Clinical Supervision and Learning in Acute Care Environments: A Multifaceted Relationship

by
DOMINIQUE PIQUETTE
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Institute of Medical Science
University of Toronto

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Dominique Piquette
Doctor of Philosophy
Institute of Medical Science
University of Toronto
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Abstract

Context
Clinical supervision is intended to maintain a balance between a safe and timely provision of care to the patients and the creation of learning opportunities for the trainees. Many changes have recently affected the health care and medical education systems. The effects of these changes on current supervisory practices and on clinical learning are only partially understood. The objective of this program of research was therefore to explore the complex relationships between clinical supervision and learning in today's acute care environments.

Design
Two studies were combined: a mixed methods, simulation-based study, followed by an observational, naturalistic study. For the simulation study, 53 residents were randomized to one of three levels of clinical supervision and completed acute simulated scenarios. This study explored the impact of the level of clinical supervision on quantitative outcomes related to patient care and trainee learning, and on the learning processes involved in acute resuscitation. The second study, based on 350 hours of participant observation in real acute care environments, explored three aspects of the learning interactions among supervisors and trainees.
Results

The simulation study indicated a benefit of direct supervision for patient care. Direct supervision had a neutral effect on learning, despite the creation of distinct learning opportunities. In real acute clinical environments, learning interactions between clinical supervisors and trainees facilitated trainee involvement in patient care and allowed supervisors to adjust the level of supervision. Factors related to the clinical case, the participants, and the broader context interacted to affect the occurrence of these learning interactions. In addition, the specific clinical situations in which participants interacted affected the nature and the educational potential of the learning interactions.

Conclusion

This program of research revealed that direct supervision could improve patient care without compromising trainee learning. In-person interactions between clinical supervisors and trainees were commonly used to create learning opportunities in today's acute clinical environments. Clinical supervisors and trainees displayed different types of learning interactions in response to different clinical circumstances.
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Chapter 1
Introduction

1 Context

Anecdotally, postgraduate trainees have reported mixed feelings regarding the in-hospital presence of supervising clinicians during after-hours (nighttime or weekend) work. On one hand, junior trainees may feel reassured by the continuous access to a clinical supervisor when in need of assistance. On the other hand, trainees may perceive that their ability to provide care according to their own assessment and initiatives is, at times, limited by the continuous presence of a supervising clinician at the bedside.

These considerations represent an interesting line of inquiry for numerous reasons. First, these concerns pertain to the process of clinical supervision in acute care environments. They raise the question of whether closer supervision can impact learning negatively or positively. Clarifying the educational consequences of certain types of supervisory practices is a timely research endeavor. Societal expectations towards the health care system and the medical profession have changed(1, 2). Over the last 15 years, medical errors and health care system failures have been increasingly brought to the attention of the public, prompting a collective desire to develop strategies to improve patient safety and quality of care(1). In this new context, the medical profession has been held increasingly accountable for the safe and timely delivery of patient care(3, 4). Patient safety concerns have elicited a strong call for appropriate level of clinical supervision over junior trainees(3, 5-8). However, if closer supervision entails negative consequences on learning, changes in supervisory practices implemented to improve patient care may paradoxically compromise future physicians' ability to care for acutely ill patients.

Second, the questions raised by residents' mixed feelings about closer levels of clinical supervision also relate to two broader issues pertinent to postgraduate training: the nature of the learning opportunities offered by today's acute clinical environments and the physicians' ability to maintain a balance between care delivery and learning in these environments. Studying the supervisory practices in acute care environments could provide further insights into the learning opportunities emerging from physicians' clinical activities and into current tensions between
service and learning experienced on a daily basis by the clinicians. The relevance of these two issues in today's medical context cannot be stressed enough. Recent changes in the clinical environment have likely affected the learning conditions experienced by medical trainees (4, 9-11). More than a century ago, Abraham Flexner crystallized, in his landmark report, a way forward for medical education (2, 12, 13). He established the standard of a training divided in 2 phases: the pre-clinical and the clinical phases. While promoting the development of a factual knowledge grounded in basic sciences, Flexner also emphasized the importance of learning by doing. His vision of the clinical phase of training embraced the value of continuous interactions between students and physicians-educators on the clinical wards. In its earliest version, postgraduate medical education shared most of the characteristics of traditional apprenticeships (4, 6, 14, 15). By spending time in the clinical units where they would eventually practice, medical students worked alongside experienced clinicians. Students could observe and model clinicians' behaviors, practice their skills under guidance, and develop the attitudes required for their future profession. From the very beginning of postgraduate education, the interactions between trainees and supervisors and a balance between service and education were considered central to clinical training (4, 14).

Many contextual and structural changes have since transformed the health care environment, and potentially affected trainee-supervisor interactions (16-19). By requiring additional services, the aging population has put tremendous pressure on the health care system (16, 19, 20). Hospitals have been increasingly managed as businesses, especially in the United States, but also to a certain extent in Canada, where limited public wealth has forced governments to constrain the constant growth of public funding dedicated to health care (19, 21). In an attempt to care for a greater number of patients at a lower cost, attending physicians and medical trainees have experienced increased clinical workload, potentially exacerbating tensions between patient care and learning (4, 20, 22-24). In parallel with these changes, the universities' modes of promotion and reward have, until recently, attributed greater value to research activities than educational activities (2, 21, 25). As a result, many academic clinicians now spend less time in the clinical environment in comparison to decades past, often in short assigned blocks of one or two weeks (2). Such short periods of clinical time may be insufficient to develop significant, continuous interactions with medical trainees. Additionally, the increasing complexity of patient care delivery and health care systems has contributed to define modern clinical environments (2).
New technologies, while providing more efficient tools for care delivery, have also represented new areas for trainees to master(6, 16). In such complex environments, team care delivery has widely replaced individual provision of care. Today's medical trainees must therefore interact with a variety of health care professionals and technologies, and need to understand the implicit rules governing these interactions. From an educational perspective, such extensive changes in the health care system raise concerns(4, 16, 26, 27). The reduced amount of time spent by trainees working with the same experienced clinicians and the creeping clinical demands posed by care delivery could contribute to create an environment where service-oriented clinical care takes precedence over education and where learning opportunities are mostly incidental. Trainees may struggle to learn the exploding amount of knowledge, skills, and attitudes required for today's practice in such clinical environments.

In response to these educational concerns, multiple changes have been implemented in postgraduate medical training systems worldwide(9, 11, 17). To address the increased need for health services of an aging population, universities have increased the recruitment of new medical students(6, 20, 28). To ensure appropriate learning experiences during postgraduate years, distributed medical education models have been adopted (i.e. the physical distribution of medical trainees among geographically dispersed training hospitals and ambulatory sites)(20, 29). In addition, longitudinal training programs have been designed to allow trainees to spend longer periods of time in the same clinical environment(8, 30). Greater efforts have also been deployed to integrate the pre-clinical and clinical phases of medical training by providing earlier clinical experiences to medical students(17, 31). Formal learning opportunities, such as lectures, simulation-based training, and e-learning modules, now complement clinical learning opportunities(25). Many clinical environments have promoted the delegation of certain clinical tasks to non-physicians health professionals (e.g. nurse practitioners, physician assistants, etc.) to decrease the workload of attending physicians and medical trainees(22). Duty-hours regulations have been implemented in many countries to limit medical errors committed by sleep-deprived trainees and to improve postgraduate trainees' well being(6, 8, 32, 33). Finally, in order to ensure that trainees would master, by the end of their residency, the knowledge, skills, and attitude required to address the continuously evolving societal needs, competency-based (or outcome-based) models of postgraduate medical education were developed(6, 9, 11, 34, 35). Exhaustive compilations of general competencies required by today’s physicians have been translated into
Specific objectives and outcomes to be monitored and assessed throughout the medical training. Still hotly debated, such models offer the possibility of designing postgraduate training programs based on competencies fulfillment rather than time.

Implemented to address the educational challenges resulting from a transformation of the health care system, changes to the medical education system have paradoxically elicited additional educational concerns. Further limitations in bedside, one-on-one interactions between trainees and experienced, qualified clinical teachers have been foreseen based on three changes: the increased number of medical trainees, the proliferation of formal educational activities pulling residents away from the clinical environment, and the implementation of duty-hours regulations. These changes could be partially offset by the adoption of longitudinal training designs and closer levels of clinical supervision, which may present their own educational challenges.

1.1 Problem Statement

The multiple changes in the health care and medical training systems call into question the relevance of Flexner's vision of clinical training as based on a traditional apprenticeship model. It seems timely to re-explore the process of clinical supervision in current clinical environments, to take a second look at the learning opportunities created in the course of clinical practice, and to re-examine the tensions between patient care and learning experienced by supervisors and trainees during their clinical activities.

Therefore, the general objectives of this program of research were threefold:

1- to study the effects of the level of clinical supervision on patient care and trainee learning during acute care episodes;
2- to explore the learning opportunities emerging from the clinical activities performed in acute care environments;
3- to better understand the tensions between patient care and learning experienced by the medical trainees and clinical supervisors working in acute care environments.

The term clinical supervision will be used in this dissertation to represent the daily discussions and interactions about clinical cases and their management, undertaken both to fulfill the
educational needs of the trainees (clinical learning and teaching) and to monitor and optimize patient care (clinical oversight). Clinical supervision involves a triad of elements: the supervisor (the most senior physician), the trainee (junior physician), and the clinical environment. Embedded in the process of supervision are the potential opportunities and conflicts emerging from the interactions between supervisors, trainees, and clinical environment. Gaining a better understanding of the supervisory practices in the clinical setting could therefore point towards strategies for improving clinical learning and means for reconciling service and education during daily clinical activities.

The choice of the critical care environment as a setting for this program of research was justified by practical and theoretical reasons. As a critical care physician, I was interested in the process of clinical supervision and clinical learning in acute care environments, and more specifically during acute care episodes (i.e. medical crises, emergencies). Furthermore, appropriate clinical supervision appeared primordial in terms of patient safety during time-pressured, high-stakes events such as acute care episodes. However, these episodes could also present specific educational challenges because of the potential need for the physicians to prioritize patient care over trainees' educational needs. Finally, as will be further described in the literature review on clinical supervision (Chapter 2), acute clinical environments have been the objects of only a limited number of studies.

1.2 Overview

To address the objectives of this program of research, I have used a broad range of theoretical backgrounds, methodologies, and methods. Furthermore, the approaches selected have greatly shifted and evolved throughout the research process. This thesis is presented as a paper-based dissertation and includes the findings of a mixed-methods program of research based on two studies: a simulation-based, mixed-methods study followed by a subsequent naturalistic, qualitative study. However, in an attempt to represent accurately and honestly the multiple twists and turns that characterized this research process, I took some liberty with the traditional structure proposed for a paper-based dissertation. Furthermore, sections have been added
between the core sections of each chapter to explain the transitions between different pieces of the dissertation.

The literature review relevant to this work is presented in two different chapters (Chapters 2 and 3) for two reasons. First, each chapter represents distinct bodies of knowledge related to two relevant, yet different topics: clinical supervision and clinical learning. Secondly, the two literature reviews were not completed at the same time during the research process. The literature review on clinical supervision (Chapter 2) occurred before the beginning of the simulation-based study, whereas the review on clinical learning (Chapter 3) mostly occurred during the analysis phase of the qualitative part of the simulation-based study. I decided to present both literature reviews in subsequent chapters instead of respecting the real chronology of the research process to preserve cohesion in the presentation of the results of the simulation-based study (Chapters 5 and 6).

Chapter 2 summarizes how clinical supervision is currently conceptualized in the medical education literature (definitions, goals, and conceptual models). Two key aspects of clinical supervision are detailed: the duality of its goals (patient care and education) and the idea that the level of supervision must vary according to the clinical circumstances and to the medical trainees. In addition, Chapter 2 presents a summary of the literature on how clinical supervision can be, should be, and is currently delivered. In order to achieve its goals and to respect trainees' need for progressive independence in their clinical practice, clinical supervision must be applied with different levels of intensity. Different definitions, recommendations, and impact studies related to the level of clinical supervision are then presented. Gaps in the literature relevant to this program of research are summarized at the end of this chapter.

To gain a better understanding of the clinical setting as a learning environment and of the process of clinical supervision as a learning mechanism, a broader exploration of the literature on learning was required. Chapter 3 presents a review of the learning theories originating from different perspectives, including behavioral, cognitive, experiential, and socio-cultural theories. These theories are explained and compared to provide the theoretical background later required for the collection and analysis of the qualitative data included in this thesis.
In Chapter 4, I discuss the overall methodology of this program of research. This chapter addresses methodological issues that could not be extensively discussed within the methodological sections of the subsequent chapters. Some of the controversies regarding the nature, the legitimacy, and the use of mixed methods methodology are explained, and personal methodological choices and orientations are justified. Methodological shifts that resulted from our early research findings and from the nature of the research questions emerging during the simulation-based study are further explained in Chapter 7.

Chapter 5 presents the quantitative findings of the simulation-based study designed to explore the learning processes and the learning outcomes associated with different levels of clinical supervision. For the purpose of this study, the level of supervision was defined in function of the physical proximity of the supervisor to the bedside. The simulation study was based on the comparisons between simulated resuscitation scenarios completed by pairs of residents and supervisors who were randomized to one of three levels of clinical supervision. Chapter 5 describes the effects of the level of clinical supervision on patient care, resident participation, and resident learning.

The qualitative component of our simulation-based study further explored the differences in the learning processes between levels of clinical supervision. These findings are presented in Chapter 6. For this part of the simulation-based study, we conducted an inductive thematic analysis of the transcripts of the interactions among the supervisors, the trainees, and the simulated clinical environment. We explored the differences between levels of supervision in the types of learning opportunities created by the direct interactions among trainees and clinical environment, among supervisors and clinical environment, and among supervisors and trainees.

Chapter 7 first presents a summary and an integration of the results of the quantitative and qualitative parts of the simulation-based study. This chapter also explains how the results from the simulation-based study directly informed the subsequent naturalistic study included in this thesis. The simulation-based study revealed that many of the interactions between the trainees and the supervisors contributed to create learning opportunities. However, the nature of these interactions in today's clinical environments, their educational potential, and ways by which they could be improved had been only partially explored. As such, the second study focused on the
exploration of the in-person learning interactions among trainees and supervisors during acute care episodes. The objectives of that study called for a methodology that differed from the simulation-based study. The last part of Chapter 7 is dedicated to the introduction of the methodology used for our observational study: the origins of grounded theory methodology, the different approaches used by grounded theorists, and the specific methodological choices made for the naturalistic study.

The next three chapters (Chapter 8, 9, and 10) present the results of the naturalistic, observational study. These chapters correspond to successive and overlapping phases of observation-analysis that focused on slightly different aspects of the learning interactions among trainees and supervisors in acute care environments. The findings emerging from each phase of observation/analysis are presented in separate papers because they addressed distinct, although related research questions. Chapter 8 presents a model of interactive clinical supervision during acute care episodes based on different types of learning interactions, defined by their ability to establish different degrees of trainee involvement in clinical activities. How supervisors can maintain both trainee involvement in patient care and a safe care delivery is detailed according to three main themes.

