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Easier and faster is not always better: Grounded theory of a large-scale, system transformation on the clinical work of emergency nurses and physicians

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ABSTRACT

Lean Thinking was pioneered during the 1980's by the Toyota Motor Company as a method of process improvement for their production lines. Since the early 2000's, there have been published reports of using Lean to redesign healthcare systems. Its effectiveness as a quality improvement method for healthcare has been contested due, in part, to our limited contextual understanding of how Lean affects the working conditions, and clinical workflow, of healthcare professionals. The objective of this dissertation was to explore how a Lean intervention may impact clinical work, and within what contexts.

A realist grounded theory approach was used to explore the clinical work of nurses and physicians practicing in two adult emergency medicine departments (ED) from a single teaching hospital in Canada. The hospital has 1,000 beds, and its two ED annually treat about 128,000 patients. In 2013, both sites began a large-scale, Lean-driven, system transformation that was intended to make their ED work easier, faster and better.

Three grounded theories (GT) were developed from interviews with 15 nurses and five physicians. The first GT describes ways in which the reconfigured ED disrupted professionals' established practice routines and resulted in the intensification of their clinical work. Professionals also identified indications of deskilling of nurses' work and described how the new, push-forward model of patient care detrimentally impacted their physical, cognitive, and emotional well-being. A major element of the Lean intervention was the construction of a three-zone, front cell at both sites. The second GT describes how the

physical configuration of the front cell further intensified professionals' clinical work by requiring them to actively search for spaces better-affording privacy and confidentiality for patient encounters. The third GT describes how professionals perceived their hospital fell short on demonstrating effective leadership throughout the development and execution of its Lean-driven plans. Of particular salience to nurses and doctors was how their institution had failed to deliver on a set of procedural and structural changes they recalled were promised to occur as a result of the Lean intervention.

Rather than support nurses and physicians in their management of the complexities that characterize emergency medicine, the physical and process-based changes introduced by the Lean intervention acted to complicate further the environment under which they delivered patient care. The GT illuminated some unintended consequences associated with accelerating patient flow on the clinical workflow and perceived well-being of healthcare professionals. This dissertation identifies some areas for reconsideration by the ED departments along with ideas for future research.

Co-Authorship Statement

The study design, data collection and management, and primary analyses are the work of

Elaine M. Zibrowski. I completed my dissertation research under the supervision of

Dr. Kamran Sedig. I met regularly with Dr. Sedig and the members of my dissertation

committee, Dr. Richard Booth and Dr. Candace Gibson. During these meetings, I received

feedback and guidance regarding my evolving work. Additionally, as I was preparing the

articles that comprise this dissertation, I received written and verbal feedback from my

supervisor, committee members, and Dr. Lisa Shepherd, an academic emergency physician,

who provided additional, collaborative feedback and support. All of these individuals are

named as co-authors in the publications from my dissertation.

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One of my favorite sayings is that "education opens doors," and Western University did this for me in many ways. I have enjoyed a very fulfilling career at Western, and have been blessed to have sat in a classroom, worked in a laboratory, researched side-by-side, struggled through some challenges, and enjoyed laughter and smiles with many intelligent, talented, and kind individuals. Rather than risk inadvertently omitting a name, please let me extend a collective, sincere 'thank you' to you all for enriching my life.

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CHAPTER 1

1 INTRODUCTION

1.1 Lean Principles

Lean Principles, commonly referred to as Lean Thinking or simply Lean, was pioneered by Toyota Motor Company during the 1980's as a continuous method of process improvement for their car manufacturing production lines [1-6]. Lean Thinking can be dichotomized into two primary components: 1) Lean philosophy, which includes its guiding principles and the need for continuous improvement, and 2) Lean activities, which involves the tools, techniques, and applications that are used to identify where process change needs to occur [7-8].

Lean philosophy emphasizes that an organization works to continually deliver a product or service that is valued by its customers [1-3,5, 7]. Satisfying customer needs requires that an organization consider not only what is of value to customers, but also how fast their customers' needs are being met [2]. Value is optimized when needs are met with a minimal time lag between the "moment the customer asks for that product or service and the actual delivery at an appropriate price "[2, p. 11]. Lean asks that an organization examine its activities under the lens of customer value. An organizational activity that is not contributing

to delivering value is wasteful in time and motion. Wasteful activities must be avoided or removed. Activities that are contributing to value delivery must be preserved, and standardized, to ensure that an organization's employees are continually performing these actions. Therefore, Lean philosophy promotes that an organization does more with less [1-2, 7-8]. In recognition that customer values may change, Lean philosophy requires that an organization is committed to engaging in a continual cycle of value reassessment and waste elimination 1-2, 7-10].

A Lean intervention does not involve a single, prescribed set of activities [1, 4, 7-10]. An organization can select from a variety of techniques to customize its intervention to its needs. That being said, value streaming, process mapping, gemba walking, and kaizen are the most commonly used Lean activities [1, 7-10]. A value stream refers to any process that an organization undertakes to deliver a product or service. Value streams can involve multiple steps, and an organization may have various value streams [1, 7]. During value streaming, the organization specifies and maps out all of the actions that are involved within a given process. Care should be taken to illuminate activities that require human interaction, physical resources, and information management [1]. To understand its value streams, individuals who hold executive leadership or management positions within an organization will walk directly onto the gemba (Japanese for shop floor) [7-8]. While on the gemba, management will observe how front-line employees work. During a period of observation, executives are encouraged to engage in dialogue with an employee(s) to understand employees' perspectives and to promote their input [7-8]. Once value streams have been created, and activities have been specified regarding whether they pull value versus are wasteful, the organization then will undertake one or more kaizen. A kaizen is a structured project where a

designated team of individuals works together to develop an improved process. The team is expected to repeatedly test the new process to ensure that it is error-free and standardized [8]. Given that Lean activities require interaction and involvement of both management and front-line employees, overall, Lean is regarded as a bottom-up approach [1,3].

1.2 Lean Thinking and Healthcare

Reports of the use of Lean Thinking in the redesign of healthcare systems began to appear in the scientific literature during the early 2000's [4, 6, 11-13]. While the state of the discourse on Lean in healthcare has been recognized as being relatively new [5-6], the most commonly reported medical environments where Lean interventions have occurred are hospital-based emergency medicine departments and surgical settings [5].

Review articles by Holden (2010), Vest and Gamm (2009) and Moraros, Lemstra and Nwanko (2016) have disagreed regarding whether Lean is an effective quality improvement method for healthcare. Holden (2010) undertook a review of articles that described Lean interventions conducted an emergency medicine department (ED) [4]. The inclusion criteria used by Holden for this review were that the article was published in a peer-reviewed journal, the Lean intervention was not part of a hospital-wide initiative, and the article did not include descriptions of patients' care trajectory before ED triage. Although the initial number of articles that were screened for their eligibility by Holden was not identified, eighteen articles were screened into this review. Thirteen of 18 papers were from the United

States, three originated from Australia, and two were from Canada.

Overall, Holden (2010) presented a positive perspective on the impact of Lean in the ED. He noted that "patient care usually improved after implementation of Lean" (p.265), and that most of the studies that were part of his review "observed reductions in length of stay, proportions of patients leaving without being seen, and waiting times" (p.270). While Holden remarked that improvements to patient outcomes were "rarer" (p. 270), he still concluded that after Lean was introduced into the ED, "patient outcomes were often improved as well" (p. 270). One of the Canadian articles that Holden identified as demonstrating patient-and process-levels improvements was a study conducted by Ng and colleagues (2010) [19]. These authors described Lean-driven changes that were introduced to a single ED located in Windsor, Ontario. The ED began their Lean work by building an internal team comprised of emergency physicians, nurses, medical learners, along with individuals in leadership roles with that ED and other hospital departments. The internal team first undertook a mapping exercise that was conducted over a three-day kaizen event. During the kaizen, the team mapped out all of the clinical activities that were involved in the care of non-psychiatric patients who were assessed at triage as being dischargeable (referred to as current-state process). Dischargeable patients were selected as the focus of the ED's Lean initiative because they represented the majority of patient cases that were seen by the department. As the team set out to map each step of the ED's current-state process, the team estimated the time that was typically required for that clinical activity, the wait time that was typically experienced by a dischargeable patient until that particular step was performed, and the frequency "for which that step was both complete and accurate" (p. 52). The steps may have included information exchange, consultation, laboratory work or radiology. Once the current-

state steps were mapped out, the team then grouped sequential steps into six, future-state 'chunks.' Repetitive activities were eliminated from each of the six chunks, and the team identified the ideal length of clinical time that each chunk should require. The team then developed a series of projects to look for ways to reorganize the ED regarding its layout and workflow of its staff.

Regarding revamped patient processes, Ng et al highlighted that at triage, nurses sorted patients into one of three groups depending based on their anticipated admission status (admit, dischargeable, or uncertain). Dischargeable patients were all seen in one area of the ED. The space reserved for dischargeable patients underwent a reorganization of its layout with improvements including reorganizing stockroom, IV carts were standardized, and supplies were moved closer to patient areas. Hard-copied, patient charts were labelled with visual symbols to simplify patient identification. Laboratory results were rerouted to a printer located closer to the patient care area. Regarding clinical workflow, nurses and physicians were encouraged to nurses to complete all of their work for a given patient, including procedures, prescriptions and patient instructions, before they received their next patient.

The authors reported that within five months of the ED's use of Lean Thinking, statistically significant improvements were seen across all of its performance metrics. For example, time from patient registration to being seen by an emergency physician was reduced by nearly 30% (from 111 to 78 minutes), length of stay for discharged patients was reduced by 31.6% (from 3.6 hours in the ED to 2.8), and the percentage of patients who left the hospital without being seen was reduced by almost 40% (from 7.1% to 4.3%). Patient satisfaction scores were also noted to shown improvements, but the article did not present any data to support this

conclusion. Although Ng and colleagues indicated that some of the changes attempted by the ED were "never embraced by staff despite repeated attempts" (p.56), they did not provide information about how their frontline healthcare workers were affected by any of the changes that were made to their practice environment. We do not know why some changes were successfully integrated by nurses and physicians into their work, while others were not.

This lack of exploration into the impact of Lean on healthcare workers was the primary knowledge gap identified by Holden in his review. He noted studies that did present information regarding effects on healthcare workers described positive changes, but these effects were "not systematically assessed and were either implied or based on anecdotal evidence" (p. 271). As an example, Holden presented an article by Schooley (2008), which reflected on how an ED located in the United States worked with an external consultant to make operational improvements. Schooley listed several ways in which Lean had positively affected ED staff. Employee turnover dropped from 40% to 19% while worker satisfaction increased, after the consultant's work was completed nurses took on a leadership role in the development of additional improvement projects, and "other staff members also became more involved in shared governance, which allows them to take control and have input into changes in the department" (p. 38). Schooley did not present any data within his article to support these claims.

Vest and Gamm (2009) presented a more cautious appraisal of Lean in healthcare. These authors examined quantitative studies from the United States that described the effectiveness of transforming clinical work processes in a variety of healthcare environments with the use of methods pioneered by Lean Thinking, Six Sigma, or StuderGroup Hardwiring Excellence

[12]. Based on their findings, these authors advised that "while informative results may be gleaned" (p. 1) from the studies they reviewed, they emphasized that the Lean discourse lacked research studies that were aimed at illuminating a "real understanding of 'what, how, and why' of what worked (or didn't)" (p 7). They advocated for future inquiry that arose "from a realistic perspective that seeks to better inform practitioners of the applied value of these (Lean) efforts."

The quality criteria used by these authors to screen articles for their review were that the study was disseminated in a peer-reviewed journal and was not a review article, the work did not involve a pilot study, and the study reported quantitative data including an effect size or estimate of statistical significance. Of the 46 studies these authors located that utilized Lean, nine met their screening criteria. Six of these studies were set in hospital-based laboratories. Moreover, Vest and Gamm cautioned that although articles that were part of their review all reported that their Lean interventions were successful, the majority of these articles were limited in their methodological quality and they "routinely omitted statistical analysis, violated statistical test assumptions, failed to adjust for confounding, introduced selection bias, and failure to include a comparison group" (p.5).

Two studies that were described by Vest and Gamm involved process improvements of hospital-based laboratory services. The first of these articles is by Persoon, Zaleski and Frerichs (2006) who reported on efforts made by a clinical chemistry lab to improve its turnaround times and reduce technicians perceived levels of workplace stress [13]. The lab was responsible for servicing multiple healthcare facilities including a 763-bed acute care hospital, emergency treatment and trauma centre and several clinics providing general and

specialty medical care. The authors reported that the lab performed 7,000 to 10, 000 chemical analyses daily on a minimum of 1,000 biological samples. Before the Lean intervention, the lab screened their requests for service as being expedited or not. Requests for expedited service were initiated from the provider, and about half of all daily samples received by the lab were requested to have expedited service. Moreover, the authors noted that requests coming from emergency and trauma often requested that their analyses be "expedited beyond the stat classification" (p. 17). Rather than add more complexity into their lab queue with additional time labels, the lab sought to redesign their processes so that they would deliver results for 80% of the samples they received within one hour. Doing so would eliminate the need for the lab to employ expedited status on any sample. After mapping out its processes in detail, the lab created five workstations that would handle specific duties. Technicians were assigned to a workstation for two hours. With technicians' input, best practices were prepared for each workstation. Lab turnaround times recorded at six and 12 months after the Lean intervention was found to be 30% improved compared to times recorded before the lab's redesign. While the authors noted that workload increased by approximately 0.54% during each of the 12 months after the redesign was introduced, the amount of employee turnover remained consistent with the lab's history before the intervention. The authors presented no other details related to worker stress levels.

The second article is by Zarbo and D'Angleo (2007), which reported on efforts to reduce laboratory waste and rework within a hospital-based, department of pathology and laboratory medicine [14]. The department was staffed by a group of anatomic and surgical pathologists and technical staff who provided laboratory services for about 48,000 cases per year. The department undertook a redesign of work processes for all of its staff to reduce its numbers

of surgical pathology case defects and waste materials towards a zero-defects performance goal. A survey was distributed to all staff asking them to identify common issues they encountered from specimen collection to generation of laboratory reports. From this survey, 100 indicators were defined. These included specimen flaws and imperfections sources of waste including process flaws such as wrong stain being applied to the sample, poorly labelled sample, and a non-readable barcode. A whiteboard poster wall was then installed within the department, and the staff was asked to manually document the types of defects and wastes they encountered during their work shift. From the whiteboard data, it was estimated that the defect rate was nearly 1 in 3 cases (27.9% or 494/1690 surgical accessions had defects). Team leaders used the whiteboard data to create daily email reminders and discussion with staff regarding compliance issues. The authors also noted that subsequent improvements made to the department included the use of a computer software program to monitor discrepancies in patient information, and specimen label checks that compared information appearing on the container with laboratory-issued information tags. One year after the process improvements were introduced, the defect rate was reduced by 55% to 1 in 8 cases (12.5% or 288/1791 surgical accessions; McNemar's test = P=.004).

Finally, a systematic review by Moraros, Lemstra, and Nwanko (2016) presented a much less positive perspective regarding the effectiveness of Lean in healthcare redesign [6]. Based on their findings, these authors concluded that the "while some may strongly believe that Lean interventions lead to quality improvements in healthcare, the evidence to date does not support this claim. It is far more likely that Lean is but one of many strategies that may or may not have an impact on healthcare delivery" (p. 162).

Moraros and colleagues screened both journal articles and grey literature for studies reporting on a Lean intervention carried out in any healthcare setting. Additional inclusion criteria used by these authors included that reports were publicly available, peer-reviewed and that they included quantitative data. The reports that were initially located by these authors were appraised for their methodological quality using validated checklists. From an initial pool of 1056 reports, 22 of these were screened judged as being of acceptable quality for further review. Twelve of these reports were from North America (11 United States, 1 Canada), nine were from the United Kingdom or Europe, and one was based in Australia. Regarding medical settings where Lean interventions were introduced, half of the articles involved an emergency medicine department (six articles) or a surgical setting (five articles) based in a hospital. Three of the articles reported on Lean efforts that were introduced across an entire hospital.

Similar to the concerns expressed by Vest and Gamm (2009), Moraros et al noted that of the 22 articles that were screened into their systematic review, none involved the use of an experimental or quasi-experimental design. One study involved the use of a control group for comparison. Regarding the outcomes explored by the 22 articles 15 involved process outcomes, four studies involved patient health outcomes, and three articles involved both patient health and process outcomes. Moraros and colleagues also disseminated findings disseminated in the grey literature regarding the Canadian province of Saskatchewan. Beginning in 2012, the entire province of Saskatchewan underwent a Lean-driven overhaul of its processes. As such, Saskatchewan is regarded to have undergone "the largest Lean

healthcare transformation in the world" (p. 151), and Saskatchewan-based data related to

patient satisfaction, healthcare worker experience, process outcomes, and financial costs

were examined as part of this review.

The article that received the highest quality appraisal score by Moraros' review was from Jha

and colleagues (2012) [15]. This study used Medicare billing data to examine the impact of a

pay for performance program on mortality rates in 252 hospitals located in the United States.

In 2003, these hospitals joined a "Premier Hospital Quality Incentive Demonstration

(HQID)" program (p.1607). This program provided hospitals with financial bonuses if they

reported some of the lowest risk-adjusted mortality rates. Conversely, HQID hospitals that

experienced the highest mortality rates were assessed a financial penalty. The authors did not

present any information regarding the use of Lean Thinking by the HQID hospitals nor how

the pay for performance program may have been potentially tied to Lean-driven, quality

improvement efforts. Billing data from six million patients were used to calculate 30-day

mortality rates for patients received treatment a cardiac-related event or pneumonia at one of

the 252 Premier hospitals or at one of 3363 control hospitals that were not part of the Premier

HQID program. Mortality rates were estimated from hospital billing records obtained during

six years from 2003-2009. Baseline estimates were calculated for hospitals during one year

before the entry of any hospital into the HQID. After adjusting for demographic and

comorbidity characteristics, no significant differences were detected between the mortality

rates of the HQID hospitals versus the controls at baseline [12.33% HQID vs.12.40%

controls, 95% CI for difference (-0.40 to 0.26)] or during the terminal period [HQID 11.82%

vs. 11.74% controls, 95% CI for difference (-.30 to 0.46)].

The Canadian article that was included in Moraros' systematic review was disseminated by Vermuelen and colleagues (2014) [16]. This article described a retrospective cohort study that explored the impact of a pay-for-performance program that was launched in 2009 in the province of Ontario by the Ministry of Health and Long-Term Care. These authors explained that the program targeted hospital ED performance and as part of this initiative the Ministry disseminated to all of the hospitals in Ontario an ED length of stay target of eight hours or less for admitted and higher-acuity patients. The Ministry also began requiring that Ontario hospitals begin publicly reporting their ED wait times. Funding was also offered to hospitals to support them to develop a Lean-driven initiative to optimize their patients' flow from ED arrival to time of discharge from an inpatient unit. While hospitals were not required to undertake a Lean initiative to participate in the pay-for-performance program, hospitals that were interested in doing so were required to put together an internal improvement team. The Ministry provided funds to hospitals with an internal team to bring in an external Lean consultant to provide training and mentoring to team members. These hospitals were also afforded other sources of support including "on-site support from Lean management experts, training on the program methodology and tools for implementation, data management tools to track and report performance, linkages across sites to facilitate peer-to-peer mentoring, and forums for teaching and sharing progress among process sites" (p. 428). Regardless of whether they undertook a Lean initiative, all of the hospitals that participated in the pay-for-performance program were awarded financial incentives for demonstrating improved 90th percentile ED length of stay. Although Vermuelen and colleagues noted that the Ministry

recruited 36 hospitals across three cycle waves to develop Lean-driven initiatives, the

identities of these hospitals were not revealed. Information regarding the Lean work

performed by the hospitals was not provided.

For the retrospective cohort study, ED wait times experienced for the 36 hospitals that took

on Lean-driven planning (process improvement program sites) were compared to 63 non-

identified hospitals that were also enrolled in the pay-for-performance program but did

undertake any Lean effort (controls). Data regarding the ED performance was obtained from

the Canadian Institute of Health Information. The primary outcomes used for comparing the

performance of the process improvement program sites to controls were 90th percentile ED

length of stay and median time to see a physician, and the percentages of admitted and non-

admitted patients that missed the provincial ED length of stay target. Primary outcomes were

calculated for each of the three cycle waves. Vermuelen et al summarized that regarding the

primary outcomes, the "control sites saw improvements that approached or even exceeded

those in program sites during the study. In some cases, the control sites improved while the

program sites got worse" (p. 434). The process improvement program sites showed increases

in 90th percentile ED length of stay during wave 1 (increased 23 minutes more than controls)

and wave 3 (increased 31 minutes more than controls) of the pay-for-performance program,

and had modest reductions in median length of stay in wave 1(decreased two minutes more

than controls) and 2 (decreased two minutes more than controls). For admitted patients, the

length of ED stays increased for the process improvement program sites compared to

controls (213 minutes, 245 minutes, 397 minutes more than controls for waves 1-3,

respectively). For non-admitted patients, 90th percentile ED length of stay was decreased during waves 2 (decreased 14 minutes more than controls) and 3 (decreased 33 minutes more than controls) for low-acuity patients. Aside from wave 3, (decreased 25 minutes more than controls), no substantial changes were observed between the groups in terms from time to see a physician.

Moraros et al. presented analyses of data that was gathered by the Health Quality Council of Saskatchewan (HQC) and the Saskatchewan Union of Nurses (SUN). The HQC surveyed over 30,000 patients that were discharged from hospitals both before (December 2009-January 2012) and after (February 2012- March 2014) these institutions had undergone Lean interventions. Although details surrounding the nature and scope of the Lean-driven changes were not presented by Moraros et al in their systematic review, they noted that these patient surveys had probed more than 30 outcomes including "self-reported health, hospital experience, communication, respect, and patient management" (p. 160). Of the entire set of patient-level indicators, introduction of Lean-driven changes was associated with greater compliance of healthcare staff washing their hands [Risk Ratio=1.179, 95% CI 1.05-1.10], greater compliance by healthcare staff of checking patient identification bands [Risk Ratio = 1.08, 95% CI 1.06- 1.10], and healthcare staff providing their patients with informational brochures [Risk Ratio = 1.56, 95% CI 1.49 – 1.63]. Lean changes were not associated with patients' self-reported, overall level of health [pre-Lean 34.5% versus post-Lean 34.5 % perceived their level of health was high, Risk Ratio = 1.00, 95% CI, 0.98-1.04]. Patients did not perceive that the quality of patient care they had received in a hospital was improved after Lean changes were introduced to that institution [pre-Lean 52% versus post-Lean 53% rated the quality of their hospital being very high, Risk Ratio = 1.01, 95% CI 0.99 – 1.04].

