances surrounding the implementation of the MORE-OB program as well as your experience with its implementation and outcomes. Specifically, the questions will involve the following themes:

    a. Organizational values and unquestioned assumptions;
    b. MORE—OB strategies, policies, and practices, as well as role of key leaders and implementers;
    c. Attitudes of various levels of clinical and management personnel that influenced the implementation of the MORE-OB program;
    d. Specific clinical outcomes—what were the results of the MORE-OB program on the obstetrics practice as well as the overall image and morale of the hospital; and
    e. Transfer of best practices across other units in the hospital as well as across other hospitals across the nation.

5. Your participation may take up to 2 hours of your valuable time.

6. The risks to you as a participant are minimal. These include breach of confidentiality—others may discover, on their own accord, that you have taken part in this study or have not taken part in this study. In order to minimize this risk, the researcher will not record any identifying information about you. The information about your role in the MORE-OB program will help us determine if different levels of an organization have significantly different views/experiences, but the results will be recorded in aggregate in

order to prevent anyone from linking specific views/experiences with specific individuals or hospital.

7. The results of this study may be published in scientific journals, books, or presented at professional conferences. However, your name and identity will not be revealed and your record will remain anonymous.

8. You will not receive any direct benefit by participating in this study. However, your participation will help improve the understanding of the influence of safety interventions on the broader organizational culture and vice-a-versa; this, it will advance the knowledge about safety/organizational culture. Eventually, dissemination of such research is likely to influence patient safety as well as safety across other high-consequence industries.

9. You may choose not to participate. If you decide not to participate, there will not be a penalty to you or loss of any benefits to which you are otherwise entitled. You may withdraw from this study at any time.

10. If you have questions about this research study, you may call Manoj Patankar at +1-636-675-0494 or email him at MSPatankar1@Sheffield.ac.uk. If you have questions about your rights as a research participant, you may call the School of Management's Ethics Administrator at +44-114-222-3215.

11. Thank you for considering this invitation.

University of Sheffield, United Kingdom

Participant Consent Form

Title of Research Project: **Safety Culture: A Mixed-Methods Approach to Describing and Analysing Organizational Culture**

Name of Researcher: **Manoj S. Patankar**

Participant Identification Number for this project: ____________

Please initial box

1. I confirm that I have read and understand the information sheet dated April 9, 2015 explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my participation is voluntary and that I am free to Withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. If I have any questions about the research project, I may contact the lead researcher, Manoj Patankar, at +1-636-675-0494 or mspatankar1@sheffield.ac.uk. ☐

3. I understand that my responses will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I also understand the risks associated with inadvertent breach of confidentiality. ☐

4. I agree for the data collected from me to be used in future research. ☐

5. I agree to take part in the above research project. ☐

________________	________________	________________
Name of Participant (*or legal representative*)	Date	Signature
________________	________________	________________
Lead Researcher	Date	Signature

To be signed and dated in presence of the participant

Copies:

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be placed in the project's main record (e.g. a site file), which must be kept in a secure location.

Integrated Model of Organizational Culture and Climate
<u>Field Interview Schedule</u>

The goal of this interview is to understand the circumstances surrounding the implementation of the MORE^{OB} program as well as your experience with its implementation and outcomes. Specifically, the questions will involve the following themes:

1. Organizational values and unquestioned assumptions;
2. MORE^{OB} strategies, policies, practices, and the role of key leaders and influencers;
3. Attitudes of various levels of clinical and management personnel that influenced the implementation of the MORE^{OB} program;
4. Specific clinical outcomes—what were the results of the MORE^{OB} program on the obstetrics practice as well as the overall image and morale of the hospital; and
5. Transfer of best practices across other units in the hospital or other hospitals.

Your responses will be recorded (with your approval on the consent form) and used for research purposes only. You may stop this interview at any time or withdraw from participation without any negative implications. This project (Reference Number 003587) has been approved by the Ethics Committee at the University of Sheffield, United Kingdom.

A. General Background
    1. For demographic purposes, please tell me about your background:
        a. What is your role and what are your responsibilities?
        b. How long have you worked for this hospital?
        c. What is your overall experience in the field?