The variability in the occurrence of the learning interactions among supervisors and trainees across acute care episodes was subsequently explored. To do so, we narrowed the scope of our observations to the transitions between the interactions focused on patient care and the interactions representing learning opportunities (shift to learning). Chapter 9 examines the absence of "ideal" acute care episodes for learning, the multiple factors that interact dynamically to create circumstances more or less favorable to the shifts to learning, and the strategies used by our participants to overcome these challenging circumstances.

The last phase of our observational study had the objective to better understand how clinical supervisors maintained a balance between patient care and learning within an episode of care once a shift to learning had occurred. Chapter 10 presents our findings that were based on the comparison between two types of clinical situations: acute episodes of care and routine multidisciplinary rounds. Such comparisons led to the construction of two models of integration
of learning interactions within patient care activities. These models were considered adaptive to the clinical context in which they emerged, and source of complementary learning opportunities.

Chapter 11 presents the integration of the results of the simulation-based and naturalistic studies. It also summarizes the theoretical and practical implications of this work on our understanding of the supervisory practices in acute care environments and their impact on clinical learning, as well as our understanding of potential strategies to optimize learning in those environments. Chapter 11 also includes personal reflections on the research process completed as part of this thesis, and possible orientations of future lines of inquiry that would build on our findings.
1.3 References


2 Introduction

Recent changes with health care and postgraduate medical training systems have exacerbated long-existing tensions between service and education. By relying on experienced physicians to supervise the clinical work of junior trainees, teaching hospitals have traditionally used clinical supervision as a mechanism to address the needs of both patients and trainees. In theory, clinical supervisors structure and oversee trainees' clinical activities with the intention to foster trainees' learning while ensuring high-quality care to the patients. However, clinical supervisors and trainees have not been immune to the numerous pressures brought by the changes in the health care and medical training systems. In this context, taking a closer look at the concept of clinical supervision and at current supervisory practices provides insight into the challenges faced by the physicians working in these changing clinical environments. This chapter summarizes our current understanding of the process of clinical supervision and its delivery in the medical setting. Areas of uncertainties in relation to clinical supervision will also be discussed.

2.1 What Is Clinical Supervision?

2.1.1 Definitions of Clinical Supervision

The concept of clinical supervision was first developed outside the medical profession(1). Nursing and mental health are two domains that have significantly contributed to our current understanding of supervision. Within these domains, the concept of clinical supervision has evolved from a structured, prolonged encounter between a supervisor and a supervisee towards any supportive encounter at work. In the medical education literature, different definitions of clinical supervision prevail. A prevailing definition, influenced by the clinical psychotherapy and nursing worlds, comes from Kilminster(2):
The provision of guidance and feedback on matters of personal, professional, and educational development in the context of a trainee's experience of providing safe and appropriate patient care.

Other authors have provided narrower definitions of clinical supervision, establishing a division between activities directly associated with the clinical work and other types of supervisory activities (e.g. issues of personal development and career mentoring). For example, Kennedy has preferred the term **clinical oversight** to the broader concept of clinical supervision to describe the 'participation in patient care activities by the supervisors for the purpose of ensuring quality of care'(3). Launer refers to clinical supervision as the 'day-to-day discussions of clinical cases and their management, and any issue arising from this', and provides separate definitions for the concepts of educational supervision, professional supervision, managerial supervision, mentoring, and coaching(1).

These definitions share some commonalities. In each of them, clinical supervision refers to a one-on-one relationship or interactions between a supervisor and a trainee. These interactions also differ from the more didactic, formal educational activities encountered in the non-clinical setting. Clinical supervision is mostly a conversational and discursive process, and therefore less structured and organized than other educational activities(1). For the purpose of this dissertation, the term **clinical supervision** will refer to Launer's definition, i.e. to the 'day-to-day discussions of clinical cases and their management, and any issue arising from this'.

### 2.1.2 Goals Of Clinical Supervision

Different views of clinical supervision entail a focus on different goals usually attributed to clinical supervision. For example, by defining the concept of clinical oversight as one aspect of clinical supervision, Kennedy has focused on supervisory activities primarily aimed at patient safety over education(3). However, clinical supervision has been generally recognized as a process that both ensures safe and optimal care (regulation or normative function) and fosters trainees' professional development (educational or formative function)(4). According to Launer's view, these two goals frequently overlap, but are not always simultaneously pursued during a given clinical activity(1). Proctor has described, in addition to the normative and formative
functions, a third role accomplished through clinical supervision: ensuring a sustainable practice by providing support and encouragement (restorative function)(5). Such managerial, educative, and supportive goals have similarly been incorporated in Kilminister's definition of clinical supervision(2).

2.1.3 Conceptual Models of Clinical Supervision

Medical educators have borrowed from other domains the conceptual models of clinical supervision used to guide the understanding and improvement of medical supervisory practices(2, 6). Domains such as counseling, psychotherapy, social work, and nursing have elaborated models of clinical supervision. Many of these models are based on a developmental approach, i.e. incorporate the idea that supervision must vary in accordance with the changing educational needs of the trainees as they progress along their educational trajectory(2). For example, the Glickman's Developmental Supervision model suggests that a more directive approach is effective when the supervisees' ability to define and solve a problem is low, whereas a more collaborative and non-directive approach should be preferred when trainees demonstrate gains in their conceptual development. This model was proven to be effective among in-training sciences teachers(7).

Although broadly incorporated in the medical education discourse, the idea that trainees benefit from increasing levels of independence and autonomy as they gain knowledge and experience has been based on limited empirical data(6). Rather, support for this idea of progressive independence has predominantly been based on interpretations of various learning theories. The literature on the development of expertise has been informative in that regard, especially the work of Dreyfus & Dreyfus(8), Bereiter & Scardamalia(9), and Ericsson(10). Dreyfus & Dreyfus have proposed a model of skill acquisition based on the progression through five qualitatively different stages (novice, advanced beginner, competence, proficiency, and expertise)(8). Each stage is characterized by an increasing ability to face and resolve non-routine, challenging problems. At the expert level, automatic and non-conscious judgments are used most commonly to solve unstructured problems. This model of skills acquisition thus supports a need for different kinds of guidance for learners at different levels of training. Bereiter & Scardamalia also argued that the development of expertise relies on the ability of trainees to tackle challenging problems,
at the limit of their own abilities(9). Although these authors disagreed with Dreyfus & Dreyfus regarding the use of automatic problem-solving skills as a defining criterion of expertise, Bereiter & Scardamalia's views convey that clinical activities adapted to trainees’ prior knowledge and experience will present the amount of challenge needed for learning. Ericsson has identified deliberate practice, defined as a practice involving the effortful rehearsal of an activity with timely feedback, as the mechanism by which expertise is developed(10). Feedback has been shown to be essential for the acquisition of expert skills(11-13). In deliberate practice, the frequency and type of feedback needed by learners appeared to vary according to the level training. As pointed out by Kennedy, this body of literature provides a strong argument to justify a model of supervision based on a level of support and guidance adapted to trainees' abilities(6). However, as will be further explained in the next section, the best ways to provide this graded level of supervision in the medical practice has been insufficiently studied.

2.2 Clinical Supervision Delivery In The Medical Setting

2.2.1 Modes of Delivery of Clinical Supervision

Clinical supervision has taken different forms of delivery and has evolved over time in terms of who is supervised, who is supervising, what is discussed during supervision, how the supervision is structured and organized, and the strategies used to supervise(4). In medicine, medical trainees are usually considered the supervisees, but many now perceive supervision as a life-long process also involving practicing professionals(1, 14). Senior members of the same subspecialty as the trainees have been traditionally identified as clinical supervisors, although a more recent literature refers to peer supervision, and to supervision provided by other health care professionals(4) or by non-specialist physicians such as hospitalists(15). The content of clinical supervision usually includes clinical cases, clinical contexts, and professional careers (1). The structure of supervisory activities depends on the specialty, the location, and the structure of the clinical team(2). It can occur at the bedside or away from the clinical ward, during a one-to-one encounter and within a group. It can be planned and structured or impromptu and informal, but regardless of its exact form of delivery, clinical supervision usually attempts to fulfill multiple goals.
Many activities or strategies have been considered part of supervisory practices (2). Reflection is frequently mentioned as a key component to achieve the educational goals of clinical supervision (1, 2). However, appropriate guidance has also been recognized as an essential part of the interactions between supervisors and supervisees. Other supervisory strategies involve discussing and advising, monitoring trainees and providing feedback, modeling behaviors, teaching, facilitating, assessing trainees' competence, supporting, planning trainees' activities (16).

2.2.2 Views on Effective Modes of Delivery

Only a few supervision models specific to medical education have been described. Furthermore, the current literature only includes a small number of studies based on empirical data collected through the direct observation of supervisory practices in clinical environments. Yet, many recommendations have been made about how to deliver or to seek appropriate supervision. Most of these recommendations have been informed by models developed in other domains than medicine or by broader theories of learning (4, 6). Kilminster has presented a list of helpful supervisory behaviors, such as giving direct guidance on clinical work, linking theory and practice, engaging in joint problem-solving, offering feedback and reassurance, and providing role models (4). The 2008 Institute of Medicine report on clinical supervision also mentioned the provision of feedback, role modeling, communication of learning objectives, and periodic assessment of these objectives as important components of clinical supervision (17).

Furthermore, "good supervisors" have been described as individuals with good interpersonal, clinical, and teaching skills (4). The development of such skills has been the object of specific supervisors' training with positive effects on supervisory practices (2, 17). Other positive characteristics of "good supervisors" that have been identified by medical trainees include being approachable, non-threatening, enthusiastic, and able to provide clear explanations, feedback, and a level of autonomy appropriate for trainees' competence and clinical experience (18).

From their own research work on UK trainees' and supervisors' perceptions of clinical supervision, Kilminster has presented a framework of effective supervision proposing the following features of effective supervision: direct supervision, constructive feedback, planned sessions, broad coverage of topics, 360-degree input, continuity in supervision, and supervisors'
and trainees' involvement in the supervision process. Other authors have proposed similar frameworks of effective supervision. The narrative model of Launer proposes an approach based on a non-authoritative supervisor who promotes reflection and asks questions, uses advice as a last-resort strategy, and provides an appropriate amount of challenges to the trainees(1). The SUPERB/SAFETY model of Farnan also provides a mnemonic for a list of effective strategies during on-call supervision both for the supervisor (Setting expectations; recognizing Uncertainty; Planning communication; having Easy availability; Reassuring residents; Balancing supervision and autonomy) and the supervisee (Seeking input early; contacting for Active clinical decision or Feeling uncertain, End-of-life issues, Transitions in care, help with system issues)(19).

Although slightly different, each of these frameworks includes recommendations regarding three types of skills to be mastered by effective supervisors: 1) general attitudinal skills (e.g. being approachable, enthusiastic); 2) technical skills (e.g. clinical and teaching skills involved in modeling or providing feedback); and, 3) managerial skills (e.g. setting objectives, completing assessment, organizing trainees' clinical work). However, the specific behaviors recommended to provide effective clinical supervision have been insufficiently detailed (e.g. what does it mean to provide role modeling?) and poorly distinguished from each other (e.g. what is the difference between providing guidance and facilitating). These frameworks of effective supervision delivery also explicitly recognize the requirement for the supervisors to balance trainees’ need for autonomy with their responsibilities towards the patients. Furthermore, these frameworks highlight that the process of supervision should be a shared responsibility between supervisors and supervisees. Trainees are held responsible for contacting their supervisors in a timely manner when the clinical circumstances require it. Such responsibility has also been recognized by the Institute of Medicine in the United States(17) and by many Canadian medical regulatory bodies such as the Royal College of Physicians and Surgeons of Canada(20) and the College of Physicians and Surgeons of Ontario(21). However, significant gaps between these ideal views of effective supervisory practices and their practical implementation in real clinical environments are a source of increasing concerns for medical educators.
2.2.3 Current State of Delivery of Clinical Supervision

There appear to be important variations in the amount of supervision provided between and across specialties (2, 4). However, most of what we know on the current supervisory practices in teaching hospitals is based on perceptions rather than observational studies. For example, Kilminster has completed a series of UK surveys of different levels of trainees, in different clinical contexts (ambulatory clinics and wards), and in different subspecialties, which indicated that supervision is frequently perceived as inadequate (2). A similar lack of bedside supervision and feedback across subspecialties was reported by junior trainees (22). Variable perceptions between trainees and supervisors about supervision have been captured by surveys completed in other subspecialties such as obstetrics (23), revealing disagreement about the quality of feedback and teaching occurring in the operating room. In contrast, a series of studies completed in Australia and New Zealand revealed that supervision was generally perceived as good in the emergency department, although at times limited by service (24). Busari has also reported that supervision was generally felt as adequate according to pediatrics residents (25) and that supervisors perceived themselves as good supervisors (26). Busari also identified the lack of time as a perceived barrier for appropriate supervision. However, when questioned about their actual and ideal time spent on supervision, staff physicians reported very similar amount of time, often above the time perceived as appropriate by the trainees (26). Other concerns related to the quality of supervision provided in real clinical environments include the lack of supervision during night calls (4, 17), incomplete supervision (2), a lack of clarity in the rules of game, i.e. when a supervisor should be contacted by the trainees about a patient (17), a lack of supervisor training (2, 18), and a lack of standardized tool to assess the quality of supervision provided (27). Based on this inconsistent literature, it is hard to make sweeping conclusions about the current quality of the clinical supervision provided in the medical setting. The use of survey also presents major methodological limitations. At best, it seems reasonable to conclude that the quality of clinical supervision probably varies widely across clinical environments, is perceived differently by supervisors and trainees, and could be improved in certain clinical situations.

Two recent studies have provided additional insight on the quality of supervision provided in the clinical environment. Ledema has collected data on the supervisory interactions reported by trainees in a rural hospital over a 2-week period (28). The results illustrated that the vast majority
of the supervisory interactions occurred in the course of regular clinical activities. The authors provided positive and negative examples of hands-on and hands-off episodes of supervision and concluded that supervisors need to navigate with flexibility between a hands-on and a hands-off models based on trainees’ specific needs. In another study, Ross reported concrete examples of the types of supervision failures encountered by postgraduate trainees of an academic hospital. A lack of monitoring, a lack of guidance, and a lack of feedback were identified as different types of supervision failures. Supervision appeared to be greatly valued at an earlier stage of training, but less at a later stage of training (29).

2.3 Matching Delivery With The Conceptual Model Of Clinical Supervision

In the first section of this chapter, clinical supervision has been presented as a process aimed at achieving at least two goals: providing optimal patient care and promoting trainee learning. In addition, clinical supervision has been conceptualized as a flexible process that must adapt to the clinical circumstances and to the specific needs of the trainees (i.e. need for progressive independence). Section 2.2 of this chapter explained how clinical supervision can be, should be, and is currently delivered in the medical setting. However, the practical ways to adapt supervisory behaviors in function of the patients' and trainees' needs have not been addressed. This section describes how clinical supervision can be delivered with different levels of intensity, official recommendations regarding the level of supervision during postgraduate training, and the known impact of the level of supervision on patient care and learning.