In 2014, the SUN randomly surveyed 1,500 nurses regarding their direct and indirect experiences with Saskatchewan's planning and implementation of their Lean initiatives [18]. Nurses were asked to appraise the quality of their involvement while a Lean intervention was being introduced into their working environment, and whether Lean-driven changes had improved or deteriorated their working conditions. Fifteen factors were probed by the survey including items inquiring about the nurses' involvement during the planning of Lean initiatives, the impact of Lean on the amount of time nurses' spend in direct patient care, the impact of Lean changes on nurses' workload and stress, and overall staff morale and engagement. Moraros' reported that Lean was associated with statistically significant, negative effects on all 15 of the factors probed by SUN.

Finally, Moraros and colleagues explained that to their knowledge, "the province of Saskatchewan appears to be the only jurisdiction with actual financial cost information "(p. 161). It was estimated that the province of Saskatchewan spent about ninety million dollars on its Lean initiatives. Fifty-one million of those dollars had been spent on "internal kaizen promotion offices"(p.162) with the remainder of the monies going to the fees of external Lean consultants. The consultant fees would need to be covered by Saskatchewan taxpayers [18]. The return on investment for the individual health regions totaled less than 57,000 dollars, and it was estimated that "$1511 was spent on Lean for every dollar saved by the province" (p.162).

1.3 Knowledge gap

While the Lean healthcare discourse is recognized as being relatively new, review articles by Holden (2010), Vest and Gamm (2009), and Moraros et al (2016), have contested whether the evidence to date supports recognizing Lean Thinking as an effective method for quality improvement in healthcare. The reviews criticized the overall quality of Lean healthcare research and highlighted the need for more exploration into the potential impact of Lean-driven changes on healthcare workers. This knowledge gap is surprising, given that the point of the Lean method is to support decisions of how to make changes in employees' work. Given this gap, it was felt important to generate qualitative insights related to the use of Lean in healthcare contexts, in an effort to better represent the nature, complexion, and nuance of this quality improvement methodology within clinical settings. The purpose of this dissertation was to explore the impacts of Lean-driven intervention on the working conditions, and actual work, of individuals who are involved in the delivery of healthcare.

1.4 Overview of Chapters

The chapters that follow this first, introductory chapter explored how nurses and physicians practicing emergency medicine at a single teaching hospital in Ontario experienced, and were impacted, by a Lean healthcare intervention that modified the physical practice environment and patient care processes used by their clinical department. To carry out my research, I utilized grounded theory under a realist lens.

Chapter 2 describes, in detail, the paradigmatic beliefs that informed my decision to select grounded theory under a realist lens as my methodology. I also present a detailed description of grounded theory including why I gravitated towards following the methods as articulated by Juliette Corbin and Anselm Strauss. Finally, in this chapter, I describe how I organized and conducted the work involved in my research.

Chapter 3 presents the first of three grounded theories that comprise the core of my dissertation. Each grounded theory is articulated within a separate article. The first article is entitled, "Easier and faster is not always better: Grounded theory of large-scale system transformation on the clinical work of emergency medicine nurses and physicians." This article has been published in the Journal of Medical Internet Research: Human Factors. This article describes how the Lean-driven changes made in two emergency medicine departments' disrupted healthcare professionals' established practice routines and resulted in the intensification of their clinical work. Professionals also identified indications of deskilling of nurses' work and described how the new, push-forward model of patient care detrimentally impacted their physical, cognitive, and emotional well- being.

Chapter 4 presents the second article entitled, "A Qualitative Study of the Theory Behind the Chairs: Balancing Lean-Accelerated Patient Flow With the Need for Privacy and Confidentiality in an Emergency Medicine Setting." This article is in press with the Journal of Medical Internet Research: Human Factors. A major element of the Lean intervention at

both emergency departments was the construction of a three-zone, front cell. This article

describes how the physical configuration of the front cell further intensified professionals'

clinical work by requiring them to actively search for spaces better-affording privacy and

confidentiality for patient encounters.

Chapter 5 presents the third article entitled, "Promises Made, But Not Delivered: A

Grounded Theory of the Planning And Implementation of a Lean Intervention in Emergency

Medicine." It is anticipated that this article will be submitted to the Journal of Medical

Internet Research: Human Factors. This article describes how professionals perceived their

hospital fell short on demonstrating effective leadership throughout the development and

execution of its Lean-driven plans. Of particular salience to nurses and physicians was how

their institution had failed to deliver on a set of procedural and structural changes they

recalled were promised to occur as a result of the Lean intervention.

Chapter 6 summarizes and provides concluding thoughts regarding the research that is

presented in my dissertation. Rather than support nurses and physicians in their management

of the complexities that characterize emergency medicine, the physical and process-based

changes introduced by the Lean intervention acted to complicate further the environment

under which they delivered patient care. The grounded theories I developed have illuminated

some unintended consequences associated with accelerating patient flow on the clinical

workflow and perceived well-being of emergency medicine nurses and physicians. My

dissertation identifies some areas for reconsideration by the departments and suggests ideas

for future research.

1.5 References

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CHAPTER 2

2 METHODOLOGY AND METHODS

2.1. Locating Myself as a Researcher

Finlay and Ballinger (2006) have asserted that as "all research draws on ideas from particular research philosophies or paradigms" [1, p.16], that novice researchers need to be first vigilant about first mapping or locating their research ideas within a "broader methodology, namely philosophy and associated methods" (p. 9). Denzin and Lincoln (1994) explained that a paradigm can be thought of as an interpretive framework or a "net that contains the researcher's epistemological, ontological, and methodological premises" [2, p. 22]. They put forth four major paradigms to guide researchers' actions: positivist and postpositivist; constructivist–interpretive; critical and feminist–poststructural. Finlay and Ballinger (2006) defined epistemology as "philosophical concept that is concerned with the constitution of knowledge: what it is like, from where it is derived, and how it may be explored" (p. 259). Further, they explained that ontology is "concerned with the nature of the social world: what it comprises, the objects within it, and the relationships between those objects" (p. 261). While I recognize that no research project unfolds perfectly, I believe that good-quality research can illuminate associations and relationships between people, objects, and events that exist and unfold within our complex world. I believe the role of the researcher is to uncover those relationships without interfering with them. I also recognize that the social world that we live in influences not only our observable behavior,

but as well, unobservable conditions and states including our beliefs, emotions, and our interpretations of information and situations that we may encounter. We cannot remove individuals from the influences of their social world. Moreover, I do not believe that there is a set order or single, social world, or a single reality that we all share. When we are exploring potential differences in human experience, we need to keep this in mind. When I think about research participants, I assume that the individual will be able to provide valuable insight about what the researcher is interested in. We select them as being the group of interest for that very reason. The researchers' job is to capture their insight and ultimately describe it.

In terms of the paradigms, I see myself sitting in-between postpositivism and constructivism. Finlay and Ballinger (2006) have described postpositivism as a "philosophical position that holds the central mission of scientific endeavor is to describe and document reality, while acknowledging the fallibility of measurement and the role of theory within scientific knowledge. Postpositivist researchers recognize the challenge of studying a complex social life that cannot be reduced to simple objective measures" [1, p.262]. Ponerotto (2005) clarified that the postpositivist paradigm acknowledges that the influence of the researcher upon the participant cannot be fully removed from any study, and the researcher should maintain a neutral stance when interacting with their participant [3]. I am also drawn to the constructivist paradigm because it holds that reality is constructed by the individual [3]. While the constructivist paradigm recognizes, that both the researcher and the participant together work to create research findings, I do think it is possible to engage in dialogue with your study participants while maintaining a neutral stance.

With regards to ontology, I am drawn to realism. Wong and colleagues (2010) explained that realism is a worldview that " sits between positivism and constructivism" [4, p. 91]. That is, realism dually recognizes " the existence of an external social reality and the influence of that reality on human behavior" (p. 91). Realism cautions that when we consider any intervention or program that is introduced or intervention, we need to be mindful that how it affects individuals will not be "simple, linear and deterministic" [4, p. 92]. Pawson and Tilley (1994) contended that when we explore any intervention, we must attend to contexts in which it is situated [5]. Context is not merely unwelcome noise nor a confounding variable which is to be controlled. Any context will have embedded within it socially interactive factors, including the individuals who are experiencing the intervention, their interpersonal relations, the institutional setting of the intervention, and the impact of its greater infrastructure [5]. These factors will act to support or constrain how well an intervention is taken up in a given setting. Therefore, realist ontology accepts the "messiness" of real-world interventions [4, p. 95] and puts forth that a researcher needs to attend to "what works, for whom, and in what circumstances" [6, p. 21].

2.2 Selected Methodology: Grounded theory

I selected grounded theory as the methodological approach for my research because as Corbin and Strauss (2008) described, it is an approach that seeks to explore how persons experience and give meaning to events [7-8]. Lingard and colleagues (2008) put forth that as grounded theory seeks to help "explain a process, not to test or verify an existing theory" (p. 459), it can be particularly useful when little is known about a process of interest [9]. My

thoughts about my topic area were that a Lean intervention is a process, providing emergency medical care is a process, a Lean intervention is meant to introduce change to existing processes, and emergency medical care patient involves social interaction. Given that grounded theory is focused on process and how changes to process impact individuals, social interaction, and is useful when little is known methodology that can be useful for under-explored topics [10-11], I felt grounded theory would be a sound methodological match for my research.

Glaser and Strauss pioneered grounded theory in the late 1960's with their research on death and dying in hospitals [7-8,12]. Charmaz (2014) highlighted that at the time Glaser and Strauss pioneered grounded theory, qualitative research was not prominent and quantitative methodologies were favored by scholars, journals, departments, and editorial boards [12]. Glaser and Strauss viewed both quantitative and qualitative data as being valuable and proposed that "qualitative analysis had its own logic and could generate theory" [12, p.7]. Charmaz noted that the development of grounded theory by Glaser and Strauss helped to legitimize qualitative research [12]. While there are several recognized iterations or 'versions' of grounded theory, they all share some similar features: purposive and theoretical sampling, an iterative process of data collection and analysis, a constant comparative approach, categories/themes that are grounded in the data and a focus on theory development [7-8, 11-12].

Strauss later partnered with Corbin during the late 1980's, and I am drawn to Corbin and Strauss' articulation of grounded theory. Corbin and Strauss (2015) clarified that while it may not have been clear from his earlier work, Strauss was strongly influenced by symbolic interactionism and pragmatism [7-8]. Like most of the social theories, I am new to symbolic interactionism, but I understood from Corbin and Strauss (2015) and Annels (1996) that symbolic interactionism arose from the work of George Herbert Mead in the 1960's [8, 13]. Cronk (2016) explained that Mead defined social actions in relation to social objects [14]. A social act involved the participation of two or more individuals and there were many kinds of social acts, ranging from the simple to the complex. Playing handball, hunting, and performing in a play were examples of a simple social act. The most complex ones would be those conducted within social institutions including education, law, and medicine. A social object was a non-human entity, which would have a meaning for each participant in the act. Mead proposed that it was through social acts that humans in society created their reality. Objects such as clothes, furniture, courts, hospitals are defined and exist because of social acts [8]. Through their social actions, including their emotional and behavioral reactions to events, humans play an active role in shaping the reality of their lives. Therefore, reality is, therefore, "a social construct" [15 p. 64]. Corbin and Strauss (2008) further emphasized that grounded theory focuses on "describing the process or ongoing and changing forms of action/interaction/emotions that are taken in response to events and the problems that arise to inhibit action/interaction" [7, p. 17], and that it looks for "consequences because these tend to come back to become part of the next sequence of action" [7, p. 17]. Therefore, Corbin and Strauss (2015) like Wong et al. (2010) and Pawson and Tilley (2010), assert that attending to context, "structural conditions that shape the nature of situations, circumstances or problems

to which individuals respond by means of action/interaction/emotions" is key to the development of grounded theory [8, p. 87].

Corbin and Strauss explained that pragmatism began in 1917 with the writings of Dewey [7-8]. Pragmatism is a philosophical worldview that knowledge is created through action and interaction and, therefore, human beliefs and experiences are socially situated. Pragmatism also recognizes that the world is complex and because of this complexity, any attempts to capture information about a phenomenon will be imperfect and subject to varying interpretations [15]. Therefore, pragmatism rejects the notion of the researcher needing to choose between a positivist paradigm, which asserts a single, objective reality versus a constructivist paradigm, which holds that multiple versions of reality exist [12]. Corbin and Strauss have too asserted that 'there is no one "reality" out there waiting to be discovered' [7; p. 10]. They believed that grounded theorists should aim in their research to explore multiple perspectives and viewpoints [7-8]. I applied a realist lens to my grounded theory. I felt this was an acceptable lens given that I viewed the Lean intervention that was undertaken by the hospital for its emergency departments had both objective (i.e., Lean-driven changes made the structural and patient process changes that were made to the departments) and subjective (the experiences that professionals had during the planning and implementation of Lean within the redesigned departments and how these changes affected them) elements.

2.3 Study Setting and Sampling Approach

My dissertation revolved around a Lean intervention that was undertaken by two, adult emergency medicine departments that are part of a teaching hospital located in Ontario, Canada. The hospital has 1,000 beds and the two departments annually treat approximately 128,000 adult patients. Patient wait times at both of the hospital's emergency rooms were recognized as being amongst the worst within a group of 74 hospitals that were part of the Performance-Based Compensation Program monitored by the Ontario Ministry of Health & Long-Term Care in 2011[16]. Both departments had been publicly criticized for their long wait times in the local media. In the fall of 2013, in response to their poor performance, the hospital launched a multi-million dollar Lean-driven Emergency Department System Transformation (EDST) and the revamped departments began treating patients in 2014. I gathered details regarding the EDST from a senior emergency physician who practices at one of the sites but was not a study participant of mine, and also from archived articles that were published by the major newspaper of the city in which the hospital is located. These articles contained corroborated facts regarding the EDST including its budget and timeline.

Sampling in grounded theory is non-probabilistic, non-randomized and involves a purposive approach with theoretical considerations [7-8, 11-12, 15]. When planning a grounded theory study, a researcher needs to consider who is likely to provide rich information regarding the phenomenon of interest for the purposes of their research, For my work, I sought to gather information from the individuals who were the front-line, providers of patient care in the emergency departments, which are nurses and physicians. In order to get an idea of what was changed for nurses and physicians in terms of their clinical work and how it impacted them, I felt I needed to have participants describe to me what their practice environment was like

both before and after the Lean-driven changes were made. Therefore, I decided that the ineligibility criterion for my study would be a nurse or physician who began practicing emergency medicine at the hospital after January 1, 2013. This historical date predated the launch of the EDST by about eight months and, therefore, by utilizing it I would be screening in nurses and physicians who had practiced both before and after the Lean intervention. Further, in a grounded theory study, data collection continues until the researcher feels that the amount of information they have collected was sufficient to support their exploration, and understanding, of participants' perspectives that any additional interviews were not likely to introduce major modifications to their understanding [8]. At this point in a grounded theory study, the researcher senses theoretical saturation [7-8, 11] and Corbin and Strauss emphasized that sampling in grounded theory is "based on concepts, not persons" [8, p.157].

2.4 Interviews with Emergency Medicine Nurses and Physicians

Grounded theory commonly uses interviews to gather data [7-9, 11-12] and I opted to utilize individual interviews as my method for data gathering. I selected this format because I was interested in dialoguing with nurses and physicians regarding a number of topics around which I would be seeking contextual information related to individuals' experiences. Corbin and Strauss (2008) and Charmaz (2014) advised that a detailed interview guide is not always necessary in grounded theory research and that the richest data can emerge from less structured interviews [8,12]. Further, Charmaz and Belgrave (2012) put forth that, "interview questions need to be sufficiently general to cover a wide range of experiences, and narrow enough to elicit and explore the participant's specific experience" [17, p. 31]. With regards

to reviewing the literature prior to the conduct of a grounded theory study, Corbin and Strauss (2008) advised that "researchers need not review all of the literature beforehand" when designing their grounded theory study [8, p.35]. Rather, the literature is used to enhance the researcher's sensitivity or insight by "being able to pick up on relevant issues, events, and happenings in the data" (p. 32), and that "it can be used to provide initial concepts, questions, and ideas" (p. 42). As I do not see how it is possible to not bring in at least some awareness of the literature into any study, this assertion made sense to me. I was unfamiliar with Lean Thinking and I went to the literature and read so that I could develop some understanding about Lean's underlying philosophy and the methods involved in a Lean intervention [18-25]. I had some understanding from my work experience in medical education regarding the processes involved in caring for emergency medical patients, and in 2010 I sought medical care from one of the sites. From that latter exposure, I gained additional awareness, from a patient perspective, of the practice environment prior to the introduction of the Lean-driven changes. I also did some reading about emergency medical environments in terms of the challenges involved with their physical layouts [26-29]. Finally, in preparation for developing my interview guide, I toured the practice environment at one of the sites with the senior emergency physician so that I could have some awareness of its new layout.

Following the advice from Corbin and Strauss (2008; 2015), Charmaz (2014), and Charmaz and Belgrave (2012) [7-8,12, 17], my interview guide followed a semi-structured format involving six topics which I used to inquire with nurses and physicians about their experiences before and after the Lean intervention: 1) The old versus new model of patient care that existed prior to the Lean intervention, 2) Changes that were made with the Lean intervention within the department, 3) Patient flow within the new Lean model, 4) Configuration of the physical layout of the department after the Lean intervention, 5) Planning and implementation of the Lean intervention, 6) Lean Thinking and emergency medicine. Under each of these six topics, I had questions with follow-up probes that I would use to support dialogue with the professional. For example, under my first topic, my interview guide read as the initial question, "*I am wondering about what it was like for you to practice emergency medicine with your 'old' model, before the Toyota intervention*?" with follow-up probes, "*How was your department structured before Toyota?, Does emergency medicine work in teams?, Can you describe how doctors and nurses worked together during patient care under your old model*?" (Appendix A). My interview guide was reviewed by my dissertation committee members and also by the senior emergency physician for its content. The emergency physician also advised me about language that was commonly used at both sites (i.e., the term Toyota was commonly used instead of Lean at the sites, front bubble, middle, back bubbles, workstations-on-wheels also known as WOW).

Due to privacy regulations of the hospital, I was not granted access to the names of nurses and physicians practicing emergency medicine at the two sites nor their email addresses. While the hospital lists the total numbers of nurses and physicians who practice at their institution, I was not privy to the total numbers of nurses and physicians who practice

emergency medicine at the hospital. In terms of my research process, with the support of the senior emergency physician, who I had know professionally for several years, I made arrangements with the administrative office that oversees the departments to have them circulate several, sequential, email advertisements regarding my research study to all of the emergency nurses and physicians working at both sites. The advertisements were sent directly to their hospital email accounts, and these accounts are used to disseminate official communication to nurses and physicians including their work schedules. The email advertisements contained a brief description of my study along with contact information for my dissertation supervisor and I (Appendix B). Individuals who were potentially interested in participating in my study were asked to contact either one of us at our official, university email accounts. Professionals who were not interested in receiving another email advertisement about my research were asked to contact the administrative office directly and ask to be excluded from receiving any future electronic mail out of an advertisement. I was not made aware of the number of professionals who made the request to opt out nor did I reveal to the administrative office or the senior emergency physician who had participated in my study. In total, four email advertisements, each separated by a six-week interval, were sent on behalf of my study.

After approval of the plans for my research by both University and hospital-level review boards (Appendix C), I interviewed nurses and physicians from July to December 2017. I scheduled interviews for a time and location that was convenient for each of my participants. In terms of locations, I met with professionals at both hospital sites in rooms outside of their department, at an outdoor lunch area located on hospital grounds, and also at two coffee shops not on hospital grounds. I met with individuals during early morning, afternoon, and

evening hours and on weekdays and weekends. My participants received a 20-dollar gift card as an honorarium. I audio-recorded all of my interviews, and after each meeting, I wrote some notes regarding the dialogue I had with the individual including edits and additions to my probes. A strength of grounded theory is this flexibility in questioning, and this flexibility supports theoretical sampling [7-8]. I used the services of a professional transcription company who was well known to researchers at Western University to prepare these recordings into verbatim, electronic documents. A transcript was made for me within five days of the company's receipt of my audio file. The transcripts were anonymized so that both the name of the interviewee along with any other individual mentioned during an interview would not appear in print on the transcribed document. While I erased the original recordings from my portable device after I transferred the file to the transcription company via their confidential server, as per the ethics requirements for my study, I saved a copy of each original, interview recording on a password-protected, university drive. When I received the transcribed file, I first reviewed it while listening to the original recording that I made in order to screen its accuracy [30]. To support my data analyses, I used hard copies of the transcripts in combination with a qualitative analysis software program, MAXQDA [Version 11.2.5, VERBI Software, Sozialforschung GmbH, Berlin, Germany].

2.5 Data Analysis

In total, I interviewed fifteen nurses and five physicians. In terms of interviewee demographics, I interviewed 16 female professionals and four males. Eighteen of these individuals had been practicing emergency medicine for at least ten years. The average length of my interviews was 53.8 minutes (11 SD; minimum 37, maximum 71) and the corpus of 20 transcripts contained a total of 171,592 words of content.

Corbin and Strauss (2008) explained that to them, theory referred to "a set of well-developed categories (themes, concepts) that are systematically interrelated" and together, these categories help to explain "what, how, when, where, and why of something" [7; p. 55]. Timonen and colleagues (2018) have cautioned that one of the pervasive myths surrounding grounded theory is the expectation that every study will bear out a fully fleshed out theory. Rather, than hold this expectation, these authors advocated that a researcher should seek to develop a grounded theory that illuminates a "greater conceptual understanding, clarity, or a conceptual framework, which is short of theory in the sense of a comprehensive set of ideas that intended to fully explain and predict something" [p.4; 30].