B. Environmental Factors
    1. Over the course of your tenure in this region, hospital, or your practice specialty, what changes have you observed or experienced that may have influenced what you do or how you conduct your practice?
    2. What are some examples of shifts in your assumptions regarding these environmental factors impacting the organization?
    3. What do you think were the reasons for implementing the MORE^{OB} program?
    4. How was the MORE^{OB} program implemented? What was the communication plan? What was the training schedule? How was it assessed?

C. Shared Experiences and Learning
    1. What was your initial attitude about the MORE^{OB} program? Why?
    2. Would you say that other people in your obstetrics group were generally receptive toward this program? Why?
    3. What are some illustrative stories about your experience before and after the MORE^{OB} program?

D. Organizational Values
    1. What are your organizational values? [Espoused]
    2. How do you see these organizational values play out in practice? What are some illustrative examples? [Seek stories or tangible artifacts]
E. Leaders and Key Influencers
    1. What role did leaders and key influencers play in reinforcing or revising the organizational values?
    2. If a dissonance was noted in the aspired or espoused values and the actual shared values, how was this dissonance addressed?
F. Implementation Mechanisms
    1. What are some example artifacts (policies, procedures, other symbols) that illustrate the organization's culture and commitment to its values? Can you show me some examples?
    2. How are incentives used to promote/inhibit certain behaviors?

G. Stories of Lived Experiences
    1. What are some illustrative stories about the organization's culture? [Alternate question: How do the current employees tend to describe the nature of work at this organization to prospective employees?]

H. Feedback Mechanisms
    1. How is the feedback from individual or group performance as well as broader organization-level outcomes used to reinforce or revise organizational values?

I. Performance Outcomes
    1. What were the anticipated clinical and/or financial outcomes of the MORE^{OB} program and were they achieved (as far as you can tell)?
    2. Overall, do you think that the MORE^{OB} program was successful? What could have been done differently to improve the success of this program?

J. Other Factors
    1. Is there anything else that you would like to share about your experience with the MORE^{OB} program?

Thank you very much for participating in this interview. If you have any questions, please feel free to contact me via email or phone.

Appendix B: The MORE^{OB} Safety Climate Survey Instrument

ID	Survey Questions
1	My opinion/input is regularly sought.
2	We know we can count on one another.
3	We treat each member of our unit with equal respect.
4	When a concern is raised there is an effort to act on it and/or feedback is received.
5	We show appreciation for each other's contributions.
6	We communicate with each other in a respectful manner.
7	We are open to hearing each other's points of view.
8	We value each other's knowledge base and skill sets.
9	Staff suggestions for improving patient safety are seriously considered.
10	We are encouraged to make decisions within our own area of expertise.
11	We take the initiative to solve problems faced in our daily work without waiting to be told.
12	We are encouraged to make decisions with the best interest of the patient in mind.
13	I have the skills to manage an emergency safely until someone else arrives to assist or assume management.
14	I have the knowledge to identify when someone is about to do something that might threaten patient safety.
15	I am comfortable intervening if I see someone about to do something that might threaten patient safety, regardless of their level of authority.
16	I feel free to question the decisions or actions of others, regardless of their level of authority.
17	We are encouraged to report errors, even those that are caught and corrected before affecting the patient.
18	I am asked for suggestions on how to improve patient care and safety.
19	We participate in regular drills to prepare for common emergency situations.
20	Caregivers, managers and administrators regularly discuss unit issues/patient care concerns and potential solutions together.
21	Patient safety occurrences are investigated thoroughly.
22	Learning from patient safety occurrences is shared with the entire unit staff.
23	When a patient safety issue is reported it is acted upon in a timely manner.
24	We review our safety procedures and protocols regularly.
25	Our unit is actively doing things to improve patient safety.
26	We overcome individual differences to pull together in the interest of the patient.
27	Multidisciplinary meetings about patient care are a normal part of our practice.