2.3.1 Definitions of the Level of Clinical Supervision

Although no formal definition of intensity or level of clinical supervision can be found in the medical education literature, two criteria have been commonly used to describe a gradation in the level of supervision: 1) the physical distance of the supervisor from the bedside where trainees perform their clinical activities; and, 2) the level of direct involvement of the supervisors in patient care. Kilminster has described supervision as distant (on call and available for advice, able to come to the trainees’ assistance in an appropriate time), local (in the hospital and available at short notice, able to offer immediate help on the phone and able to come within a
short period of time), immediately available (nearby and immediately available to come to the aid of the person being supervised), or direct (present in the same room as the person they supervise)(4). The American Accreditation Council for Graduate Medical Education (ACGME), which made specific recommendations about the appropriate level of supervision for residents of different level of training in its latest report on residency program requirements, has used a similar classification based on the supervisor's physical proximity(30).

Kennedy et al. have proposed an alternative model of clinical oversight based on the observation of the supervisory activities that took place in the emergency rooms and internal medicine wards of two teaching hospitals(3). They observed four types of clinical oversight: 1) routine oversight involved the daily, planned monitoring of trainees' clinical activities; 2) responsive oversight corresponded to double checking of trainees' work, triggered by general or situation-specific circumstances; 3) direct patient care occurred in clinical situations that were perceived by the supervisors as exceeding trainees' competencies; and 4) backstage oversight related to oversight that was completed without trainees' awareness. The authors concluded that by altering the nature or the amount of a certain type of clinical oversight (e.g. more direct observation of the trainees during routine oversight or more direct patient care by the supervisors), higher level of supervision could be achieved. This new typology was meant to inform the development of policies and faculty development initiatives aimed at improving the safety and the quality of care delivery.

Kennedy's model of clinical oversight implicitly recognizes the need for the supervisors to adapt their level of supervision according to trainees' level of training and experience and to the clinical circumstances. How to best translate this variable level of supervision into different supervisory practices is illustrated from a patient safety perspective. However, using distinct ways to provide a more intensive or direct supervision may have very different consequences in terms of learning. For example, providing more direct observation during routine oversight may provide trainees with additional opportunities for direct and timely feedback, whereas providing more direct care from the supervisors may deprive trainees of opportunities for practice. The meaning of escalating the level of supervision to improve the quality of care appears better described in the literature than the meaning of de-escalating the level of supervision to allow trainee's progressive level of autonomy. Furthermore, the relationship between the physical
presence of the supervisor and the specific supervisory behaviors used by them has been little explored. It is often assumed that the physical presence of the supervisor at the bedside will translate into their greater direct involvement in patient care (e.g. that supervisors present at the bedside will provide more direct care to the patient rather than providing more routine oversight). The medical education literature provides descriptions of effective supervisory practices in the clinical context, but fails to inform educators regarding the differences in supervisory behaviors encountered during direct, immediately available, and distant supervision.

Providing graded levels of supervision tailored to the trainees' needs implies the ability for the supervisors to assess trainees' competence. Furthermore, when lower level of supervision is defined as being distant from the bedside (e.g. indirect or distant supervision or oversight), appropriate supervision relies on an initial point of contact between the trainees interacting with the patient and the supervisors distant from the bedside, and the subsequent decision of the supervisors to intensify (or not) the level of supervision (e.g. the decision to see the patient themselves). Kennedy et al. have thoroughly investigated the factors involved in these decisions. They identified four dimensions on which supervisors assessed the trustworthiness of the trainees: knowledge/skills, discernment of limitations, truthfulness, and conscientiousness. Double-checking and language cues (such as structure, delivery, and spontaneous provision of useful information) were two processes used by the supervisors to determine trainees' trustworthiness. Furthermore, these authors identified many factors influencing trainees' decision to ask for help. Some factors related to the clinical case itself (urgency, within or not trainees' scope of practice), but others were independent of the clinical situation, such as the supervisors' availability and approachability, and trainees' desire for independence and good evaluation. Trainees resorted to different strategies (saving questions for later or asking specific members of the team for help) to maintain their credibility as doctors, sometimes at the expense of the patients. Other authors have similarly reported reasons for not seeking supervision that could compromise patient safety, such as fear of a negative interaction, fear of disturbing supervisor's sleep, powerlessness attributed to their trainee status, and trust in seniors' decision. A lack of clear agreement regarding conditions when the supervisors should be called, variable expectations from different supervisors, humiliating interactions with supervisors, and residents' fear to appear incompetent are additional communication barriers reported by the Institute of Medicine. Kennedy has explored further the perceived pressure experienced by the residents
to act independently. The desire to be identified as a doctor with independence of thoughts and actions, and organizational factors such as heavy workload and constant evaluations were mentioned by trainees as further motivations to work independently in the clinical environment(33). Given these findings and other concerns regarding patient safety in teaching hospitals (see Chapter 1), the Institute of Medicine and other medical regulatory bodies have recognized a need to put forward more specific recommendations regarding the level of clinical supervision provided in teaching medical institutions(17, 30).

2.3.2 Official Recommendations Regarding Adequate Level of Clinical Supervision

More stringent criteria regarding the level of clinical supervision have been proposed over time, especially in the United States. The Institute of Medicine has suggested more specific recommendations regarding supervision in its report of 2008(17) (below) when compared to the ones published in 2001(34):

The ACGME should require that first year resident not to be on clinical duty without having immediate access to a residency program-approved supervising physician in-house.

Accordingly, the 2011 ACGME approved standards for postgraduate medical programs specify that PGY1 should be supervised either directly or indirectly with direct supervision immediately available(30). These standards also state that senior residents and fellows should serve in a supervisory role of junior residents. Meanwhile, recommendations from the College of Physicians and Surgeons of Ontario (CPSO) and the Royal College of Physicians and Surgeons of Canada (RCPSC) about supervision are still fairly non-specific in Canada. The CPSO lists 'the regular communication with the trainees to discuss and review the trainees' patient assessments, management, and documentation of patient care in the medical record' as one of the attending physician's responsibilities(21). Among its general standards of accreditation applicable to university and affiliated sites, the RCPSC mentions that appropriate supervision of residents by the teaching staff must be provided within each education site. Such broad recommendations have left a lot of latitude to the specific programs and sites in terms of supervisory practices(20). However, the RCPSC is currently reviewing these recommendations with potentially more specific requirements for the clinical supervision of medical trainees.
The recommendations made by the Institute of Medicine regarding clinical supervision in 2001 have been very slowly adopted by the different medical institutions and programs compared to the recommendations regarding duty-hour limitations. Such recommendations could represent a threat to the trainees' need for progressive independence integrated in the current theoretical models of supervision and frameworks of effective supervisory practices. The consequences of the physical proximity of the supervisor to the bedside may have an impact not only on patient care, but also on trainees' autonomy and ability to contribute directly to patient care. Such effects have been the focus of studies described in the next sections.

2.3.3 Impact of Increased Level of Supervision On Patient Care

Clinical supervision has attracted an increased amount of attention from the public, governments, medical organizations, and medical training institutions over the last 20 years. In fact, the Bell commission that initially examined patient safety in teaching hospitals recommended both better clinical supervision and duty-hour limitations to improve patient safety. Since then, the literature has provided indirect evidence for the need for increased supervision, such as higher rates of adverse events in teaching hospitals with lower levels of supervision, and higher weekend mortality compared to non teaching hospital. Trainees have themselves recognized lack of supervision as an important cause of medical errors.

An increasing amount of research has confirmed that increased supervision has positive effects on patient care. McKee & Black demonstrated a decreased mortality following the implementation of closer supervision in surgery, anesthesia, emergency medicine, obstetrics, and pediatrics. Gennis showed that an in-person review of a case by a supervisor with the trainee led to differences in patient assessment and management when compared to supervisor's sole reliance on trainee's verbal report. Fallon also published a study in 1993 showing better trauma care under direct supervision, especially for junior trainees. Griffith demonstrated a better use of diagnostic tests in neonatal ICUs with direct supervision. Sox showed better process of care with higher level of supervision after an extensive chart review of patients with various medical conditions (asthma/COPG, chest pain, abdominal pain, bleed, hand laceration, head trauma, and vaginal bleed), regardless of the level of training. In a systematic review by
Farnan looking at the effects of clinical supervision on patient care and learning, 21 studies with a comparison group looked at the effect of the implementation of a supervision-related intervention at the postgraduate level on patient care(36). This review classified the level of supervision as direct, indirect with immediate physical availability, indirect with immediate phone availability, and oversight. The included studies compared different levels of supervision to each other (e.g. direct vs. indirect or direct vs. oversight). This review concluded that higher level of supervision was associated with neutral or positive effect on mortality and morbidity related to procedures, different perceptions of severity and acuity of patients among supervisors and trainees, different management plans, and better adherence to protocols and guidelines, but a lack of difference in resource utilization. The findings differed by specialty. The five studies in general internal medicine(38, 42-44) and pediatrics(45) included in this meta-analysis showed that closer supervision translated into more consistent compliance with protocols, and more reliable assessment of patients' condition severity. Additionally, trainees who perceived their level of autonomy as higher made more scrupulous use of resources, which was associated with reduced patient length of stay. The four studies related to emergency medicine(41, 46-48) showed that closer level of supervision impacted patient care in three ways: major or minor changes in management in almost 40 % of patients, higher hospital admission rates requested, and higher compliance with process-of-care guidelines. Anesthesia residents, regardless of the level of training, had a reduced rate of complications during intubations outside of the operating room when directly supervised by attending physicians(49). Studies related to surgery(50-55) showed that lower rates of complications and mortality were usually, but not systematically, associated with closer levels of supervision. The five studies related to psychiatry(56-60) indicated that more direct supervision was associated with differences in supervisors' clinical judgment of patient condition's severity, a decreased number of patients under constant observation, and better patient improvement. Finally, in radiology(61, 62), closer supervision was associated with lower rate of discrepancies of image reading, especially between supervisors and junior trainees.

In summary, closer level of supervision appears to provide equal or better care to the patients than more distant levels of supervision. However, the lack of standardization of the level of supervision and supervisory behaviors implemented in the different studies and the variability of
the outcomes assessed across studies limit our ability to make broad conclusions about the impact of clinical supervision on patient care.

2.3.4 Impact of Increased Level of Supervision On Learning

The impact of higher level of supervision on learning has represented a growing concern. Farnan's systematic review(15) on the effect of the level of clinical supervision included six studies assessing the impact of clinical supervision on learning. More supervision was associated with equal appreciation of the learning experience in psychiatry(59), lower scores of resident evaluative clinical skills(38), and better trainee scores in subsequent evaluations of their technical performance(54). Only one study examined the effect of direct supervision at nighttime in psychiatry, with no significant change in trainees' report of levels of confidence, anxiety, or shared responsibility(56).

This review illustrated a predominance of studies on the effects of closer supervision on patient care over studies on the effects on learning. The review also highlighted the paucity of studies on the effect of supervision on care and learning in acute care setting. Of the 24 studies included in the review, only four were conducted in the emergency care environment, and one in the pediatric intensive care environment. The effects of closer supervision on both patient care and learning may differ in acute care environments (e.g. the ICU) when compared to other clinical environments, such as a medical or psychiatric ward. The fast-pace and high-stakes characteristic of the critical care environment may force supervisors to intervene directly in patient care. Such direct interventions may be especially beneficial to critically ill patients highly dependent on optimal and timely care. However, direct supervision in acute contexts may translate into less involvement in patient care and less learning opportunities for the trainees. Furthermore, very little evidence is available concerning the effects of supervision at nighttime. Although nighttime direct supervision has been perceived as beneficial for both patient care and trainee learning(63), such effects has not been assessed in enough observational or interventional studies to conclude. Finally, this review used the physical proximity of the supervisor to define different levels of supervision, and little information is provided regarding the actual supervisory behaviors experienced by the trainees during these supervised encounters. Such behaviors may have a crucial effect on the ultimate learning benefits of a specific clinical situation.
2.4 Gaps In The Clinical Supervision Literature

In teaching clinical environments, clinical supervision is a mechanism that allows medical trainees to learn their profession through the practice of clinical activities alongside more experienced physicians who ensure safe and timely care delivery. This ideal rests on two assumptions: 1) trainees need a progressive level of autonomy in their clinical work to acquire the skills required for their future independent practice, and 2) clinical supervision can be delivered in a graded manner that allows progressive trainees' autonomy without compromising patient care. Furthermore, some supervisory behaviors have been identified as effective in promoting learning. Delivered in a way that strikes the right balance between too much and not enough, clinical supervision is therefore perceived as a process able to achieve the dual function of fostering trainee learning while maintaining a high quality of care.

In practice, the delivery of clinical supervision presents many challenges. The quality of clinical supervision has been shown to vary greatly within and across supervisors, subspecialties, and institutions. Supervision has often been described as too little, especially at night, or too much, when supervisors take over patient care. Supervisees have expressed concerns regarding the negative attitudes displayed by certain supervisors during supervised clinical activities, whereas supervisors have commented on the reluctance of certain trainees to seek supervision even in face of compromised patient safety. In the background of broader public concerns about patient safety and medical errors involving trainees who were inappropriately supervised, such findings have generated a call for a closer level of supervision, especially for junior trainees. Such recommendations raise questions regarding the ability to maintain trainees' progressive independence in clinical activities along their medical education, one of the defining concepts of clinical training. Could an increase in the intensity of clinical supervision (i.e. increasing the time spent by the supervisor at the bedside) threaten the balance between service and education?

Direct forms of supervision have been shown in the literature to improve not only patient outcomes, but also learning outcomes. Yet, concerns regarding the educational effects of closer level of supervision have not completely vanished. The evidence regarding the impact of closer supervision on learning is still thin and has only covered specific outcomes in a limited number of medical domains.
In an attempt to fully understand the scope of the effects of closer supervision on learning, the literature has failed thus far to explore important issues. Firstly, little is known regarding the concrete differences in supervisors and trainees' behaviors between different levels of supervision based on the physical proximity of the supervisor. The concept of gradation or intensity in clinical supervision has been essentially defined in the literature as the physical distance of the supervisor from the site of patient care delivery. Yet, the impact of supervision on learning surely depends on other factors than mere physical distance. What happens when the supervisor is at that bedside likely makes a difference. It is often assumed that the bedside presence of the supervisor will translate into direct involvement of the supervisor in patient care. Such assumptions need to be thoroughly explored. Understanding how these levels differ from each other in practice is important to determine if the concerns regarding closer levels of supervision are justified. Another assumption made regarding clinical supervision concerns the relationship between supervisor's and trainee's involvements in patient care: more involvement from the supervisor in patient care will restrain trainee's involvement in patient care. Exploring this assumption appears crucial to understand the impact of clinical supervision on learning. Are trainee and supervisor involvements in patient care necessarily inversely related? Does the bedside presence of the supervisor affect the nature of trainee involvement in patient care? Finally, the supervisor's bedside presence may be affecting learning beyond its effect on supervisor involvement in patient care. Learning opportunities created by the distant and in-person interactions between supervisors and trainees also need to be further explored.