Corbin and Strauss (2008) advised that while data analysis is a cognitive process that is often very difficult to describe [8], it is an act of "taking data, thinking about it, and denoting concepts to stand for the analyst's interpretation of the meaning intended by the participant" [8, p. 85]. As recommended by Corbin and Strauss (2008), I began exploring my interview data once my first interview was completed [7]. After checking on the accuracy of the transcribed document to the original recording, I read the interview in entirety. I then went through it again line-by-line and while doing so I paid attention for the occurrences of

gerunds, which are verbs that act as nouns, and/or phrases that signified process, action/interaction and emotions that may have been evoked with these (e.g., pushing patients forward from triage, patients' information is running through your mind) [12]. I also was vigilant to participants' descriptions of how their department worked both before and after the Lean intervention across the contextual conditions Pawson and Tilley (1994) put forth [5]. I began coding information into some categorical topics using both emic (concepts using participants' language such as push-pull patient care, front bubble) and etic language (concepts labelled by me such as what patients experience, nurses' clinical work). Corbin and Strauss referred to the process of initial data review and categorization as open coding [7-8]. As my interviews continued, so did my data analyses, and given that I was a doctoral candidate I was the primary data analyst. I discussed my initial coding of two transcripts with one member of my committee and also with the senior emergency physician. Both of these individuals are qualitative researchers, and they reviewed the transcripts, my open categories along with a memo that I wrote regarding some of the ideas that I saw coming out of my data analysis. Both these individuals expressed that they felt my interviews and coding were progressing well, and I continued to check with my committee as my work progressed.

My coding continued alongside my data collection, and I was continually considering new information in light of information that I had already collected. I reread transcripts continually throughout my data collection and refined my categories. I made note of variability occurring in my data including discrepant cases. I wrote memos about what I was seeing my in data including hand-drawn maps of my concepts and how I thought they fit together. Corbin and Strauss (2008) refer to this process as the method of constant comparison, and it is during this process that the researcher organizes their open codes into

related concepts and key categories [7]. I organized my codes into themes around several central ideas (central categories) [7-8]. This process is referred to as focused or selective coding [1, 7-8], and focusing coding around the central category supports theory development. In the three articles that will follow this chapter, my central categories are articulated within the title of those works. For example, in the first of my three articles, 'easier and faster is not always better' was the central category around which I developed my first grounded theory [31]. Easier, faster, better was the actual tagline for the EDST, and it signified the expectations that the department and hospital had for the intervention. My discussions with nurses and physicians revealed that rather than support nurses and physicians in their management of the complexities that characterize emergency medicine, the majority of the physical and process-based changes introduced by the Lean intervention seemed to further complicate the environment under which they delivered patient care. I illuminated some unintended consequences associated with accelerating patient flow on the clinical workflow and perceived well-being of health care professionals, and I also described several ways in which the new model of patient care undertaken by the departments disrupted established practice routines and intensified clinical work.

Corbin and Strauss (2008) argued that "objectivity in qualitative research is a myth" [7, p. 32] and that, instead, a qualitative researcher should strive for sensitivity. Sensitivity is the ability to carefully listen and respect both participants and the data they provide [8; p. 77]. These authors put forth that rather than ignore their professional knowledge and experience, they should acknowledge and be aware of what they bring into their research. I feel that I was in a largely neutral position during my research because I was not a member of the department nor did I have a vested interest in illuminating a particular viewpoint or judgment

regarding the Lean intervention. I inquired with participants about what were strengths and weaknesses of how the emergency departments worked both before and after the Lean intervention. I had visited one of the sites as a patient and recalled that it was crowded and that my wait time was long, but I was not aware of what nurses and physicians experience during patient care. I was sincerely interested in dialoguing with participants about their experiences and took time during interviews to ask for clarification of any terms and processes that I did not understand. I spent time with my data analyses and during the development of the three articles that comprise my dissertation; I made an effort to acknowledge multiple voices and experiences.

While Corbin and Strauss (2015) acknowledged that hypothetically " while a researcher could go on collecting data forever, adding new properties and dimensions to categories," eventually a researcher "has to accept that they have gathered enough data to support the purposes of their research" [8, p.140]. At this point, the researcher has sensed that they have reached a point of theoretical saturation [7-8 ,11]. I discussed the depth of my dataset with the member of my committee and the senior emergency physician as my work progressed. At 20 interviews, we felt that my data analyses had progressed to the point where the concepts were sufficiently well developed to support my understanding of participants' perspectives, and that additional interviews were not likely to introduce major modifications of understanding of the data that had been gathered during my dissertation. Therefore, at 20 interviews, theoretical saturation was sensed, and I did not seek additional interviews with new participants. I also did not seek to member check, which can involve the re-interviewing of study participants and/or have them review their transcribed interviews. Thorne (2016)

explained that the purpose of member checking can be to inquire with participants to see, "whether they will confirm having said what you think they said" [33; p. 175]. I did not feel it was necessary to ask my participants to review the transcribed copy of our dialogue given that I had audio-recorded interviews, had the recordings professionally transcribed, and I also reviewed the accuracy of the transcribed document to its original recording. Member checking can also be used to gauge whether participants agree with "your interpretations you are drawing based on the accounts they may have provided" (p. 176). While this verification may seem desirable, a review by Thomas (2017) argued that there is little evidence that member checks actually improve the quality of qualitative research that seeks to develop theory [34]. While the senior emergency physician who supported my research did not guide me through my analytical interpretations of the data, this individual was instrumental in providing me with feedback regarding whether I understood the structural and process-based changes that my participants were describing to me during their interviews and that I understood the terminology that was commonly used by emergency nurses and physicians. The findings I presented within all three of my articles resonated with their own experiences as senior physician in the department, and also what they had sensed from interactions with their departmental colleagues. In all of these areas, the feedback I received from this individual was that I did, indeed, have a good understanding of the information communicated to me and that given what the physician had experienced and what they were aware of others had experienced, my findings were relevant and made sense. Given the feedback from this individual and that, as described above, that we had sensed theoretical saturation with 20 interviews, I did not seek to re-interview any of my participants.

2.6 Assessing Quality of Grounded Theory

While there is no consensus about how to best assess the quality of qualitative research given that qualitative inquiry is both scientific and creative, the final product of any qualitative research should reflect both of these components [7-8]. In terms of concepts for assessing the quality of grounded theory research, Corbin and Strauss (2008) noted that the credibility of the work is a key concept. These authors emphasized that credibility does not refer to truth, but rather, that the research is believable and plausible [7]. To assess credibility, Glaser and Strauss put forth the ideas of fit, workability, relevance, and modifiability [8, 35]. Fit refers to the extent to which the grounded theory is aligned with the information that was used to develop it. The researcher should not feel the need to force data into categories nor should they adopt preconceived concepts [7-8, 35]. While I reviewed the literature in advance of drafting my interview guide, I did not have any theories in mind as I went through the ongoing processes of data collection and analysis. Given my novice level experience and understanding of Lean and the processes involved in emergency medical care, I did not have any overt preconceived ideas or expectations about what my participants' experiences would have been during the Lean intervention. From experience as a patient at one of the sites, I recalled the emergency department to be crowded that day and that I experienced a long wait time. I did not know what the reasons may be for that wait time or what the nurses and physician who cared for me that day had experienced. I sought existing theories, for example, Moulton's theory of slowing down [see Chapter 3] and Rousseau's theory of psychological contracts [see Chapter 5] while I was writing the articles that are part of my dissertation in order to help me interpret my data and enhance my understanding of how my findings fit with existing knowledge [36].

Workability refers to the applicability of the research, and a grounded theory should have some practical implications [7-8, 35]. I feel that my three articles have raised some questions for the hospital whose two emergency departments were the focus of my research, and also that my work has made a contribution to the literature surrounding Lean healthcare. To my knowledge, the articles that are part of my dissertation are the first grounded theories that have explored the processes involved in the planning and implementation of a Lean intervention in emergency medicine, and also how the changes that were borne out of the Lean intervention impacted the working conditions and actual clinical work of emergency nurses and physicians.

Relevance relates to how a grounded theory resonates with others [7,8, 35]. Ways to gauge, and demonstrate, relevance include scrutiny of the work by professionals working within in the field under study and contribution to knowledge through publication [33, 37]. My thesis committee, the senior emergency physician have scrutinized my work, and further, two of the three articles that are part of my dissertation were accepted by a leading, peer-reviewed journal, the *Journal of Medical Internet Research: Human Factors*. I anticipate submitting my third article to that journal in the near future.

Modifiability relates to an underlying assumption about grounded theory, rather than to a concept of quality. A grounded theory should be able to be modified and evolve with further research [35]. In my articles, I acknowledge that my work, as with other qualitative research, is limited to the two Ontario emergency medicine departments. For my findings to become transferrable beyond this initial setting requires additional research in other emergency medicine departments and in other medical settings and in my articles I identified some ideas for future work.

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CHAPTER 3

3 Easier And Faster Is Not Always Better: A Grounded Theory Of The Impact Of Large-Scale, System Transformation On The Clinical Work Of Emergency Medicine Nurses And Physicians

3.1 Introduction

Background

One outcome of encouraging healthcare systems to consider interdisciplinary approaches has been the overhaul of patient care environments with the use of the Lean Principles model. Lean Principles (commonly referred to as Lean Thinking or Lean) is a continuous method of process improvement pioneered by Toyota Motor Company for their car manufacturing production lines [1-6]. In brief, Lean is a customer-driven, continuous method of process improvement that asks an organization to focus on and reconsider, how they are delivering what is of value to their 'customers' [1-3,5]. Value is determined not only by what customers desire but also how fast what they desire is delivered to them [2]. Activities that are not contributing to value are considered to be wasteful in time and motion, and therefore, they are to be removed [1-2]. In contrast to other process improvement strategies, Lean is a bottom-up approach that relies on the input and engagement of both management and workers [1,3].

While the state of the discourse on Lean in healthcare has been described as being relatively new [5], a systematic review by Moraros and colleagues [6] concluded that the current evidence base is not strong enough to support upholding Lean as an effective quality improvement method for healthcare. Amongst the reasons underlying this assertion is that we have limited, contextual understanding of how Lean affects the "multitude of internal and external variables" [6, p.163] that exist within any healthcare setting.

Holden [4] and Rees and Gauld [7] advocated that efforts to enhance our contextual understanding must include exploration of the impacts of Lean-driven intervention on the working conditions, and the actual work, of individuals who are involved in the delivery of healthcare. There are some initial indications that Lean can intensify work performed within medical environments. Work intensification manifests under expectations that employees expend greater work effort by spending more time working, take on greater responsibility and/or more duties, or cope with fewer staff [7-9]. These pressures, in turn, can incubate increased levels of job-related stress and strain [10].

As part of a multiple case study by Rees [11], managers, nurses, physicians and other support workers were interviewed about their involvement in the implementation of Lean interventions carried out in three, hospital-based emergency department in New Zealand and found that employees from two of the three sites experienced work intensification. While details regarding the nature and scope of duties that were affected by these interventions were not presented, individuals attempted to manage their elevated workloads with strategies including prioritizing duties related to patient care and using unpaid time to complete their work. Two Canadian studies reported on the experiences of nurses and of clinicians and

managers, respectively, with the widespread implementation of Lean across the province of Saskatchewan. While the specifics of the interventions were not described by these studies, a random survey of 1,173 nurses found that 49.5% reported that they experienced heavier workloads and greater levels of stress (rate ratio= 0.29, 95% CI 0.24-0.35) and 58.2% reported feeling less engaged and had weakened morale (rate ratio =0.30, 95% CI 0.25-0.36) after Lean-driven changes were introduced into their workplaces [12; data described by 6]. Clinicians and managers who participated in the provincial implementation of Lean healthcare acknowledged, in hindsight, that interventions were overwhelming for their staff [13]. Hung et al surveyed 1,333 healthcare professionals in the United States, including physicians and clinical support staff, before and after their ambulatory care clinic had undergone a Lean-based redesign of their clinical processes [9]. While the details of interventions undertaken by individual clinics were not presented, these authors noted that Lean redesign included the composition of care teams and their workflow. The surveys probed aspects of worker engagement and teamwork and participants were also asked to complete a measure of occupational burnout. After the redesign, non-significant increases were observed in both groups in terms of their scores on measures of engagement and work satisfaction. Despite these improvements, Lean changes did not appear to mitigate job-related stress, as statistically significant increases in emotional exhaustion were reported by both groups (physicians parameter estimate=0.39, $P<.01$, clinical staff parameter estimate=0.365, $P<.05$ for non-clinical staff).

3.2 Objective

If we are to more fully advance our contextual understanding of Lean in healthcare, including how it may be linked to work intensification, we will need to disseminate more granular levels of description of the changes that were introduced to clinical activities within local settings and the impacts, both intended and not, these modifications have on the professionals who practice within that working environment. The purpose of the present study was to explore the ways in which a Lean intervention may impact clinical work and within what contexts.

3.3 Methods

3.3.1 Study Design

We utilized a grounded theory approach with a realist lens. Pawson [14] contends that when we explore any intervention, we must attend to contexts in which it is situated. Context is not merely "unwelcome noise nor a confounding variable to be controlled for" [14, p.36]. Any context will have embedded within it socially interactive factors, including the individuals who are experiencing the intervention, their interpersonal relations, the institutional setting of the intervention and the impact of its greater infrastructure. These factors will act to support or constrain how well an intervention is taken up in a given setting. In sum, Pawson [14] describes the realist mantra is one that attends to "what works, for whom, and in what circumstances" [p.15].

We selected grounded theory because it is a methodological approach that seeks to explore how persons experience and give meaning to events [15-16]. Rather than focus on testing of specific hypotheses or theories, grounded theory seeks to describe social processes from data that are systematically collected or grounded in their participants and is analyzed throughout the course of the study [15-16]. This methodology has been recognized to be particularly useful for exploring phenomena about which little is known [17-18].

3.3.2 Hospital Sites and Participants

From July to December 2017, we recruited 20 emergency medicine professionals (15 nurses and 5 physicians) from two sites of a teaching hospital in Ontario, Canada. Eighteen of these individuals had been practicing emergency medicine for at least 10 years. The hospital has 1,000 beds with 128,000 emergency department (ED) visits annually. The reported wait times for the hospital's emergency department were amongst the worst for the province, and in response to this, in 2013 both sites began a large-scale, Lean-driven, system transformation of their practice environments.

3.3.3 Data Collection

We recruited professionals from email that was sent to the official, hospital accounts of emergency nurses and physicians by the ED on behalf of our team. In order to be eligible for participation in this study, a professional needed to have been practicing at the hospital for a

minimum of one year, beginning no later than a specified date which preceded the ED's planning for the Lean transformation. Nurses and physicians were asked to directly contact EMZ via her official, University email account. Interviews were arranged at a time/location convenient for the professional and these meetings were audio-recorded for later transcription into verbatim, anonymized documents by a professional service. The department was not informed of participants' identities. Interviews were scheduled for one hour, which is consistent with grounded theory [18]. Participants received a 20-dollar gift card as an honorarium. Both University and Hospital health research ethics boards approved the protocol for this study. Consistent with a realist focus, the interview guide probed the physical structure of the ED, organization of patient flow, individuals' clinical workflow, opportunities for nurses and doctors to collaborate during patient care, and the impetus and planning around the transformation of the ED. Data collection was organized around a constant comparative process that hallmarks grounded theory [15-16, 19].

3.3.4 Data Analysis

After each interview, notes were written about dialogue with the professional and the interview guide was refined to probe emerging ideas across successive participants. Once a transcript was received from the professional service, its accuracy to the original recording was reviewed. As the interviews proceeded, their transcripts were first coded into categories with the use of MAXQDA software [Version 11.2.5, VERBI Software, Sozialforschung GmbH, Berlin, Germany]. We checked on the consistency of coding across three team members (EMZ, RB, LS) for two of the transcripts. Coding continued alongside data

collection so that new information was compared to existing codes. Through repeated review of the interview transcripts and our evolving coding, we organized categories into themes. Our data collection continued to theoretical saturation of meaning at which point we felt that the amount of information we gathered was sufficient to support our understanding of participants' perspectives and that any additional interviews were not likely to introduce major modifications of our understanding of the data gathered in our study [20-21]. For our study, we sensed theoretical saturation after 20 interviews.

3.4 Results

3.4.1 Themes

The results of our study illuminated the impact of large-scale, system transformation on emergency medicine nurses and physicians with three themes: [1] Organization of our clinical work; [2] Pushed pace in the front cell; and [3] The toll it all takes on us. In the following sections, we describe the clinical practice environments of the ED, both before and after their redesign and our three themes in greater detail. As is consistent with grounded theory, we have supplemented our results with anonymized, illustrative quotes from participants [16]. Quotes with a generic identifier beginning with 'N' are from an emergency nurse while generic identifiers beginning with a 'P' are from an emergency physician.

3.4.2 The Clinical Practice Environments

Original model

The original practice configuration of the ED involved a triage area which triaged patients to three pods (labelled A, B, C). Pod A housed patients with the most acute care needs. Less ill patients were triaged to the other two pods. Patients requiring major resuscitation, mental health assessment or special emergency procedures, such as an eye examination, were performed ED spaces outside of the three pods.

Pod A was configured with 10 beds each spaced with surrounding curtains A central desk with computers and a departmental, landline telephone was available for use by registered nurses and unit clerks while physicians had a desk area off to one side of Pod A. Medical supplies for all patient care areas were distributed from a central supply.

In terms of staffing, two nurses were assigned for triage duties, three to four nurses for Pod A, plus other nurses in the additional care areas. Aside from overnight hours, three emergency physicians attended to patients throughout the ED. Nurses worked 12-hour shifts and physicians worked eight. In the event that a nurse was called in for additional coverage in the ED, she/he would work eight hours. Physicians working overnight in the ED were scheduled for a six-hour shift. At the end of their shift, it was common for physicians to wrap up patient care on their own time.

Reconfigured model

In 2013, both sites began a departmental system transformation (EDST) involving both the reconstruction of their physical environment along with changes made to their patient care processes. The plans for the transformation were developed in collaboration between an international consultant with expertise in Lean healthcare, front line staff and management. The overall goal, and resulting byline, for the transformation was that it would make the ED easier, faster and better. All patient care areas were re-conceptualized into three 'bubbles' or cells. Pod A became the front cell and it was split into three zones (blue, green, orange). Each colored zone was equipped with three beds and six chairs. The physicians, nurses and learners assigned to each colored zone were allocated portable, battery-operated, computer, workstations-on-wheels (WOW) clustered around their stretchers. The staff was encouraged to use the WOWs in a standing posture. The unit clerk was situated at a central hub that included a photocopier/fax/printer as well as a landline telephone. Portable phones were assigned to nurses and physicians in each zone. While supplies were still provided from central supply areas, medical supplies stocked for each cell were reconfigured.

During each shift, the reconfigured ED was staffed with a total of 13 nurses [two nurses at triage, one primary assessment nurse (PAN) and two nurses for each of the five patient areas across the cells] and three emergency doctors (one assigned to each colored zones in the front cell). In addition, a communications clerk and emergency department technician would be working with these professionals. In terms of operating schedules, the three zones were

opened during the day and evening, and overnight with reduced staff working in one or two of the zones depending upon patient volumes and staffing. The number of hours in a typical shift for professionals did not change.

3.4.3 Organization of our clinical work

Original model: Physicians

In the original model, physicians explained that the ED was organized by patient acuity. At triage, an emergency nurse assigned a Canadian Triage Acuity Scale rating to every patient that categorized one's medical priority to be seen [22]. A patient would be brought to their assigned bed by a nurse and would remain there until their point of disposition. Using a computerized boarding system, physicians selected or pulled patients specifically into their care. Physicians were not assigned to a particular pod within the ED and they would move, or float, around to provide care.

Even during periods of high patient volume, physicians described that the original ED model allowed them to generate an overall, comfortable cadence of patient flow. This was primarily afforded through opportunities for physicians' to make one or more strategic patient pulls during their shift. Interviewees explained that, during a given shift, they were able to review the ongoing list of triaged patients and use this list to make decisions regarding the type and number of patients they should pull into their care. By making some strategic patient pulls, doctors perceived that they were able to maximize their clinical efficiency:

We would just kind of do the sickest people first, it'd go to the sickest person, usually by triage code. And sometimes you would do, just for efficiency as well, so if there was a sick person and a not sick person in one of the three rooms, I would often grab two of them. Because one would be quick and one would be longer, but I'd only walk in there once as opposed to twice. What it also gave you the chance to, like, if you saw three sick people in a row and had a lot of things going on, the sensible thing to do is to see that twisted ankle, sew up the finger, in between, so that there's kind of a self-driven load or control the amount. But it also allowed you to, you know, you know you've got 10 minutes so you can call out some of the quick ones and not at the expense of the others. So it was self-driven movement. [P201]

Strategic patient pulls were also used to support the efficiency of other doctors, and participants described using strategies including pulling specific patients into their care so that another colleague wasn't caring for too many complex patients at one time, and as this participant explained, streamlining your cases to avoid issues at the time of handover for the next doctor coming on shift:

We'd always had an agreement in the last two hours of the shift, that you could clearly go ahead and pick out cases that you felt were likely to be simpler so that you would have to, less likely to hand over those cases. There's really limited utility in seeing somebody 15 minutes before you're supposed to leave. You're just going to have to hand it over right to another person who is basically going to have to start over anyway. [P202]

Moreover, doctors felt that because they were able to float across the three pods they were able to band together and support one another by covering for colleagues during their breaks and checking in on another doctor's patient if they were already heading over to a particular pod, "*You could say, 'There's that really urgent person that just came into bed 2, can you go see that person?" And we would work, the physicians who worked together would work as a team*." [P204]

Original Model: Nurses

In the original model, nurses' explained that their work was organized by designated bed assignments. That is, during their shift, a nurse would be assigned to a specific block of beds within a pod and it was understood that "*Those were my patients regardless. And if I'm going on break, I have to make sure that there's coverage for them, and if I have to leave the room. I'm primarily responsible for them.*" [N106]

Nurses explained that the process of assigning them to bedsides held several advantages to the delivery of patient care. As a nurse was likely to be the first provider a patient encountered in a pod, she/he played a very important role in the critical assessment and monitoring of that individual. As one of the nurses explained:

> *It was good because you could see them from the beginning to the end. You could tell if treatments and interventions were making them better or not having any effect at all. If they're coming in and they're in their worst possible presentation, I need to know if what we have done has helped them. And if it's not, then I need to report that to the physician so we could try something else because it's not working.* [N109]

Secondly, both doctors and nurses asserted that nurses-at-bedsides often freed up physicians' time that, in turn, often allowed a doctor to be able to spend more time with other patients, or to be able to pull more patients into their care during a shift:

> *The best part was the continuity of care. So when we're assigned a bed (for the patient), that nurse stayed with them. There weren't multiple handovers and you kind of knew where they were. You could plan your movements in the department knowing they were there. You had a consistent nurse assessing changes, physiologic changes, anything that came up was picked up, the orders were consistently carried out, and you didn't have to worry about that.* [P201]

Further, nurses viewed that being with patients throughout their trajectory meant that they had an important opportunity to establish rapport with patients and their families. Nurses were valuable in answering their questions and comforting them; furthermore, gaining information from family members that was relevant to the patient's condition. "*I find you had more time to speak with patients, the families, getting to know just some little nuances that could tip you off. You had the time to talk with them. I also found you had more time to build a relationship with your patients.*" [N110]

Finally, nurses perceived that the original configuration afforded nurses working together in a pod to develop a strong sense of camaraderie. In pressing moments, nurses recalled banding together to work as a team. A nurse recalled what it was like to practice in the Pod A of the original model, which was used to treat the most urgent cases:

I liked it. I didn't mind working in Pod A. It was nice, to have people around, to have people helping. Everybody would know what was going on, in a general sense, of all the patients in the Pod A area. Everyone else was right there that could come and help you deal with it at that time. If someone came in with a heart attack, per se, you had them with you the whole time. [N111]

Reconfigured model: Physicians

During their interviews, doctors perceived that their site had shifted from an acuity-based model to one that was orientated towards maximizing the number of patients their ED sees daily. One of the physicians summed up the new situation as, "*Time management was very different than it is now. We are now in a push-forward model.*" [P200] The system transformation generated a new staff role in the ED, the Primary Assessment Nurse (PAN) whose primary job is to direct patients into a colored zone of the front cell. Once a patient has been directed to one of these zones, the physician will assess the patient. Ideally, this will occur within a targeted period of time. In the event that a patient requires further assessment and/or treatment, they will be physically moved from the front cell to the middle and/or back areas. While the patient is still cared for by the same physician after they are moved to another cell, an attending is required to begin working with a new set of nurses.