28 I know there is support available whenever I need it.
29 When things do not go well with a patient, we meet as a multidisciplinary group to discuss the issues involved.
30 When things do not go well with a patient, we work together to identify ways to reduce or prevent the chance of recurrence.
31 We keep one another appropriately informed about the patient's condition.
32 Input from all disciplines regarding patient care is welcomed and respected.
33 We take the initiative to offer assistance when needed without waiting to be asked.
34 I am included in inter-professional meetings regarding patient care and safety.
35 Information is communicated accurately between people and between shifts.
36 We are able to communicate our points of view without fear of reprisal.
37 I am comfortable sharing my observations or concerns in multidisciplinary patient review meetings.
38 There is a feeling of openness and trust in our unit.
39 If I don't understand something, I feel free to ask questions.
40 Information is shared across disciplines on a regular basis.
41 We are informed about changes that are made as a result of a patient safety occurrence.
42 There is open discussion of the results of patient care reviews so that all members of our unit learn from the experiences of others.
43 Patients are included in discussions and decisions regarding their care.
44 Clinical errors and near misses are used as learning opportunities to improve and prevent recurrences.
45 We receive in-service training to update skills and proficiency using the equipment and technology in our unit.
46 The focus of patient care reviews is on identifying system problems and not on individual blame.
47 Clinical management processes are examined to identify where errors might be made and how they can be prevented.
48 We voluntarily share knowledge and experiences with one another.
49 If we don't know something, we take the initiative to ask someone who does.
50 We have made improvements as a result of our learning from near misses.
51 We have made improvements as a result of learning from past clinical errors.
52 We have a well-structured process to report unexpected events (errors, near misses).
53 We have a well-structured process to report potential patient safety hazards.
54 We are given time for professional development.

Appendix C: Justification for Level of Aggregation

Table C-1: Individual to obstetrics group level aggregation of patient safety climate data

Obstetrics Group (n=68)	$r_{WG(J)}$ (N=13,123)					
	Factor 1 (items=7) Range: .80-.95	Factor 2 (items=5) Range: .66-.94	Factor 3 (items=6) Range: .85-.97	Factor 4 (items=2) Range: .56-.89	Factor 5 (items=4) Range: .84-.97	Factor 6 (items=4) Range: .55-.90
1	.88	.90	.94	.70	.92	.82
2	.88	.85	.93	.71	.92	.72
3	.85	.81	.93	.65	.92	.63
4	.86	.82	.92	.70	.90	.67
5	.91	.85	.96	.84	.93	.80
6	.93	.93	.95	.82	.96	.90
7	.94	.91	.97	.86	.95	.84
8	.88	.85	.94	.64	.91	.76
9	.88	.85	.92	.69	.90	.76
10	.90	.89	.95	.74	.94	.77
11	.82	.66	.88	.59	.84	.57
12	.86	.85	.92	.70	.91	.68
13	.88	.85	.92	.70	.91	.73
14	.84	.80	.90	.68	.87	.65
15	.85	.81	.93	.66	.92	.74
16	.88	.88	.94	.72	.90	.76
17	.87	.84	.94	.68	.94	.75
18	.95	.94	.97	.84	.96	.87
19	.91	.89	.95	.80	.92	.85
20	.83	.75	.94	.64	.91	.64
21	.87	.82	.93	.81	.94	.69
22	.80	.85	.92	.71	.86	.76
23	.80	.77	.95	.71	.93	.55
24	.86	.84	.94	.70	.92	.75
25	.89	.86	.93	.70	.93	.73
26	.90	.88	.93	.75	.92	.71
27	.91	.89	.93	.72	.91	.80
28	.90	.89	.94	.72	.93	.78
29	.91	.87	.94	.74	.94	.75
30	.90	.86	.92	.70	.91	.75
31	.92	.87	.95	.81	.92	.78
32	.91	.87	.96	.73	.94	.76
33	.86	.87	.96	.86	.92	.80
34	.86	.79	.91	.65	.91	.67
35	.90	.84	.92	.74	.91	.77
36	.91	.90	.95	.78	.93	.79