A second aspect of the relationships between supervisory practices and learning that has been little explored in the literature concerns the contextual factors potentially affecting these relationships. Certain supervisory strategies have been identified in the literature as effective, but do not seem to be consistently applied in practice. A wide variety of practices among different clinical environments have been reported. Supervisors assume multiple roles in the clinical setting and may struggle to integrate effective supervisory behaviors in their daily practice. Such struggles may be particularly relevant in acute clinical contexts like the ICU, where the clinical demands could easily overwhelm supervisors and trainees. Understanding how to incorporate certain helpful supervisory behaviors in physicians' daily practice may play an important role in improving the quality of supervision in real clinical contexts.
2.5 References


Chapter 3
Literature Review on Learning

3 Introduction

This chapter presents an overview of the different learning theories and theoretical frameworks related to our research objectives. The goal of this review was not necessarily to identify areas of uncertainties to be explored in our research program. By gaining a broader and deeper understanding of the phenomenon of learning, I aimed to obtain different perspectives or tools to think about learning in the clinical setting and during the process of clinical supervision. I therefore consider this review as helpful background information that later became essential to inform the data analysis. The structure of this chapter represents a cohesive summary of these theories rather than a reflection of the importance of their influence on our analyses. These issues will be further discussed in Chapter 7 and 11.

3.1 Overview Of Theoretical Approaches To Learning

Learning is a complex and multidimensional phenomenon whose definition varies according to underlying assumptions and focus. Illeris(1) has described two basic processes involved in any learning activity: 1) an internal, psychological process of individual acquisition/construction of learning content, and 2) an external, interactional process between individuals and their environment (Figure 3.1). Most learning theories have focused on one of these processes. For example, cognitive psychology theories are mostly centered on the internal psychological processes of knowledge acquisition/construction, whereas sociocultural theories explore the external processes of interaction with the socio-cultural environment.
Another conceptual division useful to the understanding of the breadth of learning theories was introduced by Sfard(2). She described two metaphors to which most discourses on learning alternatively belong: an acquisition metaphor and a participation metaphor. Most cognitive theories, by assuming that knowledge can be acquired and possessed as a valuable good, carried over by individuals from situation to situation, and eventually transmitted among individuals, represent examples of the acquisition metaphor. In comparison, socio-cultural theories endorse the view that learning is a participative process that results in an increased ability for the learner to act within and to belong to a social practice. As such, these theories are illustrative of the participation metaphor. A third metaphor of learning has been subsequently proposed by Paavola(3): the knowledge creation metaphor. This third approach regroups theories interested in creativity, innovation, and advancement. These theories focus on understanding how new concepts, tools, and artifacts are developed. The knowledge-building theory of Bereiter(4) and Engeström's expansive learning theory(5) represent examples of learning theories associated with the knowledge creation metaphor.

Sfard(2) has recognized the respective contributions and challenges associated with both the acquisition and participation approaches to learning. A summary of these characteristics, detailed in the following sections of this chapter, is presented in Table 3.1.
Table 3.1: Contributions and Critiques Associated With Cognitive and Socio-Cultural Theories (2, 3, 6-12)

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<tr>
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<th>CONTRIBUTIONS</th>
<th>CRITIQUES</th>
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<tbody>
<tr>
<td>ACQUISITION</td>
<td>• Description of the role of mental representations</td>
<td>• Division between individual minds and socio-cultural contexts</td>
</tr>
<tr>
<td>Cognitive</td>
<td>• Exploration of the phenomenon of expertise</td>
<td>• Division between knowing and doing</td>
</tr>
<tr>
<td>Theories</td>
<td>• Transfer between contexts relying on general concepts</td>
<td>• Division between learning and performing</td>
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<tr>
<td></td>
<td>• Potential inability to apply abstract concepts to concrete problems</td>
<td>• Potential inability to apply abstract concepts to concrete problems</td>
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<td></td>
<td></td>
<td>• Focus on the reproduction of knowledge</td>
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<tr>
<td>PARTICIPATION</td>
<td>• Focus on the role of socio-cultural activities in shaping knowledge</td>
<td>• Problem of transfer across contexts (knowing is context-embedded)</td>
</tr>
<tr>
<td>Socio-cultural</td>
<td>• Importance of context in learning</td>
<td>• Access to the implicit content of authentic experiences</td>
</tr>
<tr>
<td>Theories</td>
<td>• Distributed nature of knowledge</td>
<td>• Risks of doing without learning</td>
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<td></td>
<td>• Learning as participating</td>
<td>• Potential lack of alignment between collective and individual goals</td>
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<td></td>
<td>• Learning as the construction of an identity</td>
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<td>• Role of tools and artifacts (mediation)</td>
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Sfard (2) has also provided strong arguments in favor of the need for more than one metaphor to gain a fuller understanding of the learning process and to appropriately inform pedagogical activities. As such, the following sections provide a broad overview of influential learning theories of relevance for the study of clinical-based learning, regardless of their affiliation to a specific approach. For each learning theory (or family of theories), key concepts and views on knowledge and learning, its main contributions to the field of learning, and common critiques encountered in the literature are discussed.
3.2 Learning Theories Of The Acquisition Metaphor

3.2.1 Behaviorism

Behavioral theories, based on the study of observable behaviors, argued that learning occurs without the intervention of any mental process(13). Thorndike first described the association between perceived stimuli (S) and neural responses (R) as a source of learning (S --> R)(14). Pavlov further contributed to the understanding of the formation of associations between environmental stimulus and individual responses by defining classical conditioning: a conditioned stimulus is repeatedly associated with an unconditioned stimulus known to trigger an unconditioned response; with repetition, the conditioned stimulus itself triggers the (now conditioned) response(15). Watson and Guthrie built on Pavlov's findings to establish the basis of modern behaviorism, which dominated American psychology during the first half of the 20th century(16). Skinner further added to these initial theories by accounting for the importance of the environmental response in the shaping of individual behaviors(17). In his view, learning depended on operant conditioning, a process based on reinforcers, i.e. stimuli or events that strengthen or inhibit a response to another stimulus (S\textsubscript{DISCRIMINATIVE} --> R --> S\textsubscript{REINFORCING}). Additionally, Skinner described the concepts of positive and negative reinforcement, punishment, extinction, generalization, discrimination, and shaping(17). Shaping was presented as the process by which complex behaviors are learned: by progressively reinforcing simpler subbehaviors, a desired outcome is achieved through successive approximations.

According to the behavioral perspective, learning represented the acquired behavioral responses to contextual stimuli. Behaviorists were therefore among the early promoters of learning by doing (in opposition to learning by listening to a lecture)(13). They introduced many instructional concepts that permeated our modern learning environments: establishment of behavioral objectives as targets of the learning process, task decomposition to facilitate learning of complex tasks, specific feedback that informs future behaviors, etc.(12). However, behavioral theories were unable to explain many phenomena where learning was unlikely to rely on environmental stimuli alone. The lack of reliance on mental processes to describe learning became a limitation to the expansion of the behavioral movement. These mental processes became the focus of cognitive psychology theories.
3.2.2 Cognitive Sciences Theories

The field of cognitive sciences encompasses numerous learning theories that represent variable approaches to learning. However, these theories share a common definition of learning: the individual elaboration of symbolic representations (mental concepts and structures) as the result of learning.

The information processing theory is concerned with the organization, manipulation, and use of mental representations of the external environment. According to the information processing theory, information from the environment is processed in distinct and successive stages by the individual mind before eliciting a response(18). Five stages have been described: the sensory stage, the perceptual stage, the working memory stage, the long-term memory stage, and the control/executive function stage(18). First, environmental stimuli are filtered by the mind before being processed at a subsequent stage. Next, perceptions are held in the working memory for further manipulation. The working memory is used for the temporary storage and processing of the information required for more complex cognitive activities(19). Some of this information will eventually be encoded and stored in long-term memory. The capacity of the working memory is limited and information is eventually lost if not stored in the long-term memory. Over time, information stored in the long-term memory contributes to organized and hierarchical networks of related and interconnected material. Some of these mental structures represent schemata, i.e. stereotyped sequences of steps that organize large amount of information into a meaningful system. Mental networks can get activated when new perceived information relates to its contents, allowing the retrieval of the stored information through a process of spreading activation. Metacognition contributes to the strategic use of these mental representations in response to the environmental demands. Metacognition is what an individual knows about his or her own cognitive processes(20). As a key component of the control stage of information processing, metacognition is involved in the conscious and deliberate monitoring and control of the cognitive activities.

The information processing theory laid the foundations of our understanding of how the mind works. It led to many lines of inquiry relevant to learning, such as theories on perception, attention (e.g. cognitive load theory), and memory (e.g. encoding, storage, and retrieval of
information)(18). In addition to these cognitive processes, problem solving was the object of numerous cognitive studies following the seminal work of Newell and Simon(21). Problem solving is defined as strategies by which people achieve goals for which they do not have an automatic solution(18). Cognitive scientists first focused on the study of general problem-solving strategies(22). However, research comparing novices and experts' problem-solving skills later revealed that the use of these strategies did not differ based on the level of expertise(23, 24). Furthermore, expertise was shown to transfer poorly across domains, and thus to be content-specific(25). Experts, rather than relying on better general problem-solving strategies, appeared to present structures of knowledge better fit for problem-solving, to process the information at a deeper level, and to more adequately use their metacognitive skills(22).

Studies in the medical field have further illustrated that expertise is not based on a greater mastery of general cognitive skills or on a greater use of basic sciences knowledge(24, 26). When comparing clinical reasoning of experts and novices, both were found to use analytical strategies (hypothetico-deductive method) to solve clinical problems(24, 26, 27). However, the use of certain kinds of knowledge structures, such as semantic qualifiers (dichotomous categories such as acute vs. chronic)(28), encapsulated knowledge(29), illness-scripts(29), and exemplars(26), was superior among experts(26, 27). Such knowledge structures allow experts to more effectively use non-analytical methods (e.g. pattern recognition) to define and resolve clinical problems(30). Non-analytical strategies are based on the comparison of a clinical problem with prior clinical encounters that leads to an instantaneous, unconscious recognition of the diagnosis(31). Both analytical and non-analytical strategies are associated with biases that can lead to clinical errors(27). A complementary use of both strategies has been demonstrated among experts and is believed to represent a better approach to clinical reasoning than the over reliance on one strategy(32). An important condition for the development of the type of knowledge structures used in non-analytical reasoning is the exposure to numerous, slightly different examples of the same problem(26).

The importance of efforts and purpose for the improvement of performance also emerged from the work of Ericsson on deliberate practice(33). Ericsson defined three essential characteristics of deliberate practice: efforts dedicated to the improvement of performance, repetitions of the task to be learned, and immediate and informative feedback(33). His work emphasized the
importance of personal motivation and proper planning of the practice sessions for learning, including the choice of the tasks and of the feedback provided(34).

According to these bodies of knowledge on information processing, problem-solving, clinical reasoning, and expertise, learning is seen as the constant acquisition of new mental representations or restructuration of previously acquired knowledge structures. This literature has contributed to our understanding of learning in many ways: the role of prior mental representations in the selection and interpretation of subsequent environmental stimuli, the intrinsic limitations to learning posed by certain cognitive structures (limited attention and working memory capacity), the content-specificity of knowledge structures and expertise, and the importance of multiple exposures to similar encounters to develop automatic and fluid performance. Pedagogical approaches based on rehearsing, cognitive elaboration (link to prior knowledge), organization, and conscious monitoring of mental activities are rooted in the information processing theory(12). However, this literature has paid less attention to the role of individual motivation in learning, and to the socio-cultural influences on individual cognition. Some of these elements have been explored by Bandura's social cognitive theory, which is described in the following section.

3.2.3 Social Cognitive Theory

Bandura's social cognitive theory focused on the processes by which the interaction between an individual and the environment leads to cognitive learning(35). Bandura described two mechanisms of learning: vicarious (observational) learning through modeling and enactive learning(35). Bandura argued that most people learn by observing and listening to models, which include physical persons, but also audiovisual material such as videos and books(36). Modeling is defined as the behavioral, cognitive, and affective changes deriving from observing models(36). Modeling was found to achieve multiple functions: providing social prompts to behave as others (response facilitation), inhibiting or disinhibiting previously learned behaviors, pointing towards attention cues; causing emotional arousal, and facilitating the display of new behaviors (vicarious learning)(36). However, Bandura argued that individuals could learn from observation without any display of new behaviors(35). Modeling is described as relying on four processes: attention, retention and rehearsal, production, and motivation(36). Bandura also
identified three conditions that affect the likelihood of learning from modeling: model attributes (e.g. model prestige), observer attributes (e.g. developmental status of learners, goal setting, self-efficacy), and functional value (e.g. observed consequences of model's behaviors)(36). In addition to modeling, enactment (i.e. the performance of actions that have consequences) is considered another learning mechanism. Bandura argued that the consequences of an action provide information and motivation for learning(36). Information allows learners to see if their conception of a situation matches with the consequences of their actions. Complex tasks can therefore be learned both vicariously and through actions(36). Bandura's definitions of vicarious and enactive learning imply that both processes are conscious(35). He therefore established a difference between learning and performing, the later being at times unconscious(35).

In addition to emphasizing the learning value of social interactions, the social learning theory attempted to explain the role of personal agency in learning. Bandura identified goal setting and outcome expectations as two key processes in learning(36). By having a purpose in terms of performance (goal setting), individuals commit to an activity and display efforts to achieve this goal. When these efforts translate into a performance closer to the desired outcome, learners perceive progress, which positively influences their beliefs in their own ability to perform at a certain level(36). These beliefs, called self-efficacy, in turn affect individuals' choices of activities and motivation to persist into an activity. According to Bandura's views, motivation is also determined by outcome expectations, i.e. the expected consequences of a particular behavior(36). When the expected consequences of a behavior are believed to match individual desired goals, efforts are more likely to be invested in this behavior. Based on their goals, learners can plan actions and assess their results. Self-regulation, which includes the processes of self-observation, self-judgment, and self-reactions, then allows for adjustment in performance based on one's goals and outcome expectations(36).

Bandura's social views on cognitive learning focused on the social processes (observation and enactment) involved in the acquisition of new knowledge (i.e. on how people learn), and explored the role of motivation in learning (i.e. why people learn). Modeling is still presented in today's literature as a vital mechanism of clinical learning(37, 38). Furthermore, the key relationships between enactment and motivation described in Bandura's theory may raise concerns regarding the impact of a lack of trainee's autonomy in the clinical setting. However,
the social learning theory considers individual learners and their mental processes as the driving force of learning, and the environment is seen mainly as a trigger of these mental processes. These assumptions have been increasingly challenged by subsequent learning theories that considered both the interactional aspect of learning and the socio-cultural environment itself of critical importance for learning.