Physicians were frustrated about how the reconfigured model had decreased the level of control they had over their clinical workflow and therefore, they had less ability now to control the cadence of the ED. Assigning physicians to particular zones of the ED also

diminished their abilities to interact and support one another. Rather than be able to float from pod to pod, *"In the new system, the physicians are like islands. We do not work with each other. We do in a very minimalistic fashion."* [P203]

They also sensed that their department expected more as they were, essentially, now required to see one-third of all of the patients that were pushed forward from triage during their shift. An interviewee admitted, *"It can be a very overwhelming system to work with because it basically puts all the pressure on you. So, if you are really tied up with someone who's very ill or a very complex patient, then you are constantly, like 'Oh my god, I've got these other patients that are mine that no one else is going to see them'."* [P202]

Given that patient flow was delegated to the discretion of a PAN, interviewees noted that their ability to make strategic patient pulls was diminished, and as a doctor who was interviewed noted, the PAN didn't always understand why an attending would want, or even request, that they not be given several complex patients within a short period of time, *"In the old model, I had more choice over who I was going to see. You could allot your time easier and pick the patients you wanted to see. You don't want a PAN nurse to give you five critically unwell patients in a row. You want them to put in a few easier ones to help you with your flow of patients and sometimes they don't do that, they keep putting them in."* [P200]

Finally, physicians highlighted that being assigned to a particular zone did not mean that they would remain stationary during a shift. It was common for an attending to move back and forth, and even repeatedly so, within and between the front, middle and back cells. A variety of examples were given of why they needed to do this including moving back and forth between front and middle cells in order to check on several patients, needing to retrieve

medical supplies, changing out a dead battery on a WOW, and needing to move patient out from a chair in the front cell so that they could speak with the individual in a more private manner.

Some doctors perceived that the reconfigured model had diminished the overall role of the physician in the ED because as a participant explained:

> *Emergency physicians are used to multi-tasking. We're used to a busy environment. We're used to an unpredictable environment. But what we're not used to is not having control with regard to how we manage our environment. And that is the salient difference. It's taken the complete autonomy and leadership quality that a physician provides in the emergency department completely out. So now we come to work and you're just assigned a little zone and a little box and you're told what to do.* [P203]

Reconfigured Model: Nurses

Nurses also perceived that the reconfigured ED diminished their opportunities for collaboration. Firstly, the new configuration relies on fewer nurses to provide care and if fully staffed there are two nurses working within a cell. However, as participants explained, in situations such as when a nurse calls in sick for their shift, the individual may not be replaced by another colleague, "*So, yeah, sometimes there are two nurses, but a lot of times, particularly on nights, there's now one. Sick calls have gone through the roof, so, like, Saturday night they were five nurses short, last night there was three. So we find ourselves working with one nurse.*" [P201]

Secondly, nurses noted that aside from times of patient handover, there could be little, if any interaction, amongst the nurses practicing in other cells:

> *You interact very differently because now you are assigned to a cell. You're focusing on the cell. You're not focusing on if you're one cell and just the way the cells are. Your back is turned towards one cell and you don't know what they're doing, you don't know if they need help. But you can't help them either because you're working at a cell and you might have one to two doctors, you might have residents and if you're short staffed you're now working in the cell by yourself.* [N103]

Opinions were split amongst nurses and physicians about the impact of the reconfigured ED on the quality of nurse-doctor interaction. Some doctors felt they had better opportunities to establish a working rapport with nurses in the new model, while others expressed they worked better with nurses in the original configuration. While nurses generally acknowledged that it was easier to keep track of an attending in the reconfigured ED, it didn't necessarily mean that you would be working collaboratively with them.

Some nurses felt that the reconfigured ED increased the power differential between nurses and doctors, "*It now means that it's one physician, he's like, 'Dah, dah, dah', so now you're his robot. 'Do this, do this, I need that, you need to go give that, you need to do this.'* " [N108]

Nurses asserted that, by pushing all patients through the front cell, the new configuration had fundamentally changed the nature of their duties. Nurses working in the front often carried heavier workloads involving more physical work. As this interviewee explained:

> *I would say work for nurses, to give you an idea, in the new model, where most of the blood work, IVs and everything else is all done in the front bubble. Every patient is seen in the front bubble. And I'm not saying that middle and back bubbles are easy to work, but at the same time, I wouldn't say you're doing as much work in those areas. So, physical work-wise, definitely there's a lot more imbalance. I would say that would be the main thing, is that, in the older system, there was a lot more equalization.* [N114]

Moreover, nurses viewed that the redistribution of physical work to the front cell, in turn, diminished the purpose of a registered nurse in the reconfigured ED away from being a key actor involved in ensuring continuity of care.

3.4.4 Pushed Pace in the Front Cell

While interviewees noted there were times when the reconfigured ED worked well to meet patient demands, there were times that both sites struggled with high patient volumes, "*Some days I feel like there's a bus that drops them all off at the same time. That's what it feels like. It's every day. It's not weekends. It's every day.*" [N112] Doctors and nurses viewed factors that were contributing to ongoing patient volume pressures included the sites receiving greater numbers of complex cases including those transferred from smaller communities along with increased demand for mental health and addictions treatment, "*Acuity-wise, I am*

finding patients are sicker, in general. There are fewer beds [everywhere], so people are

sicker before they come into the hospital, and also just the sheer numbers. We are averaging

200 to 230 patients in 24 hours." [N110]

During times of high patient volume, interviewees were aware that the reconfigured ED model emphasized flowing them through, "*We've got to get people moving. We've got to do this. We've got to do that. There's push from all over. There's push from the physicians in the front. There's push from management. There's push from PAN or charge nurse, either one. Keep it moving. Keep it moving.*" [N113]

The front cell was identified as the primary area where professionals experienced the brunt of the impact of high patient volume. While a PAN was viewed as being involved in the ongoing flowing of patients, some interviewees perceived the role as being one that did not require the same skillset as the other registered nurses in the ED:

> *[Role of a PAN] Is to push them and to keep them going and keep the flow. One of our co-workers said, 'a monkey could do that job'.* [N109]

> *The PAN nurses, they call them primary assessment, but they don't really do it. It's us, but they're the ones who are pushing.* [N108]

Several participants recalled incidents, during which they served as a PAN in the front or they interacted with one that involved tension with other staff:

For me, I like to go and talk to everyone face-to-face. And I'll say, 'I'm PAN nurse today.' And some people roll their eyes because I'm a mover, organizer, shaker, and I do the rob Peter to pay Paul. I'll move and shuffle people like a Jenga. [N112]

Push the pace. And you'll say to the PAN nurse, 'Can you just give my zone a 10-minute reprieve? I have a bunch of reassessments to do and then I really need to go eat something'. And they'll still fill your beds up because management told them that they needed to continue to fill beds up. [P204]

Professionals perceived that a crowded ED amplified the challenges that the new configuration already introduced to their clinical work. First, there were capacity issues associated with flowing all patients through the front. As a nurse who was interviewed counted out, the front cell typically contained a minimum number of people that would need to be working within that space:

You used to have, you know [in the old model], if you had three physicians on, there might be two people seeing a patient in Pod B, and there might have been one doctor seeing a patient in Pod C. There might not have been anyone in Pod A, which is where the front bubble is now. But everybody now, there is one doctor per each cell they could have upwards to three learners. If the two nurses are there, which is great, there are two nurses, so that could be five to six people per area. So you're upwards to 18 to 20 people before you're even involving the patients, in that area. [N105]

Add to this mix, patients and any family members that may have accompanied them to the ED and the front became very congested," *It's like a hornet's nest. It's the best way to describe it.*" [N110]

As the ED filled, so did the need to keep moving patients around the ED. Interviewees asserted that figuring out where to move patients could be complex and time-consuming:

> *We're always behind. We can't keep up and whereas, previously, we really could. So, it's like this constant Rubik's Cube. Like, move this person here and move that person there. And it's like never-ending. You could be moved around several times because of the fact that there is somebody else competing for your stretcher who is iller than you. And then, it's eventually deemed, okay, you can't have a stretcher anymore, you've got to sit in a chair.* [P202]

Participants recalled being interrupted more, struggling to keep up with what needed to be done for their patients' care, and often feeling overwhelmed while working. In a crowded front cell, some nurses also admitted that their clinical workflow could become very fragmented to the point that they could not complete everything to the standard they desired:

> *What happens often too I find is that there is a lot of pressure to get these people in and be seen that they just bring them all in. Charts get disorganized. There's no kind of methodical movement to all of this stuff because 'Oh, this person needs this and that.' They may need that done, but the policy procedure as far as nurses go, they need vitals after. They might need to be fully disrobed. You need to listen to a chest. There are all these little bits that have to occur based on standards of care that don't always happen in*

this environment because of the movement of people so quickly. [N103]

On a similar note, some physicians recalled moments in the front when they needed to be more vigilant about what nurses were doing (and not doing). During times when they sensed a nurse could actually miss an order, they needed to make an effort to verbally push that nurse more in order to ensure that the work was actually carried out. As a doctor explained, "*I've had to change my practice in the bubble to say, 'Do not move that person until this, this, and this are done.' Because if I don't do that I will go to a room two hours later, three hours later, and things aren't done.*" [P203]

Participants noted that during periods of high volume, eventually, patient movement would stop due to bottlenecks in the front cell or the hospital had become bed-blocked, meaning that the number of patients requiring admission had exceeded the number of beds that were available.

3.4.5 The Toll This All Takes On Us

Participants admitted that working in the front cell was often a stressful experience that impacted them physically, cognitively and emotionally:

We are in an area where it is so high stress that sometimes…last night we had a [complaint anonymized] case come in. I've been there for [number anonymized] years and I felt like I was going to have a panic attack. That's the kind of environment. It is stressful, stressful, stressful." [N114]

I just find most shifts I just keep my head above water. Like, you feel like you're drowning constantly. [N105]

Interviewees identified several conditions of their working environment including the constant movement required from doctors and nurses in the front cell during patient care, difficulty finding the time, and place, to take a nutrition break during a shift, and being required to stand for long periods of time often resulted in doctors and nurses feeling very physically fatigued, *"Our legs are tired. Every nurse, guys and girls alike, even the docs, we're all wearing the compression stockings. Before we had chairs where we could sit down and chart. Now we're standing up at the computer doing our charting. You're standing your full 12 hours."* [N112]

Professionals also recalled moments where they felt cognitively overextended. During these times, they described having difficulty maintaining attention, needing information to be repeated to them, forgetting patient names, second-guessing whether they had completed a task fully (or not), and using moments where they used a more menial task, such as retrieving supplies, as an opportunity to take a cognitive respite. Moreover, some interviewees admitted that in order to try to cognitively decompress after working a shift in the ED they needed to be socially isolated for some period of time from family and friends:

It's just sensory overload. You're constantly, in the front bubble, you're constantly being pushed to get patients in, get patients out, get patients in, and get patients out. For me, and this doesn't happen all the time, so I don't want to paint a bad picture, but I shouldn't go home so mentally tired that I don't want to socialize with people. [N102]

Some days you physically feel fine, but, mentally, you are drained. And it's because you have ninety patients' information running through your mind. [N101]

Most interviewees recalled incidents where they had been on the receiving end or witnessed moments of *push back* from patients to staff (and vice versa). These incidents were difficult to experience, and witness and most times, these events seemed to catalyze from patients' frustration with wait times:

We [the general public] don't seem to control our tempers anymore. We [the general public] don't seem to control our outlets. We [the general public] want instant gratification, we [the general public] want this and they get angry and they feel it's acceptable to become angry, yelling, threatening to hit. Lives have been threatened in the emerg. You hear some events that have happened and the nurses are becoming angry at the patients as well. [N108]

Overall, participants sensed that colleagues' morale had declined at work and, as evidenced by the following statements, showing awareness of colleagues that were contemplating leaving their position at their site or had recently quit their job:

Of the heavily trained people, the people that I perceive as the strongest up-and-comers, a lot of them are peeling off. [P201]

I don't know where it's heading, but I just know that something has to change because we're going to lose more. At least, from a nursing aspect, we're going to lose more. I have been in this department for (number anonymized) years. I love emergency medicine but I hate what is happening. Five years ago, I wouldn't have even looked at the job board to get out. [N110]

3.5 Discussion

Principal Results

Emergency medicine is a highly complex medical discipline characterized by a fast pace, interruptions, multi-tasking, overcrowding, and unpredictability [23-29]. While the EDST was supposed to make the ED work easier, faster and better, the participants in our study described that the Lean-driven changes made to their practice environment, most especially with the design of the front cell, had the opposite impact.

Physicians and nurses spoke about how assigning them to work within the front cell fundamentally disrupted routine patterns of how they interacted with patients and with each other. Doctors noted that despite the responsibility they held within the reconfigured ED, they had diminished autonomy over their work. The physicians in our study found it especially disruptive to have reduced opportunities over the course of their shift to plan, and execute, as many strategic patient pulls as they judged necessary. This should not be surprising given that Kovacs and Croskerry [23] posited that the most important type of information used by emergency physicians in their clinical decision-making relates to their patients' acuity, and moreover, that Schubert and colleagues identified time management as

one of the defining features [29] that distinguishes expert emergency physicians from novices. By limiting their ability to make strategic patient pulls, the ED was unintentionally disrupting physicians' ability to exercise their professional expertise. Therefore, any moments of tension between PAN and attending, where a physician requests that patient flow be slowed (or even halted) are very likely important signals of physicians' heightened situational awareness. Moulton and colleagues [30-32] observed that surgeons' often experience transitional moments during patient care when they feel the need to slow down. These transitions may be routine or unplanned and can result from factors including recognition of the need to deal with distractions and sensing one's fatigue. Moulton asserts that slowing down is the "crucial part of expert surgical judgment, and failing to transition during critical moments may lead to medical error and patient harm" [31, p.1019]. Given that physicians recalled moments where they felt they needed to slow down patient flow for reasons similar to that observed by Moulton, rather than continuing to push the pace, we suggest that the ED should reframe these requests as important opportunities for assessment of potential risks. Future exploration of the potential relationship of emergency physicians' strategic patient pulling and requests to slow down patient flow to expert physician judgment and distributed cognition is warranted.

While a nurse may still be the first provider whom a patient encountered within the front cell, the quality of that nurse-patient interaction may have shifted significantly. The nurses who participated in our study did not indicate that their department had intentionally restricted their involvement in certain clinical activities, but they did perceive that they held diminished value within their department after the reconfiguration of the ED. Nurses viewed that the front cell required less use of their critical assessment skills, they were less involved in

monitoring patients, were being pushed towards carrying out more general tasks that often involved physical work, and they had fewer opportunities to develop a rapport with patients and their families. Although some physicians perceived their working relationship with nurses had improved after the reconfiguration, nurses did not share this opinion. Nurses felt they had fewer opportunities to collaborate with physicians and, compared to the original model, they were now working less *with* physicians and more *for* them. In the United Kingdom, intentional narrowing and standardization of workers' duties under Lean has been associated with deskilling of taxation civil servants [33] and automotive manufacturing employees [34]. We found that the Primary Assessment Nurse, a role that was directly borne out of the EDST, was viewed by some professionals as being a position that did not draw on the same skill set as required by other registered nurses within the ED. This observation taken together with other above-mentioned perceptions of nurses' work suggests some unintentional deskilling may have been introduced in the ED with Lean. As such, the relationship between clinical workflow redesign and deskilling of nurses requires further attention.

An argument can be made that as emergency medicine is highly complex, by definition, the clinical work performed by its nurses and doctors will always be intense. That being said, the acceleration of patient flow to the front cell appeared to further ramp up the existing pressures faced by healthcare professionals in the ED. The participants in our study described how, several years after their department underwent a Lean redesign their clinical workloads were intensified. They reported greater pressure to keep patients flowing, spent time moving patients around the front cell, were more likely to be interrupted while working, carried out more menial tasks which added to their workload, and weren't always confident that their

work was completed to the desired standard. They also admitted feeling emotionally and physically exhausted, noted more of their colleagues requested sick time away from work, were aware of incidents of tension between colleagues and patients and knew that other professionals had already or were contemplating leaving their jobs. It has been estimated that at least 60% of emergency medicine physicians and nurses have experienced symptoms of burnout syndrome [35-37]. While we are unable to estimate the prevalence of symptoms in our study, the ways in which participants described how their work impacted them physically, cognitively, and emotionally suggests that they are at risk for developing burnout syndrome. Similar to the results of Hung et al, we did not find that Lean redesign mitigated levels of job-related stress perceived by nurses and physicians [9]. We did not find that participants were more engaged and more satisfied with their work after the reconfiguration of their practice environment. Our findings suggest that the ED revisit and re-evaluate its Lean-informed design of the front cell including its relationship to work intensification, workplace stress, and worker burnout.

Lean has been described as a quality improvement approach that depends on worker engagement and input [3-4]. Although in this study, we have not addressed participants' conceptual understanding of Lean nor their involvement in the planning and implementation of the ED's reconfiguration, we did not sense any unwillingness from them to try to ensure that the intervention was 'successful' for their department and hospital. Rather, despite the ergonomic challenges they faced, interviewees seemed to be quite passionate about their work and commitment to patient care. It is unclear, at present, how the perceptions of the

nurses and physicians who deliver patient care in the reconfigured ED resonate and align with what hospital management expected the intervention would achieve. Future exploration of what constitutes success in Lean-driven healthcare is warranted.

3.6 Limitations

As our study involved two sites of a single teaching hospital, its findings are representative of our local context. Further research into the impact of Lean healthcare on the clinical work of nurses and physicians practicing in other emergency medicine departments, and in other medical settings, is necessary to explore the transferability and resonance of our findings.

3.7 Conclusions and Implications

To our knowledge, the present study is the first grounded theory regarding the impact of Lean on the working conditions, and actual work, of emergency nurses and physicians. We theorize that rather than support healthcare professionals in their management of the complexities that characterize emergency medicine, the physical and process-based changes introduced by the Lean intervention acted to further complicate the environment under which they delivered patient care. Our research has illuminated some unintended consequences associated with accelerating patient flow on the clinical workflow and perceived well-being of healthcare professionals. Nurses and physicians described several ways in which the new model disrupted their established practice routines and resulted in the intensification of their clinical work. Participants also identified indications of the deskilling of nurses' work and

how the new, push-forward model of patient care had detrimental impacts on their physical, cognitive, and emotional well-being. Based on our findings, we advocate for future exploration of the relationships between emergency physicians' use of strategic patient pulls and requests to 'slow down' patient flow to expert physician judgment and distributed cognition, clinical workflow redesign, work intensification and deskilling, and Lean healthcare and burnout symptoms experienced by nurses and physicians.

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CHAPTER 4

4 A Qualitative Study Of The Theory Behind The Chairs: Balancing Lean-Accelerated Patient Flow With The Need For Privacy And Confidentiality In An Emergency Medicine Setting

4.1 Introduction

Background

The provider-patient relationship is the foundation of medicine, and this relationship revolves around trust. As part of a trusting relationship, a patient must have faith that any information exchanged during their encounter with a physician or nurse will remain private and confidential [1-2]. While privacy and confidentiality share some ideas, these two concepts have distinct definitions. Privacy has physical, decisional, and informational dimensions. Regarding these dimensions and medical care, a patient should not experience any unnecessary or embarrassing exposures of their body. A patient should also be free to make informed decisions regarding their care without facing undue pressure or interference from another individual, and they should entrust that any information collected during their medical care will be kept confidential [3-5]. Violations of confidentiality can be intentional or unintentional [3,6]. Intentional violations occur when a professional directly communicates a patients' information to an unauthorized person. Unintended violations arise when conditions are inadvertently created that enable an unauthorized individual to see or hear information about a patient. Intentional violations or failure to adequately protect a

patients' personal health information may result in an investigation or audit from a professional regulatory organization with potential consequences including disciplinary action [1,2].

An emergency department (ED) is considered to be one of the most complex environments in which to deliver patient care [5, 8-10], and although reviews by Ulrich and colleagues (2008; 2010) have highlighted a dearth of research in this area, there are some indications that the design and layout of an ED can increase the vulnerability of patients to breaches of their physical and informational privacy and confidentiality [11-12].

Mlnek and Pierce (1997) asked trained observers to record patients' names plus their diagnosis/reason for treatment while they were sitting in a triage chair or empty treatment areas of a hospital-based ED in the United States. From the triage chairs, observers recorded the names of 81% (26/32) of patients and the diagnosis/reason for treatment for 56% (18/32). Both elements were recorded for 53% (17/32) of triaged patients. Observers noted that when they were stationed in treatment areas with curtains, they were able to hear "almost everything" (p.1143) that occurred in adjacent areas. When other rooms left their curtains open, observers were also able to craft detailed notes about medical procedures they saw being performed on patients. The authors noted that no privacy breaches were recorded when observers were stationed in empty patient rooms with solid walls [13].

In another American study, Zhang et al (2015) asked an observer to record the ambient conversation while they were seated near a nurses' station and in some empty patient rooms of hospital-based ED. Thematic analyses of transcripts prepared from the recordings revealed that nursing station conversations predominantly revolved around patient care (86% of

content, 95% CI 68.7 to 94.7%). While patient names were not heard on the nurses' station recordings, other details including individuals' medical and social histories, physical examination results, and diagnoses were audible. The authors noted that although 44.8% (95% CI 17.7 to 62.2%) of the conversations that were recorded from patient rooms revolved around clinical topics, these contained very little patient-related information [14].