Table C-1: Continued

Obstetrics Group (n=68)	$r_{WG(J)}$ (N=13,123)					
	Factor 1 (items=7) Range: .80-.95	Factor 2 (items=5) Range: .66-.94	Factor 3 (items=6) Range: .85-.97	Factor 4 (items=2) Range: .56-.89	Factor 5 (items=4) Range: .84-.97	Factor 6 (items=4) Range: .55-.90
37	.87	.83	.90	.60	.88	.72
38	.85	.79	.93	.65	.91	.63
39	.85	.82	.94	.71	.92	.73
40	.90	.88	.94	.71	.94	.67
41	.87	.81	.93	.69	.89	.71
42	.94	.93	.96	.81	.93	.85
43	.83	.83	.94	.69	.90	.72
44	.84	.79	.89	.68	.88	.63
45	.92	.88	.93	.67	.92	.79
46	.87	.82	.95	.76	.94	.62
47	.81	.80	.91	.69	.89	.63
48	.83	.81	.94	.73	.91	.65
49	.88	.89	.94	.72	.90	.82
50	.90	.90	.86	.83	94	.67
51	.87	.84	.97	.89	.97	.82
52	.88	.87	.93	.75	.92	.78
53	.88	.87	.96	.78	.95	.79
54	.90	.87	.94	.78	.93	.72
55	.87	.84	.94	.74	.92	.72
56	.86	.87	.91	.69	.87	.79
57	.91	.87	.93	.75	.91	.80
58	.91	.89	.95	.72	.92	.82
59	.86	.80	.90	.64	.90	.68
60	.93	.84	.96	.71	.93	.83
61	.90	.91	.95	.77	.94	.76
62	.87	.84	.93	.71	.92	.76
63	.89	.88	.93	.69	.92	.77
64	.86	.84	.93	.75	.91	.79
65	.87	.82	.92	.56	.91	.75
66	.80	.87	.85	.73	.86	.56
67	.82	.77	.92	.73	.91	.67
68	.84	.78	.92	.65	.89	.63

Table C-2: Obstetrics group to adopter group level aggregation of patient safety climate data

Adopter Group (n=2)	$r_{WG(J)}$ (N=13,123)					
	Factor 1 (items=7)	Factor 2 (items=5)	Factor 3 (items=6)	Factor 4 (items=2)	Factor 5 (items=4)	Factor 6 (items=4)
1 (n=39)	.86	.81	.92	.69	.91	.67
2 (n=29)	.86	.83	.93	.71	.91	.69

Appendix D: Training Needs Analysis

TRAINING NEEDS ANALYSIS
FACULTY OF SOCIAL SCIENCES

[Skills and experiences that a PGR student should obtain by the end of their higher degree studies]

Student: Manoj S. Patankar

Supervisor: Malcolm Patterson

Second supervisor: Jeremy Dawson

Year of Study:1

To become an effective researcher in the social sciences, you need to have extensive knowledge and experience in a range of areas and need to develop a variety of skills. Please place a number in the Competency box to indicate your current level of experience and understanding, where

1 = I have no competency in this: for example, I have no knowledge or experience of this
2 = I have limited competency in this: for example, I have some knowledge, but no experience of this
3 = I have some competency in this: for example, I have done this only occasionally
4 = I am moderately competent in this: for example, I do this regularly, but require more experience to become proficient
5 = I am sufficiently competent in this: for example, I have extensive knowledge and experience of this
6 = I consider myself highly competent at this: for example, I could train others in the area

Please fill in the Evidence/Comments box to illustrate how you have gained your skills. Evidence may come from education experiences (e.g. degree transcripts, training courses) or other experiences (e.g. jobs held, voluntary work, etc.). Your training needs will be identified when discussed with your supervisor.