3.2.4 Experiential Learning Theories

Experiential learning, i.e. creating meaning from experience through reflection, has been the object of multiple theories of different traditions(39). Both theorists from cognitive and socio-cultural orientations have attempted to explain the role of experience in learning. Fenwick has summarized these different approaches in three views: a phenomenological tradition focused on the reflection and emotional state of the learner in response to an experience; a critical theory tradition presenting critical self-reflection as a means to correct political and social inequalities, and a situated tradition emphasizing the socio-historical roots of experiences(39). Therefore, experiential learning theories encompass a broad range of perspectives that could include all the theories presented in the rest of this chapter.

These theories share a common view of experience as the foundation of learning, as being actively constructed by the learners, and as a socio-cultural phenomenon(40). Learning is seen as a holistic process involving individual thoughts, emotions, and senses, which are constantly re-interpreted based on prior experience(41). Central to experiential learning is the process of reflection, defined as a metacognitive activity that occurs before, during, or after an interaction with the environment(42). By reflecting, individuals aim to develop a greater understanding of themselves and of the environment, so that future interactions become informed by previous experiences(42).

Important distinctions exist among different experiential theories that justify a specific exploration of each theory(39). What counts as an experience, what is changed by the interaction between the individual and the environment, and what are the consequences for instruction constitute examples of divergences between theories. Many experiential learning theories were
predominantly diffused in the literature based on the name of their main author, which will be used in the following sections to introduce specific theories.

3.2.4.1 Dewey: Learning by Doing and Pragmatism

Dewey's work has inspired a number of educational theorists, including those interested in the role of experience in learning(40). In his book *Experience and Education*(43), first published in 1938, Dewey spoke of the importance of first-hand experience in learning(40). He argued that individuals of any age learn from their environment by building on their prior experiences(43). He also emphasized the fact that all experiences are not equal. Immediately enjoyable experiences may lack long-lasting positive consequences on later experiences(43). To lead to learning, a new experience needs to be connected with prior knowledge (continuity) and to allow an active interaction between the learner and the environment(43). Learning by doing was therefore considered by Dewey as an essential part of any educational process. Accordingly, he viewed teachers as learning facilitators enabling learners to interpret their experiences, rather than content providers(43).

Dewey's work inspired a pragmatic view on learning that defines experience as a transaction between the individuals and the environment(44). However, in comparison with other learning theories that focus on the interactional component of learning, knowledge is not perceived by the pragmatists as the only dimension involved in this transaction. Emotions, aesthetic, and ethics also play a role in every experience(44). Based on a pragmatic view of learning, experiences are objective realities that trigger emotions. Experiences lead to learning when these emotions lead to reflection. Creativity therefore emerges from the emotional discomfort perceived during the experience(44). Furthermore, experiences are seen as experiments oriented towards the future. Learning by doing is not viewed as a trial and error process, but as the use of concepts and theories to define a problem, predict outcomes, and inform action(44). Thinking and acting are closely interconnected and integrated: the meaning provided by the context informs the action. From a pragmatic perspective, learning from experience therefore depends on three factors: the cognition that relates experience to each other, the support to develop concepts and theories, and the drive to transiently control uncertainty (emotional responses to experiences)(44).
3.2.4.2 Knowles: Adult Learning Principles

Knowles defined in his book *The Adult Learner* the principles that distinguish, in his opinion, adult learning (andragogy) from pedagogy(45). Although not presented as an experiential theory per se, andragogy related to the importance of personal experience in learning. Knowles proposed that adult learners prefer learning experiences that draw on their prior personal experiences, are relevant for their life, and are problem-centered(45). Such types of experiences provide intrinsic motivation to learn. Knowles also argued that adults are self-directed, like to be respected, and are goal-oriented(45). Adult learners therefore value a collaborative approach with peers and teachers(45). According to Knowles's initial work, learning activities for adult needed to differ from pre-adult schooling. This assumption was highly debated in the education community(46-48). Later on, Knowles himself admitted that both children and adults could benefit from similar educational initiatives. He proposed a continuum ranging from teacher-directed to student-directed learning as a more useful way to think about instruction than the traditional andragogy-pedagogy dichotomy(46).

3.2.4.3 Kolb: Experiential Learning

Kolb's model of experiential learning was based on his interpretations of Dewey, Lewin, and Piaget's previous work on learning(49). Kolb defined learning as a "process whereby knowledge is created through the transformation of experience". Learning therefore involves mutual changes of both the individual and the environment. Kolb conceptualized learning as a conscious process distinct from performance (considered unconscious or automatic)(49).

According to Kolb, learning is based on the resolution of conflicts between four different modes of adaptation (see Figure 3.2): concrete experience, reflective observation, abstract conceptualization, and active experimentation(49). Kolb presented these four modes as a cycle, but also divided them according to two dimensions (or axes): prehension (i.e. grasping the experience- concretely and conceptually) and transformation (i.e. transforming the experience by reflection or by action)(49). Kolb's view of prehension is "truly transactionalism", i.e. relies equally on the concrete apprehension and on the abstract comprehension of experiences(49). For Kolb, apprehension involves perceptual attention, value, and belief, whereas comprehension leads to analysis, skepticism, and criticism(49). Both processes are thought to be essential to a
comprehensive prehension of an experience. The transformation axis of Kolb's cycle involves a change of the external environment (through extension and active experimentation) or of the internal representations of it (through introversion of reflective observation). Kolb insisted on the importance of these two axes in the processes of knowing and learning.

Kolb further described how four types of knowledge (and learning) resulted from the combinations of these modes of adaptation: divergent knowledge (creative thinking), assimilative knowledge (theory building), convergent knowledge (hypothetical reasoning), and accommodative knowledge (trial & error)(49). Kolb empirically explored individual tendencies to use certain modes of adaptation in their daily life. He concluded that individuals use preferentially certain modes of transaction with the environment, and therefore favor certain types of experiences(49). Kolb defined four learning styles based on the four types of knowledge described above. He recognized the influence of education, work, specific tasks, and personality on the adoption of these learning styles(49). He also argued that the development and maintenance of the four types of knowledge during the education and training processes would allow a maximum amount of flexibility in individuals' interactions with their social environment(49).
Kolb's model of experiential learning offers a simple way to understand how learning emerges from the interactions between individuals and their environment. Knowledge and learning are seen as distinct and complementary ways to transform and be transformed by the environment. Kolb emphasized individual preferences regarding these ways of learning and understanding. However, many have argued that Kolb has combined together an eclectic array of theoretical backgrounds, has proposed a new iteration of the earlier cognitive models based on observation, induction, and deduction, and has failed to demonstrate the usefulness of the learning style model. Others noted that thinking and acting are not truly integrated in Kolb's cycle and that emotions are not significantly taken into consideration. Nevertheless, Kolb's learning styles have attracted a lot of interest among educators by emphasizing the potential need to adapt the learning environment to different types of individual learners.

3.2.4.4 Schön: Reflective Practice

Schön explored the concept of reflection from the perspective of professional adults who have to deal with uncertainty, uniqueness, and value conflicts involved in their daily activities. His work was completed in response to a crisis of confidence in the ability of the professions to respond to the ever evolving and increasingly demanding societal needs. Through his publications, Schön attempted to demonstrate that professionals do not simply apply their knowledge in a technical and scientific approach at work, but commonly display an artful, reflective insight.

Based on his observations of professionals practicing in different domains, Schön described three ways of problem setting and solving used at work: knowing-in-action; reflection-in-action; and reflection-on-action. Knowing-in-action is defined as the ordinary use of practical knowledge during daily routine activities. Such knowledge is often not verbalized during professional activities and is believed to become refractory to changes. Reflection-in-action comes into play when the intuitive performance of an individual fails. Professionals then need to redefine or reframe the problem to create new strategies to solve it. In these circumstances, Schön observed various professionals performing on-the-spot mental experiments (What if? scenarios) before committing to a solution. Key aspects of reflection-in-action includes attending to the peculiarities of a situation, trying to make new sense of a challenging situation, and
engaging in a reflective conversation with the events. Experimenting involves testing virtual moves and hypotheses in an attempt to change an uncertain situation into a new, more comfortable problem, while staying aware of misfit between a reframed problem and the current situation. For Schön, a reflection-in-action completed with an open-mind is the most transparent way to achieve workable solutions intrinsically satisfying for individual practitioners. In comparison, over-reliance on knowing-in-action can maintain a false image of competence, potentiate individual conflicts, and paralyses actions amid challenging situations(51).

Schön's ideas on learning in a professional setting were further developed in his second book: *Educating the Reflective Practitioner*(52). He noticed the importance of being part of a practice to be able to understand it. For Schön, coaching was a way by which experienced practitioners could help new comers to learn from their experiences. Schön also explained how coaching differed from formal teaching (or more precisely from lecturing). He described more specifically three modes of coaching (follow me, hall of mirrors, and joint experimentation). *Follow me* is presented as a form of coaching mostly based on demonstration and imitation. Schön argued that when the learner is unable to identify the ultimate goal or desired result of an activity, this form of coaching is useful and can take into account the particular strengths and weaknesses of a learner. However, when learners can identify the type of outcome desired, they can be supported in the exploration of different paths or strategies leading to that outcome. Such form of coaching is called *joint experimentation*. Lastly, Schön described a third mode of coaching (hall of mirrors) useful in situations where the practice to be learned involves interactions that can be reproduced between the learner and the coach (e.g. therapeutic relationship between a professional and a client). In this type of coaching (similar to role playing), learners are at the receiving end of the skills demonstrated by the coach, before re-enacting these skills with the coach. Most practitioners were found to use multiple modes of coaching, which each relied on different abilities on the part of the learners and the coaches.

Schön's model of reflective practice has been very popular among medical educators. However, his work has been critiqued(39, 53-55). Eraut has argued that by focusing on reflection-in-action rather than on knowing-in-action, Schön presented an epistemology of knowledge creation rather than an epistemology of practice(54). Others reproached Schön his sole focus on non-routine problems, with little exploration of the other triggers of reflection-in-action. A paucity of details
was provided regarding the nature and object of reflection itself. Were the professionals reflecting on the problem, the process, or the action needed? Furthermore, time for reflection during professional activities was not taken into consideration. Doubts have also been expressed regarding the occurrence of reflection-in-action during practice completed in non-educational contexts(55). Despite these limitations, Schön triggered substantial enthusiasm for the concept of reflection, further developed by other authors such as Boud and Walker.

3.2.4.5 Boud and Walker: Reflection at Work

Boud and Walker developed a model of experiential learning similar to Kolb's cycle(56). They too emphasized the fact that learning was a conscious process based on the individual pursuit of gaining further knowledge to interact with the environment. However, they elected to focus on the impact of individual variability on the process of reflection and on the influences of specific contexts on learners' experiences. Boud and Walker argued that individuals possess a foundation of personal experiences that modify their interactions with the environment. Learners' intent (i.e. learners' personal determination to interact with an environment) focuses their attention on one aspect of the experience. The learning milieu where the experience takes place also influences the experience. The cultural, social, institutional, and psychological circumstances of a specific milieu interact to create unique circumstances for learning.

Boud and Walker's model of experiential learning involves a three-stage process including experiences, self-reflection, and outcomes(56). Experiences include individual thoughts, actions, and feelings resulting from a particular event or situation. The reflection upon the experience involves three different processes: revisiting the experience (replaying or noticing every aspect of the experience), addressing the feelings experienced (to prevent negative feelings to interfere with re-assessment), and reassessing the experience. Learners can reassess their experience through association (link current and prior experiences), integration (linking and synthetizing different aspects of the experience), validation of the authenticity of the experience (based on their coherence with prior experience and eventual application to new circumstances), and appropriation (admitting to oneself that the experience truly happened). Reflection can occur during and after the events. Through a cycle of noticing, assessing, intervening, noticing again, and re-assessing, each experience becomes a source of learning. Reflection can be facilitated
prior to an experience by assessing how prior personal experience, the context of the experience, and specific learning strategies are likely to contribute to learning. The outcomes of such reflections include new perspectives, new behaviors, new tools to fulfill future actions, and new commitments to act.

Boud and Walker's model of experiential learning operationalized, in a comprehensive and concrete manner, the process of reflection at work. Unlike Schön, Boud and Walker considered the reflection occurring during and after an experience as part of the same process. They also recognized the importance of the defining characteristics of a milieu in the outcomes of individual experiences. However, none of the theories discussed thus far have considered how experience not only modifies the knowledge of an individual, but also the identity of the individual. Transformational learning theories, described in the following section, focus on this aspect of learning.

3.2.4.6 Mezirow: Transformational Learning

Mezirow has described a transformational learning theory where reflection on experience involves the content, the process, and the underlying beliefs associated with this situation(57). Mezirow's view relies on a critical distinction between instrumental learning and communicative learning. Instrumental learning, similar to the type of learning emerging from the reflection process described in the previous sections, is defined as the ability to control the environment, to solve problems, to perform. Communicative learning refers to the ability to communicate with others empathically, to participate in a discourse, and to recognize one's own and others' frame of references (or habits of mind). Mezirow argues that discrepancies between actions and beliefs emerge from experience and lead to dilemmas that can be emotionally challenging for the learners(39). According to Mezirow, the role of the educator is therefore to engage learners in concrete experiences, to allow dialogue during and after the experience, and to support learners through these unfamiliar dilemmas(42).
### 3.2.4.7 Summary on Experiential Learning

Based on the work of the authors presented in this section, experiential learning relies heavily on the process of reflection(42). Triggered by the realization of a conflict or problem between the self and the environment, the process of reflection leads to a change in the understanding of the experience itself, of the self, or of the socio-cultural context defining the experience. Although enthusiastically adopted by the medical education community, limited empirical evidence has supported reflection as an effective learning tool(58). Learners' reflection seems to be facilitated by experienced practitioners(58). Some positive outcomes resulting from reflection have been highlighted in the literature(58). However, many challenges have been identified regarding the use of reflection in daily activities: learners' lack of engagement, emotional burden of the experience limiting the ability to reflect, lack of actions undertaken as a consequence of reflection, and lack of integration of the process of reflection in the overall curriculum(42).

Critiques of experiential learning theories have challenged the primary importance of conscious reflection as the key component of experiential learning, the arbitrary distinction made between the experience itself and the individuals experiencing it, the lack of exploration of the interaction between people and context (especially how context affects people), the actual ability of individuals to reflect on their own experience, and the ability of educators to manage others' learning experiences(39, 40, 50, 59). Based on these critiques, a growing number of educators and researchers have turned towards alternative approaches to gain a more comprehensive view of learning. Such approaches claim to better recognize the role of context, social interactions, and culture in the learning process. The following section presents an overview of these theories.