Karro and colleagues (2005) reported that 45% of patients [106/235] treated by an Australian ED had been involved in a privacy incident at an Australian, hospital-based, ED. Forty-one percent of patients [95% CI 35 to 47%] revealed they had overheard information involving another patient, and 15% [95% CI 11 to 21%] sensed other members of the public had overheard conversations related to their care. Ten percent [95% CI 06 to 14%] admitted they saw another patients' body, and four percent [95% CI 02 to 07%] felt their body was exposed. Patients treated within walled cubicles were significantly less likely overhear information about another patient ($P < 0.002$) and felt their information would be less likely to have been heard by an unauthorized person ($P = 0.06$) [15].

Finally, patient surveys from Barlas and colleagues (2001) in the United States and Lin and Lin (2010) from Taiwan explored whether patients' perceptions of privacy and confidentiality impacted how they interacted with members of their ED care team. Patients in both of these study cohorts admitted, that due a perceived lack of privacy and confidentiality, they withheld aspects of their medical history or had refused parts of their physical exam [Barlas, a total of 3.7% of patients 4/108; Lin, 21% of patients withheld aspects of history 23/108 and 19% of patients refused parts of exam 21/108]. These studies appeared to put forth different viewpoints regarding the degree of effort made by members of the care team

to circumvent breaches. While Barlas reported that 85.2% [92/108] of patients in their study perceived that ED staff showed respect for their privacy, Lin and Lin concluded, "in our opinion, the most important factor influencing patient privacy was lack of vigilance in the ED " (p. 607) [16-17].

Emergency departments have used Toyota's Lean methodology to guide the restructuring of their practice environments and patient care processes [18-19]. As part of its focus on continuous improvement, Lean asks an organization to rethink how they are delivering what is of value to their customers [18, 20-25]. Organizational processes are broken down and examined regarding whether they contribute value-adding activities [18-19]. Value-added activities are those that work towards satisfying customer needs. Conversely, non-value activities detract an organization from achieving its goals and waste time and resources including personnel and physical space. By removing non-value activities, the Lean method asserts that an organization will be able to streamline its processes and deliver what customers want at a faster pace [20-22, 5, 25].

4.2 Objective

Given that Lean healthcare focuses on the enhancement of patients' experiences, it would seem to follow that when a Lean intervention is evaluated, it should include some examination of how it potentially affected patient privacy and confidentiality. However, reviews by Holden (2011), regarding the implementation of Lean interventions in ED, and Moraros, Lemstra and Nwanko (2016), of the effects of Lean interventions across multiple medical settings, have suggested that the topic of privacy and confidentiality has not been a

priority in the Lean healthcare discourse [18,24]. None of the articles that were part of these two reviews looked at the potential impact of Lean-driven changes on patient privacy and confidentiality. Moraros' review also presented primary analyses of patient satisfaction data that was gathered by hospitals in the Canadian province of Saskatchewan. Saskatchewan is recognized to have undergone the largest Lean healthcare transformation in the world and this included restructuring of provincial ED [19]. Although the Saskatchewan analyses included multiple indicators of provider-patient communication, measures specifically tied to patients' privacy and confidentiality were not presented. Moreover, we were not able to locate a study about Lean and patient privacy and confidentiality through our searches of the published literature.

If professional regulatory organizations are going to require that physicians and nurses interact with their patients privately and confidentially, we need to examine the degrees to which their practice environment supports them to do so. The purpose of the present study was to explore how a Lean intervention affected the ability of emergency medical professionals to optimize conditions of privacy and confidentiality for patients under their care.

4.3 Methods

4.3.1 Study Design

The findings reported by this study arose from data collected as part of a realist grounded theory study that examined the impact of a Lean intervention undertaken by two emergency departments from a single teaching hospital in Ontario, Canada [26]. The hospital has 1,000 beds, and about 128,000 patients seek treatment from the two adult emergency departments annually. In 2013, in response to poor ED wait times, the hospital introduced extensive changes to the physical practice environments and patient care processes at both adult sites. The changes were anticipated to improve the efficiency of the ED and, in turn, this would reduce the wait times experienced by patients.

From July – December 2017, emergency nurses and physicians who practiced at either ED were sent emails inviting them to consider participating in a single, semi-structured interview. These emails were sent on behalf of the study by the administrative office that manages the ED sites and professionals were asked to reply to EMZ's confidential, university email account. The administrative office was not made aware of the participants' identities. Interviews were audio-recorded for transcription into verbatim, electronic documents by a professional transcription service. Participants received a 20-dollar gift card as an honorarium. University and hospital-level, research ethics boards approved the study's protocol.

The study followed a constant comparative approach that is consistent with grounded theory methodology [27-29]. Using a semi-structured format, the interview probed the ED environment, both before and after the Lean intervention, including the physical configuration of space, organization of patient flow, clinical workflow for physicians and nurses, opportunities for professionals to collaborate during patient care, the motivation for restructuring the ED, and the processes that were involved in the Lean intervention.

4.3.2 Data Analysis

After each interview, field notes were prepared about the dialogue that occurred with the professional and these notes were reviewed alongside the interview's prepared transcript. With the use of MAXQDA software [Version 11.2.5, VERBI Software, Sozialforschung GmbH, Berlin, Germany], information from the transcripts was first read line-by-line and was coded into a set of categorical topics. Categorical coding continued alongside data collection and information from new interviews was successively compared to the existing set of codes. Through the repeated review of the interview transcripts and evolving coding, the categorical topics were organized into themes. Data collection continued to theoretical saturation of meaning at which point we felt that the amount of information that was gathered from the interviews was sufficient to support our exploration of participants' perspectives and that any additional interviews were not likely to introduce major modifications to our understanding of the data gathered in our study [30-31]. For our research, we sensed theoretical saturation after 20 interviews.

4.4 Results

Fifteen nurses and five emergency physicians were interviewed, and eighteen of these individuals had been practicing emergency medicine for at least ten years. Interviews lasted, on average, 53.8 minutes (11 minutes SD) and the corpus of transcripts contained a total of 171,592 words of content.

4.4.1 Themes

All of the healthcare professionals who were interviewed during this study spoke in detail about their experiences providing medical care to patients, and interacting with their family members and visitors within a particular area of the restructured ED, the front cell. The construction of the front cell was a major element of the Lean redesign. The front cell tends to be a very busy area of the restructured ED because it receives all of the patients that are flowed forward from triage. The experiences of nurses and physicians in the front cell revolved around three themes: The theory behind the chairs; too many people in the front cell; and how we work (around) to try to preserve our patients' privacy. After a description of the physical configuration and patient care processes used in the front cell, the three themes will be unpacked with anonymized quotes to ground, and enrich, our findings with the voices of our study participants.

4.4.2 The Front Cell

The front cell of the ED was separated into three zones and triaged patients were directed to one of these. Each zone had three stretcher beds and six chairs, and the primary assessment nurse, who manages patient flow, made the initial decision of whether a patient was sent to a stretcher bed or front chair. While the stretcher beds had surrounding curtains, the chairs did not. Instead, the chairs were located together in an open concept configuration and were spaced in a side-by-side array. Prior to its restructuring, the ED did have some chairs available for patients, but these were situated away from treatment areas and spaces where nurses and physicians completed their charting.

4.4.3 The theory behind the chairs

Participants explained that the theory behind equipping the front zone with sets of patient chairs arose from an accepted idea that ambulatory patients should remain ambulatory:

> *The point of chairs is to be able to keep upright patients upright. So, if you can walk and you do not need a stretcher, per se, because your medical condition does not need you to be on a stretcher, they would seat you in a chair. A patient who was young, healthy but just needs a quick exam, belly exam, something like that, or someone with an isolated orthopedic injury. They would be able to take the patient from the chairs into that first bed, see them there and then put them back into the chairs for a plan.*
> [N101]

If you were a gallbladder, you need a bed. If we triage you and the assessment nurse

has done your blood work, and it comes back, and it is fine, you'll sit in the chair until

you get to an examination table for the doctor to be able to do a full exam. If you were

sweating profusely, pale, not doing well, we would have you still in one of those

stretchers until we get you pain-free. We may be able to move you over to the Rapid

Assessment Zone, or to the middle bubble, while we get ultrasounds and that. If you

are doing really well and you look well enough to sit in a chair and weren't in crisis,

then you would sit in a chair, continue to give you medication, and go from there.

[N112]

4.4.4 Too many people in the front cell

Several participants clarified that the ED seemed to have drifted away from its original plan

to designate the front cell as a patient only area. In the original plan, under certain

circumstances would a family member or friend be allowed to accompany a patient forward

to the front cell after triage. For example, if a patient had a cognitive issue or they required an

interpreter, one person to would be allowed to remain with the patient. While interviewees

empathized with individuals' desire to be with a loved one or friend while that person was

being cared for in the ED, they noted that over time the front cell had become, in essence, a

secondary waiting room. As this nurse noted, it was common for patients to bring one or

more people with them into a front zone, "*People get rather annoyed if family members can't*

stay with their loved ones, which I understand. I always try and say, 'We don't need to have

five family members for the one person'". [N107]

During times when family and visitors accumulated in the front zones, interviewees noted fewer chairs were available for patients, family members crowded around stretcher beds, hallways became congested, ambient noise levels increased, and as this nurse and emergency physician explained, it was often difficult for a healthcare professional to work in a front zone while their family members and visitors were also present:

> *I understand that they are worried, and they are concerned about their family members, but I have actually had put it to them, and I said, 'If anything ever happened to your family member, I can't get to them. I'm not going to be tripping over chairs or you to do my job. Please trade off any time you like, but I can only have one [of you here].'* [N110]

> *It's become like a waiting room. And even at the [stretcher] bedside, it's a small geographical space. And there are many times I'll open the curtain to try to walk in, and there will be three or four visitors with the patient. In a small area where you're trying to provide such rapid care, you cannot do it with visitors there. It was initially intended that you would do your care in the front bubble [without visitors]. Once the patient was moved, visitors or family would be allowed to come into the areas where they have been moved. The general public hasn't accepted that. And that space has just never been designed to allow for that.* [P204]

Moreover, some participants noted that the public often ignored the hospital's request that they refrain from using mobile devices in the ED, and you could see people using their mobile phones while they waited in a front zone.

Interviewees explained that during periods of high patient volume, slowed access to the stretcher beds in the front zones plus the accumulation of patients, family members and visitors in the front cell, synergized to increase the likelihood that a patient would interact with a healthcare professional in the presence of other members of the public. Professionals were not comfortable with this situation because as these two nurses described:

> *I like the idea of either putting them in the chairs to wait to come into a spot [stretcher bed]. Say, all our spots are full, there are a few more people that are appropriate, trade them out. That is fine. Or they have had their lab work done, and they are just waiting for results, they are stable, put them into the chair and wait for the results. I am okay with that. It's the people that are getting seen by physicians or nurses in the chairs. I don't like that. I don't like assessing a patient in a room full of a bunch of other people, asking them personal information questions, things like that.* [N110]

> *You could have patients in chairs surrounded by strangers beside you inches away, and a doctor is asking you questions. Yeah, or even if it's just assessing your foot, people are watching that, they're right there. And even in the stretchers, you can hear everything that's going on behind those curtains. The historical set up though we've had curtains, so there's always been some lack of confidentiality, but with the cluster of chairs where they are out in the open now. Oh, it's terrible. I think about if I was a patient how I would feel with that and I would probably put a complaint in because there is no privacy there.* [N109]

Concerns were raised regarding the impact of the departments' push-forward model on the front chair environment. Physicians explained that since the model prioritized the continual flow of patients from triage, this meant that at any given moment, it was feasible for individuals with varied medical needs to be seated together. They cautioned that although a patient may be alert and mobile when they are assessed at triage and, therefore, would be eligible to be pushed forward into a chair, it should not be assumed that the individual was experiencing a minor, medical complaint. While some physicians recalled instances where they felt a triaged patient should've been directed to a stretcher bed rather than a chair, they also acknowledged there wasn't always an available alternative:

> *I honestly feel we have to put people in chairs that should not be in chairs. But the alternative is, they wait in the waiting room [by registration]. So, I'll say to patients, 'I'm sorry that you have to be in that spot [a front chair], but it's either that or you don't get seen at all.' And people understand that equation, but it doesn't mean they're happy about it, particularly if they're not feeling well.* [P202]

Further, as these two physicians highlighted, there were medical contexts where doctors anticipated it could be especially uncomfortable for a patient to have to interact with them while they were sitting amongst other people:

> *The chairs are where I have difficulty because there will be multiple patient types in chairs. You might have two psychiatry patients, you could also have someone waiting on blood work, and you could have someone that has a sore foot in the chairs. My perception is that most patients don't like to be talked to in front of a bunch of other*

people. Of course, it depends on why you are there in the first place. If you have a cut on your thumb, you may very well not mind talking about it in front of other people. [P200]

Sometimes you're asking some pretty uncomfortable questions to people. Like, you [the emergency physician] need to know this, or you don't know this. So for them [patient] to, sort of, to be quizzed, or asked, or somewhat berated sometimes in front of a room, and then to have to go see that next person 10 feet away, that person knows exactly what's going on. Whereas in the old system, you had that privacy, and to discuss issues about patients that, you know, that person had chlamydia, gonorrhea, or something else. That's probably not the nicest conversation in a room full of 50 people. [P201]

4.4.5 How we work (around) to try to preserve patient privacy

We have previously described that managing high-patient volumes in the ED commonly involved moving patients around the three cells of the reconfigured ED [26]. When interviewees elaborated on reasons underlying these moves, they explained that would often ask a patient to move out of a front chair and accompany them over to another area of the department in order to try to optimize a sense of privacy before they began communicating with a patient:

The chairs are great, but because there is no place for patients to be moving out of the stretcher, you have people in the chairs, and there is no privacy. You can't talk and ask people. Sometimes, they are there, I'll take people around the corner, and I'm talking to them in the hall, just so their neighbour doesn't hear them, which I personally don't think it's appropriate. If they were alone in the chair, I have no problem talking to them, but otherwise, there is no privacy. There is nowhere to sit. [N110]

Hopefully, you're not assessed in the chair. Unless you're the only person in the chairs at the time, then we would talk to you there, just for privacy reasons. But if there are other people there, we've got to take you out of that chair to some corner where we can talk to you privately and then bring you back to the chair. [P201]

Participants listed off various areas, wherein the moment, they had sought out a more private location to interact with their patient including a hallway or corner, trauma bay, the resuscitation room, or even another front zone:

Well, they put patients in the chairs when all the [stretcher] beds are full. So, you're going to see them in the chairs, but there are other people there. I'm not willing to have those conversations unless it's maybe an infected finger. Even that I really don't like having in case, there's something else about it. So, it can be hard to find the space that you can actually talk to somebody. I try to move them around. But you end up going into the quiet room or the resuscitation room or pull them off to the side, trying to see if somebody else's chairs are empty. [P203]

Nurses also acknowledged that although it was an accepted practice to treat patients while they were sitting in a front chair, they were quite uncomfortable doing so when other members of the public were present. During these moments, some nurses admitted that they, too, felt like they were on public display:

> *I do find there's far less confidentiality [compared to our old model]. I have to now go into the small area where patients are more or less knee-to-knee with each other, and I have to disclose information or results or do vitals in front of everybody else, spike meds in front of everybody else. You're being watched, and the patient that you're doing this stuff to is now the centre focus of everybody in that area.* [N104]

Two of the nurses who were interviewed described incidents where they felt their privacy was disrespected:

> *I've been caught a couple of times where people are photographing you. That is the culture, and it irritates me because it's [a mobile device] supposed to be off. And how can we enforce that, when everybody else is on them?* [N107]

> *I was on the phone with [details regarding the conversation are anonymized], and then I was called into a patient room and another patient said, 'I just wanted to let you know that I feel for you [details regarding what the individual said they overheard are anonymized] and I heard your conversation.' And I'm like, 'Oh no. Oh my god'. There's just no privacy. We have no place to have private phone calls.* [N109]

4.5 Discussion

Principal Results

To our knowledge, this is the first qualitative study to explore the impact of a Lean healthcare intervention on patient privacy and confidentiality. While the Lean redesign was intended to make the ED work more efficiently, the results of the present study illuminated that the physical configuration of the front cell often intensified the clinical work of emergency nurses and physicians because they needed to actively search for spaces that could better afford privacy and confidentiality for patient encounters.

Evidence-based design of healthcare facilities requires careful consideration, and anticipation, of the complexities that exist within the delivery of patient care [32]. While published studies have cautioned against the use of open concept areas in ED settings, as these were associated with increased prevalence of breaches of patients' informational and physical privacy, the hospital embraced an open concept design for the sets of chairs located in each zone of the front cell. Although professionals did perceive value in having these chairs, they also cautioned that the chairs served multiple, and often competing, purposes. They were part of an active treatment area, they afforded an intermediary space for patients awaiting their results or further diagnostic testing, and as a result of public pressure, they had also had become part of a secondary waiting room that housed patients along with their family members and visitors. At any time in the ED, members of the public could fill the front chairs for one or more of these purposes. Again, while previous research had

demonstrated the superiority of walled patient areas over those separated by curtains [13, 15], when the doctors and nurses in our study interacted with ED patients seated in the front chairs, they were doing so in an area that was absent of any curtains or walls.

Unlike Lin and Lin (2010) [17], we found that ED staff was very vigilant of threats to the ongoing informational and physical privacy of their patients. While nurses were more limited in their ability to workaround issues brought on by the configuration of front chairs, professionals were aware that during any given shift they might need to search for a quieter, more confidential location to engage with their patient. Locating this space was not an easy task to perform when the ED was experiencing a high volume of patients, and physicians noted that their searches for private space could involve temporarily encroaching on another patient treatment area, another front zone, or moving the patient out into a hallway or corridor. While the conditions that optimized privacy and confidentiality were viewed as being essential for all patients, physicians made a point of highlighting their concerns regarding the vulnerability of individuals who sought medical care from the ED for stigmatized conditions including mental health, addictions, and sexually transmitted diseases. An ED can be the primary source of medical care for patients with stigmatized conditions [33], and while in the moment an attending may feel that moving a patient out from a front chair into a hallway or corridor may be advantageous to the individuals' privacy and confidentiality, doing so may actually bring some risk into that encounter. A survey by Stoklosa and colleagues (2018) found that 90% of American emergency physicians [206/230] believed they deviated from their usual way of performing a physical exam, and 78% [286/369] felt they altered how they took a history when they assessed a patient in a

hallway. When asked about the impact of these disruptions, over one-third of physicians surveyed admitted they had delays or failures in the diagnosis of hallway-assessed patients including cases involving psychiatric conditions, substance abuse, and domestic/intimate partner violence [34].

Our study did not focus on change management, and we do not know how closely hospital management has been working with its front-line, healthcare professionals to monitor the ongoing impacts of the restructured ED. While we do not believe that ED wait times were intentionally privileged over patient privacy, our finding that medical professionals felt the need to move their patients around the department to better afford conditions for their patients' privacy and confidentiality highlights an important, unintended consequence. Given that Lean assumes that an organization will seek continuous improvement through their examination of whether activities are adding value [20,25], it would seem reasonable that the hospital reflects on how the front chairs have been impacting their ED patients and the nurses and physicians who care for them. We do not know if the hospital is achieving its targets for improved ED wait times, but participants expressed that during a given shift in the ED it was common for them to go through the following sequence of activity: request that a patient move out from the front chair area, then ask the patient to accompany them in a search for more private space within the ED, once a suitable spot was located then the professional interacted with the patient as intended, and then they returned the patient to the front chair area. Professionals viewed this workaround as a way to prevent unintended violations of their patients' privacy and, thus in the moment, it was viewed by them as being a value-added activity. However, through the lens of the Lean intervention, it may not be. The workaround is likely adding several minutes to the clinical time spent by the professional on that case,

and as well, adding on to the patients' length of stay in the ED. Our study did not involve

discussions with patients, and we cannot make statements regarding their experiences nor

perceptions of the quality of medical care they received from the ED. Previous research has

shown that while time is important to ED patients, so are other subjective experiences

beyond waiting. Patients can show tolerance for waiting when other aspects of their

experience were perceived as being well met [35-38]. The question of whether patients value

shorter ED wait times over privacy and confidentiality in an ED setting warrants future

attention.

The issue of healthcare professionals being recorded while they provide patient care has been

raising concerns within the medical community. About 86 percent of Canadian households

own a cell phone [39], and many members of the public bring these devices with them when

they seek medical care [40]. In Canada, hospital policies on cell phone use by the public

vary, and there do not appear to be any federal guidelines in place [41].

In terms of patients' perceptions of, and experiences with, making a cell phone recording in a

hospital setting, Oyedokun and colleagues (2018) surveyed 110 patients who were treated for

a laceration potentially requiring suturing at one of three ED located in the Canadian

province of Saskatchewan [42]. In order to contrast patient perspectives about recording with

the opinions of healthcare providers, one hundred and fifty-six ED professionals (n=119

nurses and n=37 physicians) who practiced at one of the three sites were also recruited into

this study. Over eighty percent of patients (81.8%, 90/110) indicated that they had brought a

cell phone capable of making a video or audio recording with them to the ED, and 30.8%

(33/107) had admitted they contemplated making a video on the day they were surveyed.

Statistically significant differences were found between the proportions of patients versus providers who felt that video recording should be allowed in the ED. While 66/107 (61.7%) of patients were in favor of allowing patients to video record while they were in an ED, 51/103 (49.5%) of nurses and 15/35 physicians (42.9%) of physicians indicated they would allow the patient to do so (chi-square Test, p=0.000). When asked, hypothetically, why they would want to make a video while they were having a suturing procedure performed on them, 24/55 (43.6%) of patients indicated that they would want to do so in order to be able to share that experience with others, and 21/55 (38.2%) said it would be for a memento of their experience. None of the patients surveyed felt that they would want to video of their sutures because they were unsatisfied with the care they had received. Fear of legal action, loss of control over the use and distribution of the video, and feeling that it was generally inappropriate to for a patient make a video during their treatment were among the reasons why providers indicated they would decline their patients' requests to record.