Skills	Competency	Evidence/Comments	Training Needs
Becoming an effective social science researcher			
An understanding of research in social sciences *in broad terms*	6	Overall, I have two masters degrees and a Ph.D. I have been an active researcher for 20 years with a strong publication record (four books and over 50 publications). I also have an extensive funded research record (over $6 million). I have served as a journal reviewer and editor. I have taught both qualitative and quantitative research methods courses at the graduate level and I have supervised masters and doctoral theses. A full academic CV is attached.	
Philosophical issues in the social sciences	6		
Research ethics & integrity	6		
An understanding of research *methods* used in social science	6		
Bibliographic and literature skills	6		
Understanding plagiarism and how to avoid this	6		
Effective dissemination techniques	6		
Advanced understanding of methods and analysis techniques	6		

Anything else identified and agreed by the supervisor and the student [please specify: ____________]			
Research and career skills for social scientists			
Time management	6	Overall, I have two masters degrees and a Ph.D. I have been an active researcher for 20 years with a strong publication record (four books and over 50 publications). I also have an extensive funded research record (over $6 million). I have served as a journal reviewer and editor. I have taught both qualitative and quantitative research methods courses at the graduate level and I have supervised masters and doctoral theses. A full academic CV is attached.	
Effective Communication	6		
Networking	6		
Project management	6		
Team working	6		
Interdisciplinary work	6		
Teaching	6		
Getting published	6		
Thesis writing	6		
Preparing for the viva	6		
Knowledge transfer and Impact	6		
Applying for research grants	6		
How to keep up to date with new research	6		
Anything else identified and agreed by the supervisor and the student [please specify: ____________]			
Subject specific skills			
Substantive subject training	6		
Advanced subject specific training	5	Review British / European Literature	
Research methods appropriate to the student's field	6		
Working knowledge of statistical analysis techniques relevant to the discipline	5	Become more familiar with SAS	
Application of software packages relevant to the research area	5	Become more familiar with SAS	
Awareness of relevant journals and other outlets for dissemination	6		
Up to date knowledge of current debates in the relevant literature	5	Review British / European Literature	
Anything else identified and agreed by the supervisor and the student [please specify: ____________]	—		

Student signature:		**Date:**	May 6, 2015
Supervisor signature:	M. Pittis	**Date:**	6/5/15

Appendix E: Doctoral Development Program Log

Date	Activity
April 9, 2015	Joined the British Academy of Management: Organizational Transformation, Change and Development (Primary SIG), Strategy, Leadership and Leadership Development, International Business and International Management
April 9, 2015	Joined Academy of Management: Organizational Development and Change; Health Care Management
August 2015	Completed FCS 6100 Research Ethics and Integrity Module
June 1, 2015	Secured Ethics Approval
June 11 and 12, 2015	Attended the White Rose Conference in Sheffield. Met with other doctoral students, attended relevant presentations, discussed ideas with faculty advisors, and consulted with staff regarding Confirmation Review logistics.
July-August, 2015	Reviewed international literature in organizational culture and climate and substantially expanded the literature review. New additions included The Oxford Handbook of Organizational Climate and Culture; Healthcare Performance and Organizational Culture; Understanding Organizational Culture; Cultures for Performance in Health Care; Org. Climate and Culture; and High Performing Healthcare Sys
July 2015	Reviewed online tutorials regarding the use of NVivo 10 for qualitative analysis
July 2015	Reviewed online tutorials on the use of SAS for beginners
July 2015	Reviewed online tutorials on advance-level Excel and SPSS
July 2015	Secured all quantitative data needed for the study
July 2015	Obtained access to London (Ontario, Canada) Public Library to secure the *Canadian Classification of Health Interventions: Diagnostic, Therapeutic, and Surgical Procedures*. Secured the book and copied the relevant sections.
July 2015	Conducted preliminary analysis of safety climate surveys and knowledge exam data
October 2015	Completed Confirmation Review
October 2015-January 2016	Reviewed PowerPoint slides and recorded lectures from FCS 650, FCS 660, FCS 670, and FCS 690
Mar-May 2016	Secured all qualitative data needed for the study
Jun & Aug 2016	Submitted thesis Draft #1 and Draft #2 for internal review
October 2016	Submitted final thesis for examination
December 2016	Passed the viva examination
March 2017	Submitted the revised thesis for review
June 2017	Submitted the final thesis with minor amendments