### 3.3 Learning Theories Of The Participation Metaphor

#### 3.3.1 Socio-Cultural Theories

Socio-cultural theories shared many characteristics with other experiential learning theories, such as the recognition that learning is situated in a specific context highly influenced by the socio-cultural environment(40). Socio-cultural theories are also focused on human actions (or activities), i.e. the intervention of individuals in the environment. However, socio-cultural theories assume that knowledge cannot be reduced to the content of the mind of individuals.
Rather, it is distributed across the individuals and the environment(12). More specifically, symbols (such as language) and material objects (e.g. computers or tools) are depositary of the knowledge built under socio-cultural influences. The main authors and theories that have influenced the domain of medical education will be presented in this section.

3.3.1.1 Vygotsky: Foundation of Socio-Cultural Theories

Vygotsky's work has strongly influenced the socio-cultural movement that emerged in response to other popular learning theories that focused mostly on individuals(40, 60). Vygotsky affirmed that human consciousness is heavily dependent on socially meaningful activities(61). By studying the interactions between interpersonal, cultural, historical, and individual factors, Vygotsky established that language, objects, and cultural institutions mediated these socio-cultural influences(61). He studied the relationships between thoughts and language and concluded that social speech (dialogues with others) was eventually integrated into private speech (audible dialogues with oneself) before becoming inner speech (internalization of external dialogues) (61). The individual mind was therefore considered by Vygotsky as a direct product of surrounding socio-cultural and historical forces.

Another important concept emerging from the work of Vygotsky was the zone of proximal development (ZPD), defined as the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers"(61). Based on the socio-historical context (dominance of communistic views) in which Vygotsky's work was completed, the ZPD has been interpreted as an argument in favor of the power of collective activity realized through guided participation(40). However, within the educational community, the ZPD has been more specifically applied to the relationship between supervisors and trainees. For example, the concept of scaffolding, inspired by Vygotsky's ZPD, describes how supervisors, by managing the aspects of a task that are beyond the learners' capabilities, allow learners to focus on the task's features that are easier to grasp(60).

Beyond its specific contributions to the fields of language and education, the work of Vygotsky provided a different lens on learning: the mind of the learners was not more the primary source
of learning, and the importance of the immediate social and physical surroundings of the learners, as well as their historical and cultural background were recognized.

3.3.1.2 Brown, Collins & Duguid: Situated Cognition & Cognitive Apprenticeship

According to the situated theory, thinking, knowledge, and learning are located in experiences, not in one's mind(62). The physical and social contexts of an activity provide meaning, and therefore the individual construction of meaning depends on being part of specific situations and activities(10). Learning becomes a form of enculturation. Knowledge is not considered as a series of abstract concepts withheld in individual minds. It is distributed across social and physical contexts, structured by activities, and meaningful only within social contexts(10). Therefore, the codification of knowledge (or the transformation of tacit into explicit knowledge) does not necessarily translate into its successful application. Practice is required to learn(63).

From these assumptions was derived the concept of cognitive apprenticeship, defined as a form of education that acculturates learners into social practices through authentic activities and social interactions(64). These authentic activities include all ordinary activities that are part of a culture, which often involve the resolution of ill-defined problems. Cognitive apprenticeships are based on modeling, scaffolding, collaborative learning (joint effort of multiple individuals to learn something together), articulation and reflection(64). In comparison to traditional apprenticeships focused on manual crafts, cognitive apprenticeships involve the mastery of more complex and cognitive tasks. Therefore, the process of observation and modeling may be challenging for the inexperienced learners(64). Sequencing of tasks may also be an issue because the tasks arise from work demands. Overt articulation, reflection, and exploration of the meaning of the activities at play can help learners to understand the context.

3.3.1.3 Lave & Wenger: Situated Learning & Community Of Practice

Lave & Wenger, through their observations of various forms of apprenticeships (midwives, tailors, quartermasters, butchers, AA), further developed the concepts of situated learning and knowledge, i.e. located in the experience(65). The central process of learning is defined as a
legitimate peripheral participation to a social practice. By progressively gaining access to socially meaningful activities, learners (i.e. new comers) become part of a community of practice. *Legitimate* participation involves a sense of belonging to a community. It involves being part of social communities and constructing actively an identity. By making useful contributions to the community, learners experience a sense of empowerment and motivation. *Peripheral* participation accounts for the fact that individuals can be connected with social activities in many ways. Participation is not restricted to an engagement in specific activities. Learners have access to the full mature practice, but are submitted to fewer demands than full participants. According to Lave & Wenger's views, participation is based on a continuous negotiation of the meaning of a social activity. It is not based on a dichotomy between thinking and doing or between observing and being involved. Learners get a sense of what the practice consists of, and as their understanding of this practice changes, they learn(66).

In this context, the role of experienced practitioners towards learners varies according to the circumstances. Conferring legitimacy and access prevails over providing direct instructions(65). Learning opportunities emerge through the structuring of the work practice. Language is used within activities, but direct instruction is not considered superior to demonstration for learning. Learning the language of a social practice (the talk), i.e. talking within a practice rather than talking about a practice, constitutes true learning(65). The relationship with a supervisor is therefore less central to learning than is the relationship with the work organization itself. Such organizations or communities of practice (CoP) are defined as "a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice"(65). The concept of CoP established a departure from traditional views on apprenticeships where the relationship with a single master practitioner was key, as was the development of mastery rather than identity. Within the situated learning perspective, learners who participate in a CoP construct a new identity, a process that can occur without formal teaching or direct instruction(65).

According to Lave & Wenger, being part of a social practice and participating in any social activities equals learning(65). Learning is a process of creation of meaning that occurs in every human activity; learning and participation cannot be dissociated. No process of internalization is required. Knowledge is dependent on the existence of CoPs rather than being dependent on
consciousness. It means becoming a member of a CoP and involves the development of competences in valued activities(66).

Situated learning has implications in the creation of appropriate learning environments. According to this approach, learners must be provided with authentic tasks that present intrinsic motivational value, are problem-based, and provide intrinsic feedback(67). Constraints on learners' participation may initially be implemented, but should be removed as quickly as possible. Choi has described this process of facilitation in five steps: modeling of physical and abstract processes, scaffolding, coaching, collaborating, and fading(67). Although full participation was originally seen as the main goal of situated learning, modern views accept that learning may involve different trajectories, with a range of expected competences determined locally(68).

Multiple critiques have been expressed regarding situated learning and communities of practice(12, 39). Robert(69) noticed that the issues of power, trust, and individual predispositions have not been properly addressed by Lave & Wenger. Hanley(70) argued that participation does not inevitably lead to a progression from peripheral to full participation. She described other learning trajectories, such as marginal or contingent participations. She also challenged the notion that both practice and identity are always embraced unproblematically by new comers. Hanley further commented on the difficulty to evaluate how involved a learner truly is in a community and how learner's identity has changed through their participation. Finally, she evoked multiple sources of conflict between individuals and communities that haven't been addressed by the Lave & Wenger's work: the challenges of participating in many communities of practice, and certain underlying dispositions of an individual held constant through different situations. Graham(71) criticized Lave & Wenger for their vagueness regarding the role of facilitator. Similarly to Hanley, he noticed the lack of reference to the power relationships necessarily at play within a community of practice, and the inevitable conflicts between the needs of individuals for personal growth and the need of an organization. Graham concluded that minimal empirical evidence currently supports the efficiency of the communities of practice in the health care professions.
3.3.1.4 Engeström: Activity Theory and Expansive Learning

Activity theory and expansive learning differ from the other socio-cultural theories presented in this section in five ways that define the core characteristics of activity theory(5). First, the activity (or system of activities) is the unit of analysis used in activity theory-based research. Second, the historical origins of the social activities and the objects of mediation are considered primordial to the understanding of human activities. Third, given that activities are defined as a multi-voice process, negotiation, innovations, and conflicts are expected to emerge and contribute to learning. Fourth, tensions or contradictions within and between systems of activities create further opportunities for innovation. Fifth, activities create the possibility of transformation at an individual and collective levels. Based on this theory (see Figure 3.3), activities are collective endeavors mediated by objects and determined by social motives.

Activities involve subjects that complete actions and operations to transform the object. Actions are goal-directed tasks defined at a conceptual level, whereas operations are completed concretely at a lesser conscious level. Activities also involve rules, a community, and a division of labor(72).

![Figure 3.3: The structure of a human activity system](from Engeström, 1987(73))

Within a theory where the smallest unit of analysis is an activity system, individual learning is meaningless outside of a system of activity. Education must therefore focus on favoring participation in goal-directed collective activities and on increasing individual ability to do so. Engeström, a major contributor to the field of activity theory-based research, has recently explored the concept of expansive learning(5). Expansive learning is driven by the desire to
increase one's power to act within a system of activity. Expansive learning is also concerned with the collective ability to learn. Engeström(5) has defined four processes by which systems learn: questioning the system, analyzing the system, modeling a new system, and implementing innovations. Learning at a system level involves the development of alternatives, i.e. the creation of concepts that better match the collective experience.

Engeström's work has had less impact on the educational theories and practices adopted by the medical community than the cognitive or socio-cultural approaches. As predicted by Bleakley, the potential and limitations of this approach will likely be further explored in the near future(74).

3.3.2 Theoretical Frameworks Based on Empirical Research in the Workplace

Workplace learning has attracted a lot of attention among educators and researchers. At times considered part of the broader group of experiential learning theories, the perspectives presented by the authors included in this section combined elements of the cognitive and the socio-cultural approaches. In doing so, these authors brought into light the commonalities among cognitive and socio-cultural theories, rather than emphasizing the differences between the two approaches. Furthermore, they attempted to provide a realistic view of complex and dynamic workplace environments such as the clinical setting.

3.3.2.1 Eraut: Non-formal Learning and Tacit knowledge in the Workplace

Eraut has largely contributed to our understanding of learning in the workplace through his work on tacit knowledge and implicit learning(75, 76). This section presents how Eraut characterized the knowledge encountered in the workplace, the modes of learning in use in the workplace, and the work contexts most favorable to learning.

Eraut proposed that the modes of cognition in the workplace vary in function of the time available to complete an activity(75). Instant/reflex cognition is based on pattern recognition and
preferentially used when no time is available for more elaborated types of cognition. Rapid/intuitive cognition involves the rapid creation of meaning when limited time is available, and analytical/deliberative cognition is possible when time is not a limitation. Tacit knowledge, initially defined by Polanyi (77) as what we know but cannot tell, is the type of knowledge at play during instant and intuitive cognitions. It is the type of knowledge most frequently encountered in the workplace. Eraut described tacit knowledge as taking different forms in the workplace: situational understanding, intuitive decision-making, and routinized procedures (75). Tacit knowledge provides the advantage of being readily available in situations where no time is available (knowledge that is known to fit the situation encountered) (76). However, tacit knowledge can be biased when prior experiences direct attention to the wrong aspects of a situation (76). Awareness and communicability are two other issues related to tacit knowledge that were explored by Eraut (75). When workers are unaware of their tacit knowledge or unable to verbalize it for their colleagues, the critical assessment and sharing of this knowledge become problematic.

Learning in the workplace, i.e. in an environment not primarily designed for learning, is mostly done informally. Eraut developed a typology of non-formal learning. This classification includes implicit learning (without intention or awareness), reactive learning (explicit but incidental, near-spontaneous learning), and deliberative learning (intentional and explicit learning) (75). Eraut therefore considered processes that do not involve reflection as one form of non-formal learning. He characterized implicit learning as unconscious, reactive learning as based on the recognition of emerging learning opportunities, and deliberative learning as a planned reflection.

Because tacit knowledge is not readily accessible for newcomers to a workplace, non-formal learning can be challenging. However, according to Eraut, tacit knowledge can be elicited through mediating objects, regular consultation, mentoring relationship where explanations are expected, and crises requiring, changes (75). Non-formal learning in the workplace can be a byproduct of work processes (e.g. realizing that a decision was wrong based on the negative consequences of this decision), result from a learning process at work (such as supervision, mentoring, coaching, or formal teaching), and occur during instantaneous learning activities (e.g. questions, feedback, artifacts, listening, observing, reflecting, getting information) (78). Working activities lead to learning by four mechanisms: problem solving, learning from mistakes,
questions, and feedback(76). According to Eraut, workplace learning is affected by the amount of challenge and value associated with work, the amount of feedback and support received by the learners, and the amount of confidence and commitment displayed by the learners(76).

### 3.3.2.2 Billet: Vocational Expertise

Billet has been a strong proponent of the reconciliation between cognitive and socio-cultural approaches(79). He established a list of the concepts on which these theories agree: 1) expertise is domain-specific; 2) problem-solving differs for routine and non-routine problems; 3) learning is influenced by social processes; 4) transfer depends on context; 5) individual efforts and dispositions are related to social values. Billet noticed the need to match personal agencies and social goals for a full integration of individual learners in a social practice. He proposed a new perspective on expertise based on the relationships among social practice, activities, and individual cognition(80). Billet argued that expertise is not only socio-cultural (related to a social practice e.g. nursing) but also situational (related to a specific context e.g. particular hospital or ward). Accordingly, Billet proposed that expertise should be defined as based on a specific social practice, as the product of an extensive practice, as an understanding and ability to act upon routine and non-routine problems, as mutually transforming, and as a reflection of local values.

Billet claimed that the workplace is a great learning environment because it provides authentic routine and non-routine problems, indirect (culture, values) and direct guidance, a process of automation through practice, and an environment for observing authentic activities(81). However, Billet recognized two potential limitations of the workplace environment: a need for explicit teaching to develop certain types of knowledge that are not easy to access, and a lack of disposition for engagement demonstrated by certain learners who may not be seizing learning opportunities(81). He therefore argued that everyday experience might not necessarily lead to transferrable learning. For Billet, learning in the workplace depends on three factors: an access to new or challenging problems, guidance to workplace practice, and individual agency and engagement(82). He specifically discussed the role of workplace mentors in fostering learning. First, mentors must provide access to activities of increasing criticality and accountability in everyday work activities (indirect guidance). In addition, mentors must use intentional learning strategies to guide the immediate work activities of the learners (immediate guidance). Finally,
mentors must purposefully indicate to learners how the knowledge emerging from immediate work activities can transfer to future activities (guidance forward).

3.3.2.3 Workplace Learning in Medicine

Two authors made significant contributions to our understanding of workplace learning during medical training. Both established theoretical models of work-based learning that rely on empirical data (interviews) and draw on cognitive and socio-cultural perspectives for the interpretation of these data.

Dornan's work focused on the role of early clinical experience at the undergraduate level of medical training(83, 84). He concluded that participation in clinical activities was the engine of clinical learning. He defined different forms of participation: passive observation, active observation (with interactions), rehearsal of actions, and performance of actions. Participation in the clinical environment was found to be affected by multiple factors: students' interactions with patients, doctors' behaviors toward students (level of support), climate of the team, interactions with peers and nurses, organizational factors, students' state of mind (sense of identity, confidence, motivation, and sense of recognition), and students’ competence. These last two factors (state of mind and competence) were in turn defined as outcomes of students' participation.