While we do not know the contexts under which these incidents occurred, two of the nurses in our study spontaneously recalled, respectively, that a patient overheard a conversation that they should not have been privy to, and also that another nurse sensed they had been being filmed by a member of the public. Both of these nurses felt uncomfortable about what had occurred, and with the findings by Oyedokun and colleagues [42], these incidents continue to raise the question of what degree of informational and physical privacy should be afforded to healthcare providers. Future research is warranted. At one time, the hospital we studied was noted to have a policy that restricted family members and visitors from being in the front

cell. In light of the issues that have been voiced in our study about privacy and confidentiality, it may be time for the ED to revisit the number of members of the public that can be safely, and comfortably, accommodated within patient treatment areas.

4.6 Limitations

This study is not without limitations. As with all studies involving qualitative methodologies, our findings are not generalizable beyond our local context. Exploring the transferability and resonance of our results to other ED settings will require additional research. Given that our study involved discussions with nurses and physicians who provided front-line medical care to patients, we cannot make statements regarding the experiences, and opinions, of patients who received medical care at the ED nor about the family members and visitors whom may have accompanied them. Future research on patients, family members and visitors perspectives is needed.

4.7 Conclusions and Implications

To our knowledge, this is the first qualitative study to explore the impact of a Lean healthcare intervention on the ability of emergency medicine physicians and nurses to optimize conditions for patient privacy and confidentiality. The changes made in the ED included the construction of a three-zone, front cell that received all of the patients flowed forward from triage. Each front zone housed an open concept area outfitted with a set of chairs. Our research illuminated that while, in theory, physicians and nurses perceived that

the chairs were viewed as adding value to the ED environment, in practice, the chairs served the multiple, and often, competing uses by patients, family members and visitors. In an attempt to work around the limitations they encountered and keep patients flowing from triage, physicians and nurses revealed that they often needed to move a patient out from a front chair and then go actively search for another location in the ED that better-protected individuals' informational and physical privacy. These searches involved clinical time and likely impacted the length of stay experienced by some ED patients. We advocate that the physical structure and configuration of the front cell should be re-examined under the lens of Lean's principle of value-added activities. Future exploration of the perspectives of patients, family members and visitors regarding the relative importance of privacy and confidentiality during ED care is warranted.

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CHAPTER FIVE

5 PROMISES MADE, BUT NOT DELIVERED: A GROUNDED THEORY
OF THE PLANNING AND IMPLEMENTATION OF A LEAN
INTERVENTION IN EMERGENCY MEDICINE.

5.1 Introduction

Lean healthcare management can be dichotomized into two primary components: 1) Lean
philosophy, which includes its guiding principles and the need for continuous improvement,
and 2) Lean activities, which involves the tools, techniques, and applications used during an
intervention [1]. Mann (2009) has cautioned that many institutions, including healthcare
organizations, have failed to recognize that the work involved in managing a Lean
intervention entails a balance of these two components, and they have mistakenly
concentrated their efforts on the selection, organization and execution of various assessment
and improvement activities [2]. Institutions must demonstrate to their workers that they have
the leadership infrastructure in place for deploying, and sustaining, a successful intervention
with their commitment to achieving five, Lean-driven, non-industry specific goals. First, an
institution must anticipate and prepared to respond to any difficulties that may arise during
the intervention. Secondly, the institution must follow through on any committed changes.
Thirdly, the institution needs to work to sustain process improvements. Fourth, ongoing
evaluation plans need to include measures to monitor changes made. Finally, the institution
needs to recognize that a Lean intervention is not a one-time exercise and put into place
conditions that will support an ongoing cycle of improvement [2].

Despite the importance placed on leadership for supporting Lean success, few studies have explored the experiences of individuals' involved in the work related to the planning and implementation of an actual Lean intervention within a healthcare setting [3.4]. We located three articles that used qualitative and quantitative methodologies to illuminate the experiences of professionals who were, respectively, at the early phases of their Lean leadership training and were preparing to implement some Lean plans, or had looked at individuals' in reaction to Lean initiatives that were introduced within their work environments.

In the first of two studies on Lean leaders, Aij and colleagues (2013) interviewed 31 Dutch medical professionals with backgrounds in medicine, nursing, and surgery who had completed a Lean methods training program and were preparing to implement an action plan in at least one area within their clinical department [5]. While interviewees perceived their Lean training to be beneficial, they still admitted to having difficulty transferring the knowledge and skills they felt they had gained from their training program into their actual work environment. Interviewees recalled encountering several challenges while they attempted to work with their internal Lean implementation teams. These challenges included senior leaders having limited involvement with their internal Lean team, local team members having o limited understanding of the guiding philosophy of Lean, and teams having a general lack of clarity about their individual, and collective, responsibilities. Moreover, several interviewees recalled encountering departmental resistance to change and overall, participants in this study noted that they would need to be vigilant of resistance to change as their Lean initiative unfolded.

The second study is from Goodridge and colleagues (2015) who interviewed 27 individuals, including clinicians, nurses, directors and managers, front-line staff and patients after they had participated in Lean leadership training in preparation for the upcoming province-wide Lean initiative for the Canadian province of Saskatchewan [6]. Participants who were working in a healthcare environment anticipated that a barrier they would likely face during a Lean initiative was co-workers who held negative beliefs about Lean. Interviewees sensed there was existing variability amongst their coworkers' perceptions and engagement with Lean, and they anticipated they would experience the most difficult interactions with individuals who were reluctant to change. Interviewees also noted that, although Lean initiatives were still to be formally introduced into their work environment, some staff had already begun openly questioning how the upcoming changes may impact their jobs. To justify why changes were being made using Lean Thinking, interviewees anticipated that measurement and dissemination of local data were going to be a vital process. Regardless of their coworkers' pre-existing opinions about Lean, participants in this study recognized that transitioning to new models of service delivery was going to be challenging for healthcare workers.

Finally, Holden and colleagues (2015) used a mixed-methods approach, to explore the perceptions of healthcare professionals working at one of three Swedish hospitals, generically labelled A, B, C, that had begun to implement Lean-driven changes [7]. In total across the hospitals, thirty-eight professionals were interviewed (n=10 physicians and n=28 managers) and 265 professionals submitted surveys (n=170 nurses and n=66 physicians). Survey data revealed significant main effects of hospital on professionals' opinions of process flow improvement with Lean, ($F(2,223)=7.96$, $p \leq 0.01$), their institution's

commitment to Lean (F(10,224)=8.41, p≤0.01), and their general attitude towards Lean (F(2,223)=4.88, p≤ 0.01). Professionals practicing at Hospital A were found to have expressed the least favourable opinions on each of these measures. During their interviews, physicians from Hospital A spoke voiced frustration over their hospital dismissing some of the improvement suggestions they received due to their cost, Lean projects were not being sustained, and doctors had limited control over managerial decisions regarding Lean. The authors noted that interview data tied the poorer attitudes of professionals from Hospital A to several contextual factors regarding how that healthcare institution had planned and executed their Lean initiatives. Hospital A was inexperienced with Lean, and they employed temporary support to guide their Lean efforts. One Lean consultant was hired, on a contracted basis, for every clinical department in the hospital. Hospital A also had two of its managers undergo Lean training, and it was expected that after the consultants' contracts ended, these two managers would then take over the task of educating all of the other managers employed by the hospital about Lean. However, Hospital A did not invest in developing local physicians to take on local Lean leadership roles and have these individuals serve as Lean champions within their departments. The authors also noted that, in comparison to Hospital A, the other two hospitals spent more time doing Lean training, exercised greater discretion over the degree to which physicians and nurses participated in their initiatives and had managers with more significant experience in Lean.

5.2 Objective

Although these existing studies have begun to examine the experiences Lean leaders, and also, of workers whose clinical practice environment was modified with the use of Lean Thinking, the discourse is still light on descriptions of the actual processes that were involved during the planning and implementation of Lean healthcare interventions. If we hold the expectation that the success of a Lean initiative relies on an organizations' ability to recognize and respond effectively to any barrier it may experience, including workers' resistance to change, we will need to have a better understanding of what contextual factors may have helped catalyze that barrier in the first place. The purpose of the present study was to explore the experiences of nurses and physicians during the planning and implementation of a Lean-driven intervention.

5.3 Methods

5.3.1 Study Design

This research was part of a larger grounded theory study that examined how emergency medicine nurses and physicians were impacted by a Lean intervention undertaken a single teaching hospital in Ontario, Canada [8-9]. Grounded theory does not test hypotheses or existing theories. Instead, this qualitative approach seeks to explore how individuals experience and give meaning to events [10-11]. Grounded theory has been recognized to be particularly useful for exploring phenomena about which little is known [10-12]. Sampling in grounded theory is non-probabilistic and does not involve an apriori, statistical calculation. Instead, a purposive sampling approach is undertaken in which the researcher seeks

information from individuals who are considered to be optimally relevant to the goal of the study [10-11]. Data collection in grounded theory uses an iterative, constant comparative approach in which new information is considered in light of what has already been collected from study participants [10-12]. This technique supports the researcher to illuminate ideas both within and across participants and be able to refine the interview probes for subsequent participants [11-12]. In grounded theory, data collection continues to theoretical saturation of meaning at which point the researcher senses that the amount of information gathered during the study is sufficient to support illumination and understanding of participants' perspectives and that the gathering of additional information is not likely to introduce major modifications to that understanding [11-12].

We utilized a realist lens for our grounded theory. Wong et al. (2012) explained from philosophical viewpoint realism is situated in-between the post-positivist and constructivist stances [13]. That is, while realism recognizes a material, objective reality can be approximated through data gathering, there is also a reality shaped by individuals' social experiences. Pawson and Tilley (1994) advocated that research that is aimed at understanding how an intervention is taken up within a given setting, attending to its context is necessary. All settings contain socially interactive factors. These factors may support or constrain how well an intervention is taken up within an environment. Contextual factors include the individuals who are experiencing the intervention, their interpersonal relations, the institutional setting of the intervention and the impact of its greater infrastructure [14].

5.3.2 Study Setting

The teaching hospital has 1,000 beds and two adult emergency departments (ED) which treat approximately 128,000 patients annually. From July – December 2017, the entire cohort of emergency nurses and physicians who were practicing at either of the two ED were sent timed emails to their official hospital account. The email invited eligible professionals to consider participating in a single, semi-structured interview. As the study was interested in exploring the impact of the Lean intervention, only nurses and physicians who had begun practicing no later than January 01, 2013 were eligible to participate in an interview. This date precedes the start of the planning for the Lean intervention by about eight months. Four emails, each separated by six-week intervals, were sent on behalf of the study by an administrative office that manages the ED sites. The advertisements asked professionals to reply to EMZ's, official university email if they were interested in potentially scheduling an interview. Interviews were scheduled for a time and location that was convenient for a professional. Participants received a 20-dollar gift card as an honorarium. Interviews were audio-recorded for later transcription into anonymized, electronic documents by a professional service. Due to the hospital's privacy regulations, we were not given access to the lists of hospital email addresses for the nurses and physicians practicing at the two ED, the numbers of nurses and physicians who met our study's eligibility criterion, nor the total numbers of nurses who practiced at the two ED sites. We did not inform the administrative office of participants' identities. Our study's protocol was approved by the both University and hospital-level research ethics boards.

5.3.3 Data Analysis

The transcript for each interview was read line-by-line by EMZ and information from the document was first coded into a set of categorical topics [10-11]. An analytical software program was used to support data management and coding [MAXQDA software, Version 11.2.5, VERBI Software, Sozialforschung GmbH, Berlin, Germany]. Two members of our team reviewed their consistency of coding (RB, LS) with EMZ for two of the transcripts. Categorical coding continued by EMZ alongside data collection and information from new interviews was successively compared to an existing set of codes. Through the repeated review of the interview transcripts and evolving rounds of coding, the categorical topics were then organized into sets of themes. EMZ, RB, LS reviewed these themes, and we sensed theoretical saturation after 20 interviews.

5.4 Results

Fifteen nurses and five emergency physicians were interviewed, and eighteen of these individuals had been practicing emergency medicine for at least ten years. Mean interview time was 53.8 minutes (11 minutes SD). The corpus of 20 interview transcripts contained a total of 413 pages with 171,592 words of content.

5.4.1 Themes

All of the healthcare professionals who were interviewed during our study recalled their experiences while the Lean-driven changes were being planned and implemented at their ED site. Their experiences revolved around four themes: 1) Times of mixed emotions, 2) It seemed like a lot of top-down decisions were made, 3) The letdown, and 4) Where's the follow-up? After a description of the activities that were involved during the planning and implementation of the Lean intervention, we will unpack the four themes and use anonymized quotes to help illustrate, and ground, our findings to the voices of participants. Quotations that are labelled with 'N' were taken from an interview with a nurse, while those labelled with a 'P' arose from an interview with an emergency physician.

5.4.2 Emergency Department System Transformation

During the fall of 2013, in response to poor patient wait times, the hospital began the planning process for a multi-million dollar, system transformation of its two ED sites. The official name of the initiative was the Emergency Department System Transformation (EDST). Bed blocking, a situation where the number of patients requiring hospital admission exceeds the number of available beds, was a recognized, ongoing barrier to patient flow at both sites of the hospital. With regards to ED wait times the EDST project estimated that the issue of bed blocking contributed to 80% of the problem of slowed patient flow in the two ED. The remaining 20% was attributed to processes directly involved in ED care. It was

anticipated that streamlining of ED processes would result in improved patient wait times, and this was the focus of the EDST.

The hospital first contracted an emergency physician who was already practicing at one of the EDs to serve as its project lead. This local professional had expertise and experience in the Toyota Production System and Lean methodology. The project lead began his work by presenting a series of lectures about Lean to ED staff, and at some point, the term 'Toyota' became commonly used by staff at both sites to refer to the EDST initiative. All of the ED staff from both sites had been invited to consider volunteering to become part of a local project team that would spearhead the assessment activities involved in the planning process. Including the project lead, a team of about 50 people was assembled as the EDST's project team, and its membership included departmental leaders, senior hospital managers, facilities management staff, emergency physicians, nurses, and non-clinical staff. These individuals volunteered their time to support the EDST.

As part of its work to streamline processes in the ED, the project team took part in a variety of activities. These included accompanying senior hospital officials in their observations of the ED (gemba walking) [15], and detailed review of the clinical activities that were being performed by ED nurses and physicians during their provision of ED patient care (value streaming) [15]. The project team then reviewed patient care activities regarding whether they were perceived as being beneficial versus wasteful (muda) [15] from the perspectives of both the provider and the patient. Mini-projects (kaizens) [15] were then built to explore how ED processes could be reorganized and streamlined to eliminate identified muda. The construction of a three-zone, front treatment bubble or cell became the prioritized

improvement activity for the EDST in 2014. The physician project lead left their employment at the hospital before the end of construction for the EDST. Throughout the initiative, the departments utilized a variety of methods to facilitate knowledge transfer to its ED staff. These included multiple, in-person, group discussions (both half and full-day sessions), screencast presentation, which involved a PowerPoint presentation with accompanying, recorded narration, and YouTube-hosted video, briefing notes and emails. In at least one of the knowledge translation sessions, the 80-20 bed-blocking ratio was acknowledged, and it was emphasized that the intervention was not focused on alleviating admitted patient pressures. Simulation sessions were organized both on and off-hospital sites. The departments repeatedly encouraged its ED staff to consider becoming part of the project team, share department-disseminated information about intervention with their local ED colleagues, and to provide their input to the project team.

5.4.3 Times of mixed emotions

Participants recalled that during the knowledge translation sessions, various members of the project team repeatedly communicated, and promised, that many changes or deliverables were going to be met by the Lean intervention. These promises included commitments that the hospital would reduce the number of admitted patients at each of the two ED sites to help alleviate bed-blocking. The physical layout of each ED would be improved, and patient flow was to be streamlined at each site. Further, during each shift, there were to be adequate numbers of staff working at each ED to meet their patient load demands and to provide coverage and breaks:

So the promise was [to come from this intervention], adequate staffing, the hospital promised virtually no admits. So they said, I think at [site anonymized] it was maximum eight admissions, and [site anonymized] three. I could be off on those numbers, but it was a very low number, which would allow flow. We were promised two nurses [in each of the three zones of the front bubble], an EDT, which is an Emerg Tech who's kind of a handy person for skills, and a clerk that would be shared between three [bubbles], but that [Emerg Tech] would always be there. [P201]

When the whole discussion initially started with Toyota, we were told that the physician wastage was us moving around the department so much, that it would be better, and the reason that the Toyota system was thought to be an improvement was that the patients came to the doctor, not the doctor to the patient. [P204]

Nurses and physicians recalled that they, and their colleagues, experienced a mix of emotions during the planning and implementation phases of the EDST. Several interviewees remembered feeling optimistic about the initiative because its official launch, the efforts shown by members of the project team, and the set of promises that were made to ED staff about what was going to be improved at both sites was a sign that the hospital was sincerely invested in making meaningful improvements in the two EDs:

I will admit that people were extremely motivated for this because, at the time, I think everyone in the department understood that we were going through a lot of problems, or, sorry, that we weren't going, that we were facing a lot of problems, and I think we needed to do something. So, it was great to see so much motivation and hope in making a positive change. And I know that our CEO and other higher VPs in this institution said that they were going to make flow [patient flow in the ED] a priority. [N102]

I'm going to be completely honest with you I was very optimistic off the get-go. I was [information about this individual's participation in the EDST is anonymized], I was a part of the grassroots of trying to make this system work. Not necessarily for it [insisting that we had to do this], but I wanted to be, you know, people look up to me in the department, and it sounded like it could work. Like, it made sense. [N105]

On the other hand, some nurses and doctors admitted they were afraid of the scope of the Lean initiative, and the breadth of changes that were promised to occur with it:

Just the fact that they wanted to change it and the way that it was going to be coming about, I feel like it was glorified, in terms of, it's going to be this big, wonderful thing, and it is going to change everything. Obviously, many of the staff were concerned because it [the intervention] was very big, people don't like change, and I think that was the biggest piece. A lot of people were saying, 'Well things have to change' and they do. But [did we need] such a big overhaul? And it is kind of why [do you need to] change things that aren't broken? People could debate that things maybe weren't broken in the old way. [N101]

Yeah, because it [the intervention] rolled out over months and months, so there was a lot of planning that went into it. Physicians, probably in general and certainly emergency physicians, we have proven, in the past, we are somewhat phobic to change. I personally like an environment, because emergency medicine deals with a lot of unknowns, I like to have an environment that I know is static and I know what to expect in that environment. It was very anxiety provoking, and we [the department] had a lot of meetings, a lot of discussion as groups and we [the department] were certainly involved in the planning. So it was planned out, I think, as best it could be, but we were still phobic to change to the point where some members of the group [of emergency physicians] thought it was the worst thing that has ever happened in their career. [P200]

The promised changes were also met with some skepticism. Several participants, including this physician, recalled that from the time that the Lean intervention was announced, some of their more experienced colleagues had been quite vocal about expressing that they doubted the Lean intervention would be able to revamp the ED successfully. These senior colleagues had highlighted that the hospital had tried unsuccessfully in the past to make meaningful changes to the ED, and because of this history these senior colleagues weren't confident that this latest attempt would fare any better:

I was at the very first meeting that Dr. [name anonymized] and Dr. [name anonymized] gave at one of the hotels. There was a sense of real optimism by the people that were rolling this [the EDST] out, but, obviously, there was a sense of skepticism, too, from people that had been in the emerg for a long time. This [the EDST] isn't the first time they've tried to remodel the emerg. [P203]

Other interviewees also admitted they, too, were skeptical about whether the promises that were made for the EDST could occur because during the knowledge translation sessions it was presented to them that its guiding principle, Lean methodology, arose from Toyota Motors. Based on the information that presented during the knowledge sessions, they struggled to see a legitimate connection between emergency medicine and car manufacturing:

> *I think, in a utopia, yes, everything would be perfect, wouldn't it? You wouldn't have difficult patients who need to be tied down, or you wouldn't have people covered in feces because they've been there for days. Or somebody who is demented or acopic, like they just can't tolerate life right now. Cars or I understand some of the Lean Principles, and ideally, it would work, but it doesn't. We can take some of those principles, but I don't think we can expect that it's going to work. And I don't know if it's even ever going to be a complete match, because, with patients, it's ever-changing. With cars, or any manufacturing, you have a product that is going down, and it's the same, it takes the same amount of time to do this [send a car down the line]. [N108]*

> *We're dealing with human beings. We're not dealing with parts. We're dealing with human beings who are potentially going through crises. And to just push them through, push them through; push them through [doesn't make sense]. [N115]*

Several participants put forth that their hospital may have been better positioned to have opted for intra-disciplinary insight including reaching out to other ED for ideas on how to they improved their wait times or making a more concerted effort to gain insight from their local cadre of experienced, front-line professionals:

I think, overall, it's ill-advised [to use ideas from car manufacturing]. I think that it doesn't take into account many of the issues because it's [car manufacturing] a different task. There are probably some lessons you can extract from it. But I think, what would probably be better than extracting a lesson from manufacturing would be extracting a lesson from another emergency department that's doing a good job. Why are we reinventing the wheel? I'm sure some systems apply to healthcare. We can learn from these. I'd rather see that, but I don't think it is all that bad. But, overall, not what I would think is best. [P202]

Other interviewees became skeptical about whether the EDST would be as successful as promised because of a number of concerns. First, non-technical sounding names were assigned to aspects of the newly planned ED. Second, scheduled simulation sessions were either inefficient or cancelled because of bed-block. Finally, repeated front cell construction delays remained unexplained by the project team. As these two nurses explained, these events did not reinforce a sense of confidence that the EDST would be successful because:

Of course, we made fun of it, [the names of] the bubbles and the PAN nurse. And they wanted to call the PAN nurse the sensei at one point. We were all like, 'Why?' We kind of looked at them [the project team] and went, 'No.' We went to [the name] PAN nurse, and I know people go, 'What's a PAN nurse?' They were trying to make it [the ED] be friendlier, I guess. People associate bubbles with happiness, I think that's what they were trying to do [by using these types of names]. 'You're going into the front bubble.' [N112]

[A simulation session] It's a best-case scenario of how it's supposed to go. Well then, you started to see a lot of, 'We can't run Toyota today. We can't do our Toyota trial because we're too bed blocked'. That happened all the time between [names of the two site are anonymized], it would have to get cancelled all the time because we couldn't accommodate [doing the simulation run]. And that's when people were like, 'Oh boy, this is such a fail, it's never going to work,' and the chatter started. And then, I don't remember when exactly, but it was supposed to be fully implemented, and rolled-out and it [the new ED] kept getting delayed, and delayed, and delayed. [N114]

5.4.4 It seemed like a lot of top-down decisions were made

While participants acknowledged that the project team took on a lot of difficult work during the planning and implementation phases of the EDST, several professionals recalled an experience where they had vocalized, to the physician project lead or to another member of the project team, a concern or a question about what was being planned for their ED. The response that was received from that project team member left the professional feeling that they were not being taken seriously or that they shouldn't have brought their opinion forward to the discussion at all with that member of the project team:

I went [the individual's level of participation in the intervention is anonymized]

initially. I stopped because any time you would ask questions or challenge something,

it was just, 'No, you're a non-believer. I said, 'How this was going to work? I'll

understand it'. And he [the physician project lead] said to me, "Well, there is nothing

to explain, dear. You just have to believe, and it will work.' I laughed, thinking he was

joking. And he says, 'No, really, there is nothing to understand. Just believe, and it

will work.' That's when I was like, 'Okay, peace out.' [N110]

A lot of physicians had a lot of thought processes that they didn't always agree, so to

speak, with it [the EDST] moving forward. They [project team] became the core group

of people that they had, kind of, behind the scenes, organizing the construction aspects

of everything. It became very weird. I don't know how else to describe it. It was like

they were like a cult. It was like they [project team] were like these minions under that

gentleman's [physician project lead], but they still weren't listening to the people that

were stomping the pavement every day, because those people were then and still now

are in offices and doing whatever [they are not delivering patient care]. [N108]

Once the plans for changes were approved, participants noted that there was a sense that the EDST was not open to any further discussion, feedback or negotiation. Interviewees perceived that their departments, and hospital, expected that their ED staff would comply and accept the changes that were coming to the two ED sites. Participants also perceived that there were negative social consequences if a nurse or physician was critical of the planned changes, and their skepticism became known within their department. Rather than being viewed by as a professional who was passionate about making the best possible changes to

the ED, that person would be unflatteringly labelled by the members of the project team or departmental management with names including non-believer, doubter, a negative person, and skeptic:

> *All the things we're experiencing [while the EDST was being planned], staff were saying, 'This is going to be a problem, this is going to be a problem, this is going to be a problem.' And they [project team] just kept going. Well, if people foresee all these things and you don't listen to them, and then it happens, we're just stuck in this mess. We're stuck in this non-functioning mess that we saw coming, we saw this train wreck coming, nobody listened, and now they're like, 'Well, deal with it. You saw the mess, we didn't listen, now you deal with the mess, sorry.' And if you didn't, management was not okay with you. It was known that you were speaking out.* [N113]

> *Yeah, our skepticism was that we were doubters. We were relegated to the other side of the tracks. Yeah, 'you guys are doubters, you don't know what you're talking about, and you're the outliers, and you're negative, and you're blah, blah, blah.' So, we were sort of poo-pooed that way.* [P201]

5.4.5   The letdown

While nurses and physicians did acknowledge there were some improvements made to their practice environment with the EDST, and there were times when the new model worked well to meet ED patient demands, participants still perceived that their hospital did not deliver on the set of promises that were communicated to ED staff during the knowledge translation

sessions. Professionals complained that they felt inadequately trained to work in the ED's front cell when it was opened, the new ED was continually understaffed, and it was still common at each site to have people waiting for long periods before being seen by an ED physician. Overall, professionals expressed a sense of being let down by their hospital with the Lean-driven model that was implemented at both ED sites:

> *We were promised, and I think this is why a lot of us are having a hard time with the whole Toyota thing. We were promised that it was going to change wait times. We were also promised it was going to get rid of admitted patients in the department. That's what, I guess, most infuriating about it, that we've seen the amount of money that has been sent to develop this program and nothing seems to have changed.* [N100]

> *On the process, basically, what they said [would happen with the intervention] and what occurred were two different things. Like the support that was supposed to be available in the bubble, but they were just trying. They tried their best to model this plan through.* [N103]

> *The idea of a big change was appealing, no matter what it was, because we are all aware that what we were doing wasn't working with eight-hour waits, with sick people in the waiting room, things like that. The idea of fixing that, with the idea that it will be better for the patients, okay, I'll suffer through some learning curves and figure it out. But now that it hasn't fixed anything, it hasn't fixed wait times. It hasn't fixed sick people in the waiting room. It hasn't fixed ambulances waiting to come in in the hallway. It becomes more and more difficult to understand, why did we do this?* [N111]

The biggest disappointment that participants noted with the EDST was that it failed to acknowledge, and focus, on the primary driver of poor wait times experienced by patients' at both sites was the issue of bed-blocking. During their interviews, several participants adamantly reminded out loud that alleviating bed pressures was disseminated as being part of the intended spectrum of changes that were going to be tackled by their hospital. Participants also advocated that the new system of ED care could not be expected to be consistently effective given that the hospital was still continually facing combined pressures of high volumes of patients and low numbers of available beds:

> *The reason that the staff could not assess the patients and so many patients were sitting in the waiting room was that the difficulty with the system and this is true of all Canadian emergency departments, is on the back end. There are not enough hospital beds. So, the problem is the back end. And the Toyota system completely fails to address the back end, which is where our problem is.* [P204]

> *Bed block is critical, and the hospital promised to keep us out of bed block. They have never been able to keep that promise, ever. In my opinion, if we had 40 beds and no admits then I think it [the new ED] would run very well.* [P200]

5.4.6 Where's the follow-up?

Professionals also expressed frustration about the lack of transparency their hospital had shown regarding the potential success of the EDST to meet its intended outcomes. Nurses and physicians were unsure of what institutional efforts had been put into place to monitor

the new ED. Several interviewees wondered out loud what patient-level metrics were being used to examine whether the Lean intervention was successful in reducing patient wait times in the ED, whether other aspects of the patient experience were being considered, and what aspects of staff experience were of importance to their administration. Moreover, some participants sensed their hospital might be reluctant to become informed and acknowledge that the Lean-driven changes made to their two ED did not fully achieve what was anticipated to occur:

> *Like, in a way, we've been lied to or promised something that has never happened. Sometimes, it feels like management refuses to call defeat. Everybody still wants to remain so optimistic about what's going on with Toyota, but, really, what have we changed? The wait times certainly haven't changed. What are they using as a benchmark to say things have changed? I don't know.* [N106]

> *Well, we've been doing the Toyota thing for a while now or pretending to do the Toyota thing for a while now. Toyota was presented to us as a way of not having people in the waiting room, but we have people in the waiting room. So, it's not working. Patients are waiting too long, too long for what was sold to us as the product that would solve all these problems.* [N104]

5.5 Discussion

To our knowledge, our study is the first grounded theory regarding the experiences of emergency medicine nurses and physicians during the planning and implementation of a large-scale, Lean healthcare intervention. Our research has revealed that healthcare professionals' optimism about, and ongoing engagement with, a Lean intervention is strongly influenced by the interpersonal interactions they have with individuals who have been entrusted by their department, and institution, with the responsibility of leading Lean-driven change. Professionals in our study described how their hospital fell short on demonstrating effective leadership throughout the development and execution of its Lean-driven plans. Of particular salience was professionals' identification of how their institution had failed to deliver on a set of procedural and structural changes they recalled were promised to occur as a result of the Lean intervention. Participants noted that several key individuals holding senior leadership positions within their hospital disseminated these promises.

Although participants' acknowledged that there were times when the new ED model worked well to meet patient demands, professionals still perceived that they had been let down by their hospital by the Lean intervention. Rousseau's theory of psychological contracts may help to understand this dual perspective. Rousseau (1989, 2001) postulated that workers form psychological contracts, which are complex sets of beliefs involving their employers [16-17]. These beliefs are "promise-based and, over time, take the form of a mental model or schema, which, like most other schemas, is relatively stable and durable" [17, p. 512]. A psychological contract can be formed by employees regarding any aspect of their work [18], and that once that schema has been formed, workers believe that an agreement or understanding that has been made with their employer and that agreement "binds the parties

involved to a particular course of action" [17 p. 512]. Regardless of whether their schema is accurate when an employer fails to fulfill their anticipated commitments, employees are more likely to react negatively [17-18].

One promise that participants stressed in their reflections was that a commitment was made to alleviate bed pressures at both hospital sites. Hospital bed shortages are known "choke-points" for Canadian hospitals [19, p. 27], and professionals who were interviewed in our study expressed frustration over their institution's ongoing failure to successfully reduce the impact of hospital bed shortages on its own ED wait times. Moreover, several interviewees highlighted that given that bed shortages were a known barrier and there were instances when an EDST simulation session was postponed due to hospital bed block, their institution should have anticipated how bed shortages would eventually impact the changes made to the ED.. Robinson and Morrison (1997; 2000) highlighted that when workers perceive a violation of psychological contract has occurred, either due to their employers' reneging on an expressed agreement or to incongruence between what their employer intended to communicate versus what was perceived and experienced by the employee, workers can become more vigilant to instances of perceived contract transgression [20-21]. We do not know why the decision was made to outwardly clarify that the Lean intervention was only aimed at improving the 20 percent of processes that were directly attributable to the ED, or how the 80-20 ratio was conceptualized. It may be that its declaration acted to reinforce to ED staff that their hospital was reneging on the commitment that they would reduce periods of bed block. Jordan and colleagues (2009) advocated that ongoing conversation is essential to any intervention aimed at improving healthcare delivery. Conversation supports individuals who are going to be affected by pending changes to make sense of, understand why, and have trust that changes

need to be made [22]. Sutherland and Crump (2013) have cautioned the solution to hospital bed shortages is complex and requires actions outside of merely adding more beds [19]. Without being provided with adequate follow-up discussion, and clarification, regarding why their hospital had not made improvements to reduce bed shortages while a highly-funded, quality improvement initiative was underway, the nurses and physicians who were interviewed in our study were left feeling frustrated and less trusting of the decisions that were made by their healthcare organization.

Similar to the Swedish case of hospital A that was described by Holden and colleagues (2015), the Canadian hospital we studied hired a lead change agent on a contracted basis [7]. This individual was a practicing physician in one of the ED, and this individual received assistance from a group of staff that volunteered their time to support the EDST. While having a local clinician experienced in Lean Thinking was viewed as a strength by Holden's study (2015), at the hospital we studied the physician project lead left their employment before the end of the EDST. Given that Mann (2010) emphasized that the work of Lean must be viewed as a continuing cycle of change [23], the question of what efforts the hospital made to invest in the development of local Lean champions within its two departments is essential. We also do not know if there were plans to invest in the development of other ED physicians to become local Lean champions in their ED, but the study by Holden (2015) suggests that doing so could have been beneficial.

Davies et al. (2007) have cautioned that healthcare organizations often struggle to convince its clinicians to participate in quality improvement activities [24]. Multiple reasons underlie doctors' disengagement with quality improvement, including experiencing conflict with

one/more members of a committee charged with carrying out an improvement initiative and physicians having concerns about whether planned initiatives will deliver their intended benefits [24-25]. Professionals in our study also expressed these sentiments. Consistent with work by Aij and colleagues (2013), Holden (2015) and Goodridge (2015), participants in our study also spoke about encountering interpersonal tension during the planning of a Lean initiative. Although the hospital repeatedly invited input from its staff, some participants described that when they did so they were labelled by a member(s) of the EDST project team as being difficult to work with, or they were aware some of their colleagues had been viewed in this light by the project team or management. Some interviewees did admit to feeling apprehensive about the scope of changes that were initially proposed to occur at the onset of the Lean intervention. However, there were also participants in our study who described having difficult interactions with members of the project team when they asked for more clarification, or they had expressed their opinion regarding an aspect of the EDST. These exchanges left participants feeling like they were being dismissed from participating in the initiative. Mann (2010) asserted that disagreements are common during Lean planning [23], and while we do not believe that the department intended to quiet input from its ED staff, as a result of the interactions that were described by some interviewees indicated that they had received that unintended message.

Also consistent with Holden (2015), participants in our study expressed frustration over how they perceived decisions were being made during the redesign of the ED. While Lean Thinking is intended to a bottom-up approach that relies on the input and engagement of both management and workers [15; 26], there was a sense amongst participants that the primary driver of decisions during the EDST was the project team. Again, while the hospital may

have outwardly invited healthcare professionals to bring their input forward, some interviewees did not appear to be confident that their voices were valued. Professionals also expressed frustration about the lack of transparency their department had shown regarding the metrics that were being used to monitor the redesigned ED. While participants acknowledged there were times when the new model worked to meet patient demands, they noted this was not the new status quo, and they wondered what performance evaluation plans their department, and hospital, had developed.

Moreover, some professionals raised the question of whether their hospital wanted to know whether their Lean efforts had resulted in positive change. We are aware that daily ED wait times are posted on the public websites for each of the sites, but we did not approach the hospital for information regarding what other formal metrics they utilize to monitor ED performance nor whether their ED has shown improvements in their wait times since the Lean intervention. We have previously raised the question of whether the nurses and physicians who deliver ED patient care and hospital management share similar definitions of what constitutes a successful Lean intervention [8]. Future research is warranted.

Finally, there were some questions raised by nurses and physicians regarding the suitability of Lean to guide healthcare change given that its philosophy and methods were borne initially out of automobile manufacturing. While we do not know what education was given to the cohorts of staff in each of the departments at the onset of the EDST, it was clear that at some point Lean's history was communicated because the term Toyota had become embedded within the rhetoric used by the departments to describe the EDST. This study did not examine in depth professionals' perceptions of the suitability of Lean for redesigning

patient care environments in emergency medicine. The arguments used by some of the nurses and physicians we interviewed to explain why they were skeptical about their hospital using Lean included comparisons of the degree of complexity inherent in medical practice versus what they perceived occurred during automotive manufacturing. Future exploration of nurses and physicians perceptions of the legitimacy of Lean healthcare is warranted.

5.6 Conclusions and Implications

To our knowledge, the present study is the first grounded theory regarding the experiences of emergency nurses and physicians during the implementation of a Lean healthcare intervention. Nurses and physicians who were interviewed in our study described how they perceived their hospital fell short on demonstrating effective leadership during the development and execution of its Lean plans. We theorize that while nurses and physicians are observant of a spectrum of actions that are displayed by Lean leaders throughout planning and implementation phases of an intervention, they appeared to be particularly vigilant of the perceived congruence between what was promised to occur as a result of the intervention with the actual changes that were introduced to their practice environment. Participants also described having some difficult interactions with members of the project team and how these moments led them to perceive that their input was not of value to their departments' unfolding plans for change. We advocate for future exploration of healthcare professionals' perceptions of the legitimacy of using the Lean methodology to guide healthcare interventions.

5.7 Limitations

Our research has limitations. As our study involved discussions with emergency nurses and physicians who were not involved in managing the EDST, it would be valuable in the future to also explore the perspectives of individuals who held leadership positions for the Lean intervention undertaken at the hospital we studied. As with all work involving qualitative approaches, our findings are not generalizable beyond our local setting. Exploring the transferability and resonance of our results to other ED settings will require additional research.

5.8 **References**

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CHAPTER 6

6   SUMMARY AND CONCLUSION

To my knowledge, my dissertation presented the first grounded theories regarding the experiences, and impacts, of emergency nurses and physicians with a Lean intervention that was intended to make their ED work easier, faster, and better. Overall, I theorize that the changes that were made to the practice environment and patient care processes of the ED disrupted physicians' and nurses' established routines of clinical workflow and collaborative practice. This disruption in combination with ongoing patient volume pressures experienced at both ED sites acted to synergize conditions of clinical work intensification. Nurses and physicians described how practicing in an intensified clinical environment had detrimental impacts on their physical, cognitive, and emotional well-being. Professionals sensed that, since the introduction of the Lean-driven changes to their department, their colleagues' morale had declined and more sick time had been requested. As a result of working in an intensified environment, some professionals admitted that they were contemplating leaving their role in the ED or were aware of colleagues who had already left (Figure 1).

EDST was intended to make ED work easier, faster & better

EDST
- Major kaizen project was three zone front bubble (cell)
- One physician assigned per zone/shift
- Two nurses assigned per zone/shit
- Patients flowed to a zone from triage
- If patient is not discharged, they will be moved to middle/back bubble
- New ED maximize number of patients treated

During periods of low patient volume, redesigned ED has potential to work well

As new model assigns physicians and nurses to front cell, nurses do not need to search for attending within ED, and physician has an opportunity to develop better rapport with front zone nurses

During periods of high patient volume, push forward model of patient care is emphasized

How our clinical work is not easier
- Diminished opportunities for physicians' strategic patient pulls
- Diminished opportunities for physicians to support each other
- Diminished opportunities for nurses to support each other
- Nurse may be working alone in front zone if sick colleague is not replaced during shift
- Moments of tension with PAN regarding flowing of multiple, complex cases
- Nurses performing more physical work in the front bubble
- More menial tasks performed by physicians and nurses
- Increased interruptions, need to double check work, less confident that work meets expectations

Conditions of work intensification

How our clinical work is not faster
- Continually moving patients around to accommodate ongoing push forward from triage
- Crowding around front zone chairs makes it difficult to complete clinical work
- Major workaround needed to maximize physical and informational privacy of patients involved searching for quiet space
- May need to double-check work, have information repeated, menial work performed by physicians and nurses
- Eventually, patient flow will stop due to bed-blocking

Are the ED better?
- Ongoing physical, cognitive, emotional impacts experienced by physicians and nurses
- Increased requests for sick time from nurses
- Awareness of colleagues' lowered morale and professionals contemplating leaving their ED role
- Perceived lack of transparency from hospital regarding metrics used to monitor wait times
- Bed-blocking was not addressed by EDST
- Nurses less involved in critical assessment and monitoring of patients
- Diminished opportunities for nurses to develop rapport with patients and family members
- Disrupted routines of interaction between physicians and nurses
- ED patients treated in open concept area with chairs
- Major workaround used by physicians and nurses to try to maximize physical and informational privacy for patients
- Risk of patients' with stigmatized conditions interacting with physician or nurse in presence of other members of the public
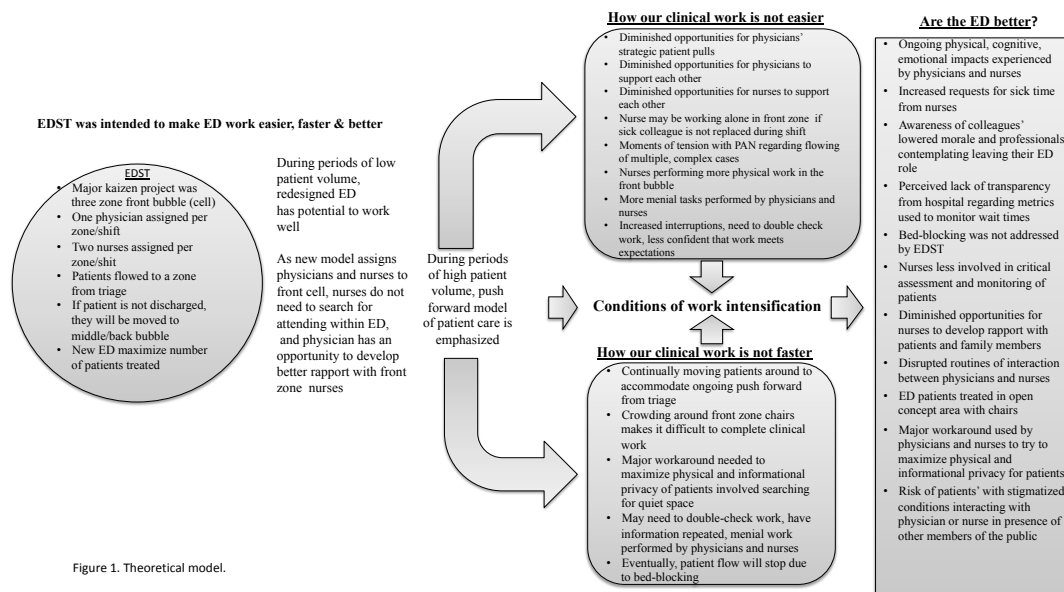
Figure 1. Theoretical model.

Figure 1. Theoretical model.

Lean Thinking operates under the premise of providing value to one's customer [1-3]. While

the notion of a singular customer may be defined within other disciplines or industries,

Young and McClean (2008) have pointed out that with regards to healthcare, a singular,

unitary definition of a patient does not exist [4]. All members of a community, including

physicians and nurses who serve as care providers, can conceivably require medical attention

at any point in time. Moreover, these authors noted universal agreement does not exist

regarding what constitutes value in healthcare. At a minimum, healthcare value revolves

around three themes: clinical, operational, and experiential [4]. The grounded theories that

have been put forth from my dissertation research raise some questions regarding the

potential value of the changes that were made in the two ED under the operational and

experiential themes.

Young and McClean (2008) defined operational healthcare value as "the prime operational

effectiveness of the service, measured primarily in terms of cost (including that which is lost

through delay and poor quality)" (p. 385). The healthcare professionals that I interviewed

identified that the design and construction of the front cell was a major element of the Lean

intervention, and that the new ED model had shifted from being acuity-based to one that was

orientated towards maximizing the number of patients their ED sees daily. The articles that I

presented in Chapters 3 and 4 outlined that, rather than make nurses and physicians feel like

they were more efficient, professionals indicated that the physical and process-based changes

seemed to further complicate their clinical practice environment. During periods of high

patient volume, a situation that nurses and physicians that their ED often faced, professionals admitted they felt pressured to keep patients flowing. In an attempt to meet patient demands, they described that they spent time moving patients around the front cell, were more likely to be interrupted while working, they carried out more menial tasks which added to their workload, and weren't always confident that their work was completed to the desired standard. Moreover, professionals noted that new ED model disrupted established their routines of working with each other. These impacts are aligned with those that define work intensification [5-6], and, work intensification has been associated with job-related stress and strain [7]. It is recognized that emergency medicine is a highly complex profession that involves a fast pace, interruptions, multi-tasking, overcrowding, and unpredictability [8-14] and therefore, by definition, an argument can the clinical work performed by emergency nurses and physicians will always be intense. That being said, professionals who participated in my research indicated that the redesigned ED was affecting them in ways that were detrimental to their physical, cognitive, and emotional well-being. They noticed that more of their colleagues had requested sick time away from work, and some colleagues had already left their job in the ED or were contemplating doing so. Finally, in the article that was presented in Chapter 5, interviewees noted that their hospital did not deliver on the set of promises that were communicated to ED staff during the EDST's knowledge translation sessions. Professionals complained that they felt inadequately trained to work in the ED's front cell when it was opened, the new ED was continually understaffed, and it was still common at each site to have people waiting for long periods before being seen by an ED

physician. Taken together, these findings signal that the question of the operational value of the front cell, including the location and configuration of the front cell chairs and policy regarding the numbers of family members and visitors that can be allowed to accompany patients forward from triage, needs to be revisited by the hospital.