Teunissen pursued similar work on clinical learning at the postgraduate level of medical training(85, 86). He also identified clinical activities as the starting point of resident learning. According to his framework of clinical learning, the information embedded in these clinical activities is eventually integrated into personal knowledge in a two-step process. First, the information is cognitively interpreted according to personal knowledge and to other people's views to become personal experiences. Second, learners, from these experiences, construct meaning that becomes part of their personal knowledge. This construction of meaning is a social process influenced by people's views and contextual factors. Reflection on personal knowledge itself or on the process of transformation of this knowledge constitutes another mechanisms of learning. Finally, access and interpretation of codified knowledge also contributed to the personal knowledge, directly or through the creation of personal experiences.
3.4 Summary

As illustrated by the content of this chapter, the breadth of the literature on learning is extensive and complex. The perspectives are multiple and sometimes contradictory. However, a few key concepts and general conclusions about clinical learning can be derived from these different approaches:

1) Both the individual and the socio-cultural context contribute to learning. By focusing on distinct aspects of the learning process, the learning theories have illustrated how specific individuals and specific contexts can both critically affect learning. Theories mostly focused on either the individuals or on the context have been invariably criticized for neglecting or denying the importance of one aspect of the learning process.

2) Direct interactions between individuals and the environment lead to learning. The construction of meaning is derived from observing the environment and from intervening (acting, doing) in the environment. The relative benefits of different types of interactions, the role of abstraction (thinking, internalization) and consciousness in the process of meaning construction, and on the relevance of indirect interactions with the environment (talking about) for learning are still matters of debate.

3) Providing access and support facilitate learning. Regardless of their orientation and focus, every approach to learning recognizes the potential roles of more experienced individuals in helping newcomers. These experienced individuals can allow direct interactions between learners and the environment and can support learners in the construction of meaning resulting from these interactions. Disagreements persist regarding the best ways to support learning effectively and efficiently.

As stated in the introduction of this chapter, this review was meant to assist in the exploration of the learning processes at play during clinical supervision. It seems appropriate at this point to re-state the general objectives of this thesis:

1- to study the effects of the level of clinical supervision on patient care and trainee learning during acute care episodes;

2- to explore the learning opportunities emerging from the clinical activities performed in acute care environments;
3- to better understand the tensions between patient care and learning experienced by medical trainees and clinical supervisors working in acute care environments.

To refer to Illeris's basic learning processes described at the beginning of this chapter, these objectives relate to the external, interactional process between individuals and their environment. According to this view, the learning theories specifically relating to social interactions between learners and their environment appear the most relevant to this program of research. These theories include the social cognitive theory, the experiential learning theories, and the socio-cultural theories. For the purpose of this research program, the learning environment will include specifically a clinical supervisor and the rest of the clinical environment (patient, other health care professionals, objects, etc.). To address the objectives of this thesis, the following chapters explore the interactions between the trainees and the clinical environment, the interactions between the supervisors and the clinical environment, the interactions between the trainees and the supervisors, and the relationships between these interactions (Figure 3.4).

Figure 3.4: Interactions in the clinical environment that may affect learning.

The black arrows refer to direct interactions between the trainee, the supervisors and the clinical environment. The dotted arrows indicate influence from one element on the relationship between the two others.
3.5 References


Chapter 4
Overview of the Methodology

4 Introduction

The first chapter of this thesis illustrated how the recent changes in the health care and medical education systems have exacerbated the tensions between service and education during postgraduate medical training. Clinical supervision is one of the mechanisms at play during daily clinical activities that aims at easing these tensions; clinical supervisors facilitate trainees' development of knowledge and skills while ensuring safe and timely care to the patients. In Chapter 2, we reviewed the current literature on clinical supervision, which reflects a certain disconnect between a theoretical view of clinical supervision and its practical application. On one hand, clinical supervisors are expected to consider the need for progressive independence of the medical trainees in their supervisory practice. On the other hand, an increasing amount of studies show that better care results from closer supervision. If and how supervisors can closely oversee trainees' clinical activities without limiting their autonomy have not been fully explored. In addition, Chapter 2 revealed areas of uncertainties regarding the actual behaviors displayed by supervisors during closer supervision and their impact on trainee learning. Therefore, as stated in Chapter 1, the general objectives of this program of research were threefold:

1- to study the effects of the level of clinical supervision on patient care and trainee learning during acute care episodes;
2- to explore the learning opportunities emerging from the clinical activities performed in acute care environments;
3- to better understand the tensions between patient care and learning experienced by the medical trainees and clinical supervisors working in acute care environments.

This chapter aims at presenting an overview of the methodology of this program of research. A description of the detailed methodology and methods used for the two studies included in this thesis will be presented in Chapters 5, 6 and 7.
4.1 Mixed Methods Methodology

A mixed-methods methodology was selected to achieve the objectives of this program of research. Creswell has described the type of research problems that fit mixed methods(1). For example, he suggested that mixed methods can be useful when one data source appears insufficient to answer a research question or when a first study can be enhanced by a second one. The choice of a mixed methods project was driven by two factors. First, the nature of the research questions to be answered directly impacted on the choice of a research design. Recognizing the complexity of phenomena such as patient care, learning, and supervisory interactions, we believed that the breath and depth of data required to answer our research questions called for the collection and analysis of both quantitative data and qualitative data. For example, quantitative data was used to measure concepts such as process of care and resident independent completion of clinical tasks, whereas qualitative data was used to explore concepts such as learning opportunities and interactions among trainees and supervisors. Furthermore, we cannot deny that influences from both the medical and the education communities contributed to our choice of mixed methods methodology. These two communities have traditionally valued and favored different types of research approaches or paradigms(2, 3). For a critical care physician and medical education research fellow who trained in both environments, combining quantitative and qualitative research presented the advantage of reaching both audiences.

Mixed-methods research is a relatively new approach of inquiry that has gained increased popularity over the last 20 years(4). However, mixed methods research has also elicited numerous controversies and debates regarding its nature, its uses, and its legitimacy(4-7). Some of these controversies will be discussed in this section to help locate the nature of our work within the broad and constantly changing field of mixed methods research.

4.1.1 Definitions

The definition of mixed methods research has been evolving over the last two decades(1). First conceptualized as a combination of quantitative and qualitative methods (techniques or tools used to conduct research), mixed methods research was later considered a research process incorporating more than one methodology (theory or rationale underpinning the process of
Johnson & Onwuegbuzie(8) have reviewed and analyzed 19 definitions of mixed methods research proposed by leaders in the field. Their work led to the following composite definition:

*Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration.*

Similarly, the first issue of the Journal of Mixed Methods Research proposed a broad definition of mixed methods research:

*Mixed methods research is defined as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single program of study.*

The terms quantitative and qualitative have been used in different contexts in the mixed methods literature, adding to the confusion surrounding the definition and use of mixed methods research(4). These two descriptors have referred both to the assumptions underpinning the research process and to the methods used to collect and analyze the data. According to Creswell(4), the terms qualitative and quantitative should refer to the methods. He argues that philosophical viewpoints should not be prescriptive of specific methods. In his view, a post-positivist approach to research could, for example, lead to the collection and analysis of both quantitative and qualitative data. Although mixed method research is usually considered a process where both quantitative and qualitative data are collected, gathering quantitative or qualitative data of different forms (e.g., texts and interview scripts) has also been defined by certain researchers as mixed (or multi-) methods research(4).

In his book *Designing and Conducting Mixed Methods Research*(1), Creswell further emphasized the idea that mixed methods research is guided by philosophical assumptions and based on the use of combined methods of research. He presented six core characteristics of mixed method research: the collection and analysis of both quantitative and qualitative data, the
mixing of the data concurrently or sequentially, the priority given to one or both types of data, the use of a single or multiple studies, the reliance on philosophical viewpoints and theoretical lenses to inform the study process, and the choice of a specific design to conduct the study(1).

Similarly, Teddlie and Tashakkori(5) have proposed eight characteristics of contemporary mixed methods research: methodological eclecticism, paradigm pluralism, emphasis on diversity, emphasis on continua, iterative and cyclical approach to research, focus on the research question in determining the methods, specific set of research designs and analytical processes, balance and compromise between qualitative and quantitative orientation. The views of these authors demonstrate a divergence of opinions within the mixed methods community regarding the nature and foundations of mixed methods research. As will be described in the next section, many of these differences have arisen from a lack of consensus regarding the role of paradigmatic stances in mixed methods research.

4.1.2 Paradigmatic Issues

The use of different approaches and methodologies within the same study or program of research has elicited many debates(4, 5, 7, 10, 11). Paradigms have been defined as worldviews informing researchers' assumptions of what is real (realist vs. pluralist ontology), what is knowledge (epistemology), what is valued (axiology), and which methodological choices are made(1) (for different interpretations of the term paradigm, see Morgan 2007(2) and Bergman 2010(12)). Many years of paradigmatic war between proponents of the positivist/post-positivist (objective) and constructivist/interpretivist (subjective) paradigms have crystallized each approach's position(1, 10, 11). On one hand the positivist/post-positivist approach has informed "value-free" studies that test theories and try to establish definitive cause-effect relationships (i.e. that correspond to one objective reality) by reducing complex phenomena to observable, measurable entities. On the other hand, constructivists have traditionally attempted to generate theories from qualitative data collected in specific contexts to better understand the multiple, value-laden, subjective perspectives of social phenomena(13). For years, researchers have debated on the boundaries and commensurability of the positivist and constructivism paradigms(10, 14). Two related sub-questions have fueled many of these controversies: Can paradigms be mixed? Are paradigms prescriptive of specific methods?(13) A position defended in the early years of the paradigmatic debate was the incompatibility thesis: paradigms are linked to specific methods,
and therefore, methods cannot be mixed because paradigms are irreconcilable (15-17). Howe (18) and others (10) have later argued that paradigms and methods are only loosely related. In their opinion, methods can be mixed without crossing paradigmatic boundaries. Another position defended by certain mixed methods researchers has been to reject the utility of paradigmatic stances and to argue that methods should be chosen based on their utility to answer the research question (the a-paradigmatic view) (14). However, many researchers in the mixed methods community have acknowledged the importance of paradigms in mixed methods research: researchers' implicit assumptions regarding reality, knowledge, and ways to access that knowledge influence the types of research questions asked, the types of methods used, and the types of findings reported (12, 19). Not recognizing these influences may affect researchers' ability to identify inconsistencies between their beliefs, methodologies, and methods, as well as the limitations of their work (19).

Mixed methods researchers have therefore proposed alternative rationales for combining paradigms based on different philosophical foundations within the same research study or research program (14, 20). Some researchers consider the mixing process fruitful because of the complementarity of the paradigms and methods used (the complementary view) (14, 21). Proponents of the complementarity view however value keeping paradigms separate within a study or program of research to preserve their respective strengths. Others, such as Green and Caracelli (22), have suggested a dialectical solution to the problem of mixing. For them, mixing paradigms is source of fruitful tensions that inform the research process as long as the assumptions within each paradigm are respected (the dialectical view) (14). For Creswell, paradigms are linked to design (rather than linked to methods) and can be integrated sequentially throughout the research process (the multiple paradigms view) (4). According to Creswell, a specific paradigm is considered more appropriate in certain contexts and should therefore be chosen over another. Finally, two groups of researchers have attempted to assign a third paradigm or approach to mixed methods research to overcome the traditional tensions between the positivist and constructivist positions (14). Mertens (23) and other researchers (14) have argued, within the transformative/critical frameworks, that value systems (assumptions about principles that should be valued by the community and the researcher) rather than beliefs about reality and knowledge (assumptions about what is real and what is known about reality) should informed the research process. Their work includes studies that address issues of social justice.
Another alternative to the positivist and constructivist paradigms has attracted a lot of attention in the mixed methods community. Pragmatism is seen by many as the paradigmatic foundation that should inform future mixed methods research (5, 13).

The pragmatic paradigm has been proposed as a promising alternative philosophical foundation for mixed methods research (5, 24). Pragmatism focuses on real-world problems and practices, and emphasizes the use of methods that best help to answer practical research questions with useful consequences (5, 13, 25, 26). Pragmatists believe in an external, objective reality, but also in multiple, subjective points of view (11). They see knowledge as both a reflection and a construction of the world experienced (13). They use both deductive and inductive strategies during the research process, and admit the fallibility of their claims, i.e. that their findings are likely imperfect and uncertain (11). Initially perceived as a rejection of any philosophical foundations (i.e. choosing whatever works in terms of methods), recent views of pragmatism have exposed more nuanced philosophical perspectives (5, 24). Three examples will be presented here. Johnson & Onwuegbuzie (13) summarized the philosophical system of pragmatism in 21 characteristics. They adopted the view that the provisional truths explored through or resulting from the research process reveal their own value by the practical consequences attributable to their understanding or their use (13). They also defined three kinds of pragmatisms: *pragmatism of the right*, based on an adherence to a strong form of realism (belief in one reality independent of observers); *pragmatism of the left*, based on an adherence to a strong form of pluralism (belief in multiple realities dependent of observers); *pragmatism of the center*, based on an adherence to weak forms of realism and pluralism (8). Biesta (26) has argued that rather than advocating for one philosophical position among others, pragmatists should advocate for the lack of superiority of a particular philosophical approach and assess the success of their methodological choices based on the consequences of their results. She concluded that rather than providing an alternative philosophical foundation for mixed methods research, pragmatism allows researchers to question their philosophical beliefs and their influences on the research process. Such questioning favors an internal consistency between the philosophical views, methodologies, and methods adopted by the researchers. Finally, Green & Hall (19) argued that pragmatism is based on the desire to promote democracy through mixed methods studies oriented towards problem solving and towards action.
These perspectives illustrate the multiplicity of viewpoints characterizing the current mixed methods research landscape. Positioning oneself within this confusing landscape is a complex exercise that requires reflection. Assuming that the result of such reflection is not definitive and immutable, I will now present the position that, I believe, underpinned this program of research.

4.1.3 My Paradigmatic Position

While recognizing the challenges posed by the differences between positivist and constructivist approaches, I believe that both can co-exist and complement each other as part of the same study or program of research. I agree with Biesta (26) that none of the traditional philosophical approaches (i.e. positivist and constructivist) should be considered superior to each other. Furthermore, I believe that these philosophical issues matter because they serve to frame, consciously or not, the research questions asked and the ways phenomena become subjects of inquiry (19). Acknowledging philosophical influences and their consequences in the research process therefore appears important. In addition, as a clinician, supervisor, and teacher, I believe that informing my current clinical practice and future inquiry on this practice is a valuable goal and consequence of the research process. My research questions emerged first and foremost from my clinical and educational practice, and I hope that the findings of this program of research will inform this practice. Such considerations are close in spirit with a pragmatic view. To use Johnson & Onwueguzie’s terms, I would therefore describe myself as a pragmatist of the center. I believe that adopting a central position between positivism and constructivism along the spectrum of philosophical approaches can lead to a synergistic use of multiple views. Such dialogues between multiple views could evoke the dialectical stance promoted by Greene (19).