Young and McClean (2008) said of experiential value "that patients value their experiences of care, as will carers and those working in healthcare systems, either through their ability to empathise with patients, or on their own right" (p.385) [4]. In addition to the worker-level impacts identified above, in Chapter 3 nurses also noted how they perceived their role had been diminished after the introduction of the Lean-driven changes. Their work in the front cell required less use of their critical assessment skills, they were less involved in the monitoring of patients, and they perceived they had fewer opportunities to develop a rapport with patients and families. The article presented in Chapter 4 highlighted that as the new, push-forward model of the ED prioritized patient flow during times of high-patient volume, it was feasible for patients with varying medical needs to be seated together in the front cell. Physicians cautioned that were medical contexts, including mental health, addictions, and sexually transmitted disease, where it could be especially uncomfortable for a patient to have to interact with an emergency physician or nurse while they were sitting amongst other members of the public. It was also feasible for a patient to receive treatment from a nurse with other people around. To try to optimize privacy and confidentiality, interviewees described a major workaround that they regularly engaged in which involved asking a patient

to move out of a front chair and accompany them during a search for a more private area of the ED. In Chapters 3 and 5, I raised the issue of whether the perceptions of the nurses and physicians who deliver patient care in the reconfigured ED resonate and align with what hospital management expected the intervention would achieve. Young and McClean (2008) put forth that operational value is of greatest concern to "service providers and their managers" (p. 385). In terms of limitations, I did not interview individuals who hold management positions within the hospital nor am I aware of any of the metrics that may have been calculated by the hospital regarding the performance of their redesigned ED. Hypothetically thinking though, if say, 15 minutes were reduced per patient with the redesigned ED, with approximately 128,000 patients treated per year, the hospital would be seeing a considerable reduction in total patient time for ED patients. I do think the question of whether hospital management, emergency physicians and nurses, and patients would all agree that a relative reduction of this type per patient would constitute success, again, is one that remains for the hospital to explore.

My dissertation utilized realist grounded theory to explore the experiences, and impact, of emergency nurses and physicians with a Lean intervention. While my use of a qualitative approach supported a deeper understanding of how the clinical workflow was affected by Lean-driven changes, my research is not without additional limitations. As with all studies involving qualitative methodologies, our findings are not generalizable beyond our local context. Exploring the transferability and resonance of our results to other ED settings will require additional research. Given that research involved discussions with nurses and physicians who provided front-line medical care to patients, I cannot draw on the

perspectives of hospital management nor of the experiences and opinions of patients who received medical care at the two ED. I also am not able to make statements about family members and visitors whom may have accompanied patients. There are several areas that my research has identified as warranting future attention. These areas include the relationship between emergency physicians' use of strategic patient pulls and requests to slow down patient flow with distributed cognition, whether patients and families value shorter ED wait times over privacy and confidentiality in an ED setting, and the perceptions of nurses and physicians regarding the legitimacy of using Lean to redesign healthcare delivery.

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APPENDIX A

INTERVIEW GUIDE

Thank you for making time for me today to discuss some of your experiences practicing emergency medicine at (hospital name is anonymized). I want to mention, again, that your responses will not be associated with your name, and when this audio recording is transcribed into an electronic document, you will only be referred to in it by a generic identifier such as Nurse_1 or Spec_1.

As a bit of a housekeeping item, could I ask, please, what your role is within Emergency Medicine and how long have you been practicing it at (hospital name is anonymized)?

I am aware that Emergency Medicine, in (city name is anonymized) has had a major overhaul in terms of its practice environment. This was done using the "Lean Principles" model that Toyota pioneered.

1) I am wondering about what it was like for you to practice Emergency Medicine within the 'old' care model? Before the Lean intervention…

   - How was the Department structured before Lean?
   - How did you work under the old model of care?
   - Does emergency medicine work in teams?
   - (if yes or no) Can you describe how doctors and nurses worked together during patient care in the old model?
   - Do you think there were any benefits to patient care under the old model?
        o Ask the person to describe an example
        o Ask for individual work plus work done in collaboration (with another nurse/doctor)
   - What were some of the challenges, you may have encountered, working within the old model?
        o Ask the person to describe an example
        o Ask for individual work plus work done in collaboration (nurse/doctor)

2) What did the Toyota intervention change within the Emergency Department?

   - (do I need clarifying prompt) I recently toured the Emergency Department, and I recall that there being three, formal "bubble environments"? Is this correct?

   - Is this a different structure than how the Emergency environment was prior to the Toyota intervention? (did you have bubbles before?)
   - What is supposed to happen in terms of patient care within the three bubbles?
   -

- Why are there three?
    - o Are there unique aspects about each bubble in terms of patient care?
    - o Are there unique aspects about how team members, now, work under the new model?
- How do you work now in the new model?

3) How are patients flowed now within this new care model?
- o Are there any time-oriented goals or even limits for patient care in the bubbles?
- o How has this been working in your experience? Has it been beneficial for patient care?
    - Ask for an example
- o Have you experienced any challenges to your delivery of care within specified time expectations?
    - Ask for an example
    - Are meeting time expectations particularly challenging for certain cases (types of patients?)
- o What about times when there are a lot of patients presenting to the emergency? How does this work now?
- o What are some of the challenges you've faced when trying to treat a large volume of patients?

4) When I toured the Emergency Dept, I also noticed that doctors and nurses were interacting, within the Front Bubble, within a specific, center space/hub and I recall that it had equipment all around including computers. Am I correct about this? Can you please describe what this is and how it works?

- o Is this different than how you worked together in the old model emergency care?
    - o Ask individual for an example

- o How do you like working together in this configuration?
- o Do you find that there's enough space for you to work?
    - o Physical space including computers to work with?
    - o Space to talk with (nurses, trainees you are supervising, doctors – will depend on interviewee is a nurse or doctor)
    - o If the interviewee supervises trainees inquire about whether anything has changed now in terms of how they interact with trainees/teach now?
    - o Do you have space where you can work alone if need be?

- o Do you have space for other aspects of care, such as discussions with family members of patients?
- o Where do these occur?

- Ask about clinical documentation if the individual does not speak to it

    o What's it like, to work, within the other bubbles?

5) Do you recall (or were involved in) any of the planning that went on for the reorganization of the Emergency Department under Toyota Principles?

o If yes, ask individual to describe some of what they recall/were involved in…
o How did you find that planning went?
    o Do you recall some of the ideas/challenges/concerns your colleagues may have had?
o When it was being planned, did you foresee any value to reorganizing patient care under a Toyota model? Probe why in all cases (yes,no, maybe)
o Now that you have been practicing in the reorganized Emergency has your opinion remained the same about it? Ask why.

6) A key concept in the Toyota Principles model is the determination of what's waste or muda. Muda is something that is to be reduced or gotten rid of.

o Do you know how the Department decided what was muda? (probe if they can describe something considered muda for EM practice) *What is time-wasting in Emergency care?

6) Do you think that ideas, like Toyota Principles, which originally came from car manufacturing, translate well into healthcare? (ask why?)

Ending: Thank you very much for taking time out today to talk with me. Do you have anything else that you would like to add to this interview? Do you have any questions that you would like to ask me?

APPENDIX B

EMAIL ADVERTISEMENT

Subject Line: Invitation to consider participating in a research study

You are being invited to participate in a research study being conducted by Dr. Kamran Sedig (Computer Science), Dr. Richard Booth (Nursing), Dr. Candace Gibson (Schulich School of Medicine & Dentistry), Dr. Lisa Shepherd (Emergency Medicine), and Ms. Elaine Zibrowski, (Ph.D. Candidate, Health Information Science) from Western University.

This email invitation has been sent, on behalf of the above research team, to all nurses practicing emergency medicine (EM) at [names and locations anonymized].

This study involves a single, in-person interview, with a trained researcher, that should require about 60 minutes time. The researcher will dialogue with participants regarding their experiences practicing EM both prior to and after the introduction of the Toyota (Lean-Optimized) environments that now exist at both hospitals.

The interview's topics include individuals' workflow, opportunities for collaborative practice, potential benefits and challenges experienced before-and-after the introduction of the Toyota intervention and potential involvement during the planning for Toyota-informed change.

Interviews will be scheduled at a mutually convenient time and will be conducted at [name anonymized] or [name anonymized].

Given that this study relates to the EM environment both before and after the introduction of the Toyota-related changes we are interested in recruiting nurses and physicians who have practiced EM at [names anonymized] or a minimum of one year beginning no later than January 01, 2013. Individuals who began practicing after September 30, 2015 are excluded from participation in this study.

In total, we are interested in recruiting 22 EM nurses and physicians for this study.

The interview will be audio-recorded for later transcription into a verbatim, electronic copy prepared by a professional transcription company. Names of participants will not be associated with any responses given during their interview.

Your decision regarding whether you are interested in potentially participating in an interview for this study will have no impact on your employment status at [name anonymized].

To follow-up on this invitation, we will send you three, additional reminder emails, separated by about six weeks, from now. If you would like to opt-out of receiving these reminders, please reply directly to this message.

If you would like more information on this study or would like to receive its "Letter of Information", please contact Ms. Elaine Zibrowski via email at [email address is anonymized]

Thank you,

Dr. Kamran Sedig
The University of Western Ontario
[email address is anonymized]

Ms. Elaine Zibrowski
The University of Western Ontario
[email address is anonymized]

APPENDIX C

INSTITUTIONAL ETHICS CERTIFICATE

LAWSON FINAL APPROVAL NOTICE

LAWSON APPROVAL NUMBER: R-17-131

PROJECT TITLE: Lean-Optimized Environments in Emergency Medicine

PRINCIPAL INVESTIGATOR: Dr. Kamran Sedig

LAWSON APPROVAL DATE: June 8, 2017

Health Sciences REB#:   109133

Please be advised that the above project was reviewed by the Clinical Research Impact Committee and Lawson Administration and the project:

Was Approved

Please provide your Lawson Approval Number (R#) to the appropriate contact(s) in supporting departments (eg. Lab Services, Diagnostic Imaging, etc.) to inform them that your study is starting. The Lawson Approval Number must be provided each time services are requested.

Dr. David Hill
V.P. Research
Lawson Health Research Institute

All future correspondence concerning this study should include the Lawson Approval Number and should be directed to Sherry Paiva, Research Approval Officer, Lawson Health Research Institute, 750 Baseline Road, East, Suite 300.

cc: Administration

APPENDIX D

LIST OF ABBREVIATIONS

ED   Emergency department (acronym refers to both singular

and plural instances)

EDST   Emergency Department System Transformation

PAN   Primary assessment nurse

WOW   Workstation on wheels

APPENDIX E

CURRICULUM VITAE

Elaine M. Zibrowski
Citizenship: Canadian

Education

2019 Doctor of Philosophy, Health Information Science, University of
Western Ontario, London, ON

2001 Master of Science, Epidemiology and Biostatistics, University of Western Ontario,
London, ON, (Population Epidemiology Stream)

1996 Master of Science, Graduate Program in Neuroscience, University of Western Ontario,
London, ON

1994 Bachelor of Science (Specialist) With Greatest Distinction, Brandon University,
Brandon, MB

Employment

May 2019 - 2020 Postdoctoral Fellow, Department of Epidemiology & Community Health,
Saskatchewan Centre for Patient-Oriented Research, University of Saskatchewan.

2018 – May 2019 Research Assistant, Department of Epidemiology & Community Health,
University of Saskatchewan.

2014-2016 Research Associate, Division of General Internal Medicine, Department of
Medicine, Schulich School of Medicine & Dentistry, University of Western Ontario.

2009 - 2014 Manager & Research Consultant, Centre for Education Research & Innovation,
Schulich School of Medicine & Dentistry, University of Western Ontario.

2003 – 2009 Program Coordinator, Group for the Advancement & Advocacy of Medical and
Dental Education Scholarship (GAMES), Educational Research & Resources Unit, Schulich
School of Medicine & Dentistry, University of Western Ontario.

2002-2003 Research Associate, Mediprobe Research, London, ON

2000 - 03 Research Associate I, The Centre for Addiction and Mental Health, Social Factors and Prevention Initiatives Section, Social, Prevention and Health Policy Research Department, London, ON.

Awards, Fellowships & Nominations

May 2019 - Postdoctoral Fellow, Department of Epidemiology & Community Health, Saskatchewan Centre for Patient-Oriented Research, University of Saskatchewan.

2017 Conference Research Prize, Canadian Health Information Management Association, Bi-Annual Conference (Principal Author)

2016, Oslo & Akershus University College of Applied Sciences, Fellowship in International Public Health (Oslo, Norway)

2016 Ontario Graduate Scholarship (one of seven awarded in Faculty of Information & Media Science)

2012 Outstanding Research Paper, Association of American Medical Colleges Research in Medical Education, AAMC-RIME (Co-principal author)

2011 Outstanding Research Paper, Association of American Medical Colleges Research in Medical Education, AAMC-RIME (Co-author)

2009 Dean's Award of Excellence, Staff Award, Schulich School of Medicine & Dentistry

2008 Western Award of Excellence Nominee, University of Western Ontario

2000 Doctoral Research Fellowship (declined), Medical Research Council

2000 Doctoral Research Fellowship (declined), Alzheimer's Society of Canada

2000 Graduate Tuition Scholarship, University of Western Ontario

1998, 1999 Special Opportunity Grant for Female Students, Ontario Ministry of Education

1996 Graduate Teaching Award, Highest-Ranked Graduate Teaching Assistant, Department of Psychology, University of Western Ontario

1997, 1998 Graduate Teaching Award Nominee (Biosciences Division), Faculty of Graduate Studies, University of Western Ontario

1997 Graduate Student Travel Award, Chemical Signals in Vertebrates VII, Cornell University (Best Student Abstract)

1996 Nominee for Best Master's Thesis in Neuroscience, Graduate Program in Neuroscience, University of Western Ontario

1996 Special University Scholarship in Neuroscience, University of Western Ontario

1994,1995 Graduate Tuition Scholarship, University of Western Ontario

1994 Silver Medal in Psychology, Brandon University

1994 G. F. MacDowell Graduate Award in Psychology, Brandon University (Best Honors Thesis)

1993 G. F. MacDowell Award in Honors Psychology (Highest Third-Year Standing)

1992, 1993 Press Radio Scholastic Award, (1992 Highest Standing in Faculty of Science)

1991,1992,1993,1994 Presidents' Honor Roll, Faculty of Science, Brandon University

1991 Clinic Award in First-Year Psychology, Brandon University (Highest First-Year Standing)

Research Grants Awarded

Myers K, and Zibrowski, EM. Consequential validity of resident assessments of their clinical teachers, Royal College of Physicians & Surgeons of Canada, Medical Education Research Grant, $30,000, 2013-14 awarded 2013-14.

Myers K, and Zibrowski, EM. Consequences of assessment: faculty reactions and reflections on their clinical teaching assessments, Faculty Support for Research in Education, $5,000, awarded 2012-14.

Goldszmidt MA., Lingard, L., Zibrowski, E.M. The Education Research Fellowship: A strategy for developing the Clinician-Educator-Researcher Role, AMOSO Opportunities Fund, $308,750.00 awarded, 2009-12.

Myers K, Lingard L, and Zibrowski EM. It's all in what you say: A corpus linguistic analysis of written feedback from medical residents on their clinical supervisors. Social Sciences and Humanities Research Council (SSHRC; Internal), September 2009 competition, University of Western Ontario, $3900 awarded, 2009-10.

Myers K, Zibrowski EM, and Lingard L. Feedback is a two-way street: A qualitative analysis of written comments by residents on their assessments of clinical teachers.

Faculty Support for Research in Education, Schulich School of Medicine & Dentistry, $9000 awarded, spring 2009 -11

Watling C, Kenyon C, Schulz V, Zibrowski E, Goldszmidt M, Singh I, and Lingard L. Engagement in the ITE process: An exploration of faculty perspectives at two learning sites. Faculty Support for Research in Education, Schulich School of Medicine & Dentistry, $11,222 awarded, spring 2008 -10.

Aragon C, Ibarra M, and Zibrowski E. Can a dental student fabricate a successful two-implant overdenture? A pilot study. Faculty Support for Research in Education, Schulich School of Medicine & Dentistry, $10,263 awarded, spring 2008 -10.

Watling C, Kenyon C, Zibrowski E, Schulz V, Goldszmidt M, Singh I, and Lingard L. Engagement in the in-training evaluation (ITE) process: an exploration of faculty perspectives. Royal College of Physicians and Surgeons of Canada, $13,922 awarded, spring 2008 -10

Watling C, Kenyon C, Zibrowski E, Schulz V, Goldszmidt M, Singh I, and Lingard L. Residents' perceptions and experiences with in-training evaluation. Faculty Support for Research in Education, Schulich School of Medicine & Dentistry, $10,000 awarded, spring 2005 – 07

Peer-Reviewed Publications

Google Scholar Citations: 902 (as of April, 2019)

Zibrowski E, Shepherd L, Booth R, Sedig K, Gibson C (2019b) Promises made, but not delivered: A grounded theory of planning and implementation of a Lean intervention in emergency medicine. (to be submitted to JMIR Human Factors)

Zibrowski E, Shepherd L, Booth R, Sedig K, Gibson C (2019) A qualitative study of the theory behind the chairs: Balancing Lean-accelerated patient flow with the need for privacy and confidentiality in an emergency medicine setting. JMIR Human Factors 6(1) e11714.

Zibrowski E, Shepherd L, Sedig K, Booth R, Gibson C (2018a) Easier and faster is not always better: A grounded theory of the Impact of a large-scale, system transformation on the clinical work of emergency medicine nurses and physicians. JMIR Human Factors 5(4) e11013 doi: 10.2196/11013

Zibrowski E, Crukley J, Malett J, Myers K, To submit or not submit: The burden of evaluation on postgraduate medical trainees, MedEdPublish, 2016, 5, [2], 30, doi:http://dx.doi.org/10.15694/mep.2016.000058

Shepherd, L, Chahine, S, Klingel, M., Zibrowski, E, Meiwald, A, & Lingard, L. (2016). Reducing length of stay and satisfying learner needs. Perspectives on medical education, 1-9.

Myers, K, Zibrowski EM, and Lingard L. Engaged at the extremes: Residents' perspectives on clinical teaching assessment, Acad Med (2012) 87(10) 1397-1400. *Co-principal author (awarded Outstanding Research Paper, AAMC-RIME 2012)

Myers, K, Zibrowski EM, and Lingard L. A mixed-methods analysis of residents' written comments regarding their clinical supervisors. Acad Med (2011) 86(10) S21-24. (awarded Outstanding Research Paper, AAMC-RIME 2011)

Zibrowski EM, Myers K, Norman GR, and Goldszmidt MA. (2011) Relying on others reliability: Challenges in locating an effective instrument for assessing clinical faculty, Teach Learn Med 239: 21-27.

Aragon C, Cornacchio A, Ibarra I, Saad M, and Zibrowski E (2010). Dental students' experience fabricating 2-implant overdentures versus complete dentures: Difference in difficulty, denture quality and patient satisfaction, J Dent Educ 74(9): 993-1002.

Watling CJ, Kenyon CF, Schulz V, Goldszmidt MA, Zibrowski E, Lingard L (2010). Challenges to Faculty Engagement in the Resident In-Training Evaluation Process, Acad Med 85(7): 1157-62.

Goldszmidt, MA, Zibrowski EM, and Legassie J. Measuring resident well-being: Impostorism and burnout syndrome in residency, JGIM 24(3) (2009) 441.

Goldszmidt MA, Zibrowski EM, and Watling CJ (2009). Fostering education scholarship with a mentored research group, Med Educ, 43(11):1084-85.

Thompson, A, Graydon, S, & Zibrowski, E. (2009). The Canadian Arthritis Referral Study (CARS): an initial evaluation of the Canadian Arthritis Referral Tool (CART). Arthritis Rheum, 60(Suppl 10), 323.

Zibrowski EM, Singh I Goldszmidt MA, Watling CJ, Kenyon C, Schulz, V, Maddocks H, and Lingard, L. (2009) Sum of the parts detracts from the intended whole: Competencies & intraining assessments, Med Educ 43:741-48.

Watling C, Kenyon C, Zibrowski EM, Schulz V, Goldszmidt M, Singh, I, Maddocks H, and Lingard L (2008). Rules of engagement: Residents' perceptions of the in-training evaluation process. Acad Med 83(10) S97-101.

Zibrowski EM, Weston, WW, and Goldszmidt, MA. I don't have time: Fragmentation, prioritization and motivation for education scholarship in medical faculty. Med Educ 42(9) 872-79.

Legassie J, Zibrowski, EM, and Goldszmidt, MA (2008). Prevalence and relationship of impostorism and burnout syndrome in an internal medicine residency. JGIM 23(7) 1090-4.

Goldszmidt MA, Zibrowski, EM, and Weston, W (2008). Education scholarship: It's not a question of "degree." Med Teach 30(1) 34-39.

Aragon C and Zibrowski EM (2008). Does exposure to a procedural video-recording enhance preclinical dental student performance in fixed prosthodontics? J Dent Educ 72 67-71.

Zibrowski EM and Robertson J.McD. Olfactory sensitivity in medical laboratory workers occupationally exposed to organic solvent mixtures: Results from a pilot study, Occup Med (London) 56(1) (2006) 51- 54.

Graham, K, Osgood, DW, Zibrowski EM, Purcell J, Gliksman L, The effect of the Safer Bars Program on physical aggression in bars: Results of a randomized controlled trial, Drug Alc Rev. 23(1) (2004) 31 – 41.

Tremblay, PF, Zibrowski, EM, Graham K. (2002), A taxonomy of human aggression in five situational domains: Psychological, biological and environmental perspectives, Proc Int Soc Res Aggress XV.

Vanderwolf CH and Zibrowski EM, Pyriform cortex β-waves: Odor-specific sensitization following repeated olfactory stimulation, Brain Res. 892(2) (2001) 301-308.

Buckton G, Zibrowski EM, and Vanderwolf CH, The effects of cyclazocine and scopolamine on swim-to-platform performance in rats, Brain Res. 924(2) (2002) 151-158.

Vanderwolf, CH, Zibrowski, EM and Wakarchuk, D, The ability of various chemicals to elicit olfactory beta-waves in the pyriform cortex of meadow voles (Microtus pennsylvanicus) and laboratory rats (Rattus norvegicus), Brain Res. 922(2) (2001) 229-233.

Zibrowski, EM, Hoh, TE, and Vanderwolf, CH, Fast wave activity in the rat rhinencephalon: Effects of phytochemicals, organic solvents, and a rodent predator, Brain Res. 800 (1998) 207-215.

Zibrowski, EM & Vanderwolf, CH, Oscillatory fast wave activity in the rat pyriform cortex: relations to olfaction and behavior, Brain Res., 766(1-2) (1997) 39-49.