However, my attention was certainly more attuned to the results that presented practical implications for my practice than to the discrepancies and surprises in the data emerging from different approaches. I therefore believe that pragmatism with high consideration for philosophical assumptions underpinned this program of research. Such position presents potential caveats summarized by Johnson & Onwueguzie (13). Three problems are specifically relevant for this thesis. First, pragmatism tends to favor applied research over basic research, and may have a more immediate, but also more limited impact in a domain. To overcome this issue, I attempted to familiarize myself with broader theoretical issues related to the immediate problem under study, hence the extensive review presented in Chapter 3. Second, the best ways to
evaluate the research process based on the utility of its consequences are poorly defined. How should we determine the utility (for what? for whom?) of the research results? This issue will be discussed in Chapter 11. Finally, although practical, the logic of pragmatism appears at times questionable in terms of philosophical assumptions, and should not be used as a strategy to ignore these issues. The rationale for combining different methodologies within this program of research and the potential limitations that ensued will therefore be explicitly discussed throughout this dissertation.

### 4.2 Research Program Design

#### 4.2.1 Overview of the Research Program

Greene et al. (27) have identified, from their review of mixed methods studies, five broad rationales for conducting mixed methods research: methodological triangulation (convergence of results obtained by different methodologies), complementarity (elaboration, clarification), development (based a study on previous study's results), initiation (discovery of paradoxes and contradictions), and expansion (broader breath of inquiry). The choice of a rationale to combine quantitative and qualitative data directly informs the design of a mixed methods study (1). The number of research designs described in the mixed method research literature have exploded over the years. Criticized for being unnecessarily confusing and poorly reflective of the mixed methods research practice (4, 14), classifications of mixed methods designs have been proposed by authors from different disciplines (1). We used Creswell's simplified classification of major mixed methods research designs and his diagram notation (28) to describe our program of research.

This program of research involved a multiphase design that sequentially combined two studies: a mixed methods, simulation-based study (convergent parallel design) and a qualitative, naturalistic observational study (Figure 4.1). As will be described in details in the following sections of this chapter, we wanted to complement the quantitative results gathered in the simulation environment with qualitative data, which could also potentially initiate new lines of inquiry. Furthermore, the naturalistic observational study was initially planned to triangulate, develop, and expand the results obtained in the simulation setting.
4.2.2 Study 1: A Simulation-Based, Mixed-Methods Study

4.2.2.1 Overview

This first study explored the impact of different levels of clinical supervision on outcomes related to patient care and trainee learning. The specific objectives of the simulation-based study (Study 1) were twofold:

1) to determine the effects of different levels of supervision during simulated acute care episodes on the process of care, trainees' participation, and trainees' subsequent ability to complete independently a similar scenario, and

2) to explore the learning opportunities emerging from simulated acute care episodes completed under different levels of supervision.

The level of clinical supervision has been mostly defined in the literature in terms of physical proximity of the supervisor to the bedside. Such working definition was easy to operationalize and to use for an experimental quantitative study. Furthermore, prior findings from the literature were available to make hypotheses about the effects of closer supervision as part of a deductive approach. A predominantly quantitative study was therefore designed. The simulation setting was chosen for this study for practical and methodological reasons(29). Given that ultimately, resident learning should translate into improved independent clinical performance, we wanted to measure such performance as one of our outcomes. This measurement would have been problematic in the real clinical setting, where we may have had to interrupt the natural performance of our participants to prevent potential harms to real patients. Furthermore, acute medical situations in real clinical settings are highly variable and unpredictable, and therefore
challenging to observe and study in real time. To try to isolate the effect of the level of supervision on different outcomes, the standardization of the scenarios and control of multiple variables was required. The simulation setting allowed such control, as well as the technical capacity to reliably record the events and conversations occurring during the scenarios. Such recording provided complete and usable data both for quantitative and qualitative analyses. Finally, high-fidelity simulation has been shown to provide useful information that can be, in certain contexts, extrapolated to real clinical environments. A simulation-based study was therefore considered a good starting point to inform an observational study in real clinical environments (29).

Realizing the complexity of the phenomenon of clinical supervision, we were not entirely satisfied with reducing the level of clinical supervision to a matter of supervisors' location during care delivery. To better understand how the physical proximity of a supervisor could affect learning, we believed that a deeper exploration of what was happening in terms of interactions among supervisors, trainees, and clinical environment according to different levels of supervision was required. The literature was less informative about the differences in interactions between levels of supervision. We believed that exploring those interactions qualitatively would provide insight on the learning opportunities offered by supervised simulated scenarios, inform our quantitative results, and contribute to achieve our overall program's objectives.

We therefore selected a fixed, mixed-method concurrent design for this study (Figure 4.2). By choosing a mixed methods design, we intended to use our qualitative findings to elaborate and possibly explain certain quantitative results (complementarity). Furthermore, we were interested in exploring contradictions between the two sets of data and in discovering new perspectives through our qualitative findings (initiation). The quantitative and qualitative data from this study were collected concurrently and were analyzed independently. The merging of the data was completed after the data collection and analysis.
4.2.2.2 Methodology Of the Quantitative Arm of the Simulation Study

The goal of the quantitative arm of the simulation study was to determine the effects of different levels of supervision during simulated acute care episodes on the process of care, trainees' participation, and trainees' subsequent ability to complete independently a similar scenario. Fifty-three residents were randomized to one of three levels of supervision, defined by the physical proximity of the supervisor (distant, immediately available, direct). Each resident completed two scenarios based on similar medical content. The first scenario was supervised by a critical care fellow, according to one of three level of supervision randomly assigned. The second scenario immediately followed the supervised scenario and was completed by the resident without supervision. The primary outcome of this study was resident learning, operationalized as resident's ability to independently complete the second, unsupervised scenario. An individual checklist score and a global rating scale were used to measure resident independent performance. The secondary outcomes included resident's participation during the supervised scenario (defined as the percentage of tasks from a checklist completed independently by the residents), and process of care during the supervised scenario (measured by a team performance checklist). The methodological details and findings of the quantitative arm of the simulation study will be described in Chapter 5.
4.2.2.3 Methodology Of the Qualitative Arm of the Simulation Study

During the data collection of the simulation study described above, we recorded all the phone and in-person interactions of the study participants during the supervised scenarios. We conducted an inductive thematic analysis of these transcribed interactions, followed by a deductive analysis using situated learning theory as a theoretical framework. The methodology and findings of the qualitative arm of the simulation study will be described in details in Chapter 6.

4.2.3 Study 2: A Naturalistic, Qualitative Study

We also undertook, sequentially, a second, purely qualitative study. The results from the simulation study were meant to inform the methodological choices of this naturalistic observational study. Therefore, the specific objectives of our second study were not initially defined (emergent design) and its methodological details were eventually based on the first study's findings. These will be presented in Chapter 7.
4.3 References


Chapter 5
Effects Of Clinical Supervision On Resident Learning And Patient Care During Simulated ICU Scenarios

5 Introduction

This first simulation-based study addressed the practical question of the effects of level of clinical supervision on different outcomes related to patient care, trainee involvement in patient care, and trainee learning. The following paper presents the quantitative results of this study. It has been published in the Critical Care Medicine journal in December 2013:

EFFECTS OF CLINICAL SUPERVISION ON RESIDENT LEARNING AND PATIENT CARE DURING SIMULATED ICU SCENARIOS

Dominique Piquette, MD, FRCP(C), MSc, MEd
Jordan Tarshis, MD, FRCP(C)
Glenn Regehr, PhD
Robert A. Fowler, MDCM, FRCP(C), MS
Ruxandra Pinto, PhD
Vicki R. LeBlanc, PhD

INTRODUCTION

Every day, medical errors and adverse events affect the quality of care provided by health care systems(1). The consequences of these events can be dramatic, especially for the very sick and fragile patients that constitute an increasing proportion of today's in-hospital population(1-4). Patients treated in teaching hospitals are exposed to the potential additional risk of trainee-related medical error, which may be prevented by closer level of clinical supervision(5, 6). Direct oversight of medical trainees' clinical activities has been strongly recommended by both the Institute of Medicine(5) and the Accreditation Council for Graduate Medical Education(7). However, only a small number of studies have demonstrated that closer supervision leads to better patient care(8).

Because of the acuity and complexity of their care, critically ill patients may benefit the most from a reduction of medical errors involving trainees(2, 3). Yet, prior studies on clinical supervision did not include critically ill patients nor did they specifically address the process of supervision during the care of acutely unstable patients(8). Most intensive care units (ICUs) are not currently covered by an in-house senior critical care physician available 24/7 for direct bedside supervision of trainees(9). Given the increased resources required to ensure such coverage, investigation into the effects of closer supervision on the care of critically ill patients is warranted.
Additionally, a better understanding of the impact of supervision on learning is needed. Increased supervision of trainees may impair their opportunities for independent practice, and paradoxically leave the next generation of physicians less capable (6). Progressively increased autonomy (10) and participation in clinical activities (11-14) are considered key components of training at the residency level. Closer level of supervision has been perceived as a threat to resident autonomy and participation in patient care (10, 15, 16). However, the evidence supporting a negative effect of closer supervision on learning is scarce (8). Moreover, medical trainees have perceived direct interactions with their supervisors at the bedside as helpful (6, 16-19). Such positive interactions could lead to better acquisition of clinical knowledge and skills (8). Therefore, it is unclear if closer levels of supervision will be detrimental, by threatening resident autonomy and participation, or beneficial, by facilitating acquisition of advanced knowledge and skills.

We designed a simulation-based study to answer the following research questions.
(1) Does a closer level of clinical supervision enhance patient care?
(2) Does a closer level of clinical supervision reduce resident participation in patient care?
(3) Does a closer level of clinical supervision limit resident learning, i.e. the development of residents’ future ability to care independently for similar patients?

**MATERIALS AND METHODS**

**Participants and Setting**
This study was performed in a tertiary care university-affiliated hospital in Toronto, Canada, where 50-70 residents annually complete 1 to 3-month rotations in critical care. The residents are heterogeneous, varying in years of training (PGY1 to PGY4) and in training specialties (internal medicine, surgery, anesthesia, and emergency medicine). In the intensive care units (ICUs) of this hospital, residents are supervised by critical care fellows and fully trained critical care attending physicians.

For the purpose of this study, the supervision was performed by critical care fellows from the same institution. ICU fellows are physicians who have completed their primary specialty training and are pursuing advanced training in critical care. Simulation sessions were conducted at the
hospital-based simulation center, which is equipped with a high-fidelity simulator (Laerdal SimMan®) and offers full access to ICU equipment, medications, and full audio-visual recording capability. Research Ethics Board approval was obtained for this study as was written informed consent from each participant.

Study Design
To answer our research questions, we used the following main experimental manipulation: each resident completed two paired simulated scenarios on the same afternoon; the first at one of three levels of fellow supervision and the second unsupervised. The level of supervision was defined by the physical proximity of the supervisor: direct (supervisor in the simulation room with the resident from the beginning of the scenario), immediately available (supervisor initially available on the phone but able to be at the bedside within one minute when needed), and distant (supervisor only available on the phone for the duration of the scenario).

Fellows supervised up to three residents, but were each time exposed to a new scenario. They were unaware of the checklist items and were instructed to "balance the care of the patient and the teaching to the resident the same way they would in real life". The confederate clinicians (nurse and respiratory therapist) also provided assistance to up to three residents. They received the same introductory clinical information as the residents at the beginning of each scenario and were instructed as follow: to assist the medical team as needed, to object if asked to do things they wouldn't do in real life, but not to make spontaneous suggestions during the scenarios unless specifically asked by the physicians.

To ensure that fellows and confederate were exposed to different scenarios, three pairs of 20-minute scenarios were designed (Appendix 2). They represented the following acute medical conditions: increased intracranial pressure, distributive shock, and hypoxemic respiratory failure. Each pair of scenarios involved the same underlying condition but differed in presentation, for example pulmonary embolism and pulmonary edema as a cause of hypoxemic respiratory failure. Such variation allowed residents to apply the knowledge acquired from the first scenario to the second scenario, without merely reproducing the exact same management selected during the first scenario.
Measurements
Demographic variables (age, gender, years of postgraduate training, subspecialty training, prior ICU and simulation experience) were collected for each participant, as well as resident level of confidence. Level of confidence was defined as residents' personal belief in their own ability to perform a task at a certain level(20). Self-confidence is context-bound and its measurement needs to include specific domains relevant to the task. A self-confidence scale, developed according to Bandura’s principles(20) was completed by the residents before and after the supervised scenario (Appendix 3). The confidence score was recorded as a mean of the score of the individual items of the scale.

Patient Care During Supervised Scenarios
To address our first research question on the effects of supervision on patient care, we measured a team checklist score, the time to stabilization of abnormal vital signs, and the proportion of achievement of definitive management specific to patient condition during the supervised scenario.

The number of clinical tasks completed during the supervised scenario was used to assign a team checklist score. A checklist task was considered done if performed by any member of the team (resident, fellow, nurse), and was reported as a percentage of the total number of items on the checklist. We also recorded on the checklist form who performed the task.

Data on clinical events were collected from all scenarios and included duration of the initial unstable condition prior to an appropriate clinical intervention, and if specific definitive management was ever achieved. The initial duration of abnormal vital signs was determined by two independent raters who indicated for each scenario the interval of time between the resident's arrival in the simulation room and the verbal order or physical action meant to correct the most threatening abnormal vital sign, pre-determined for each scenario. Definitive management was scored dichotomously as yes or no based on the predetermined specific action required to manage the underlying diagnosis of the scenario.
Trainee Participation During Supervised Scenarios
To study the effects of supervision on participation, we calculated resident participation in patient care during the supervised scenario as the number of checklist items completed by the resident divided by the total number of items included in the checklist (expressed as a percentage).

Resident Independent Performance During Unsupervised Scenarios
To address our third research question, resident independent performance was assessed during the unsupervised scenarios using the Ottawa Crisis Management Global Rating Scale (Ottawa GRS) for non-technical skills(21) and an individual checklist score for task-specific clinical actions (Appendices 2 and 4). The Ottawa GRS assesses individual non-technical skills according to five different domains (leadership skills, problem-solving skills, situational awareness skills, resource utilization skills, and communication skills) and the overall performance using seven-point anchored scales(21). It has been validated to assess residents’ individual performance during ICU simulated scenarios(21).

Two independent raters were trained to use the global rating scale and the checklists during a two-step process including 1) the independent review of three videotapes recorded during the pilot phase and 2) participation in a round of score calibration during which agreement was reached on how to interpret the scale of each items of the assessment tools. The raters then independently reviewed and rated all the videotaped performance of the participants. Any discrepancy in the checklist scores was resolved by a third independent assessor who reviewed the videotapes to confirm whether an item had been completed or not.

Statistical Analyses and Sample Size Calculation
Descriptive continuous variables were reported as means and standard deviation when data were normally distributed or as medians and interquartile range otherwise. Categorical variables were reported as percentages.

Seventeen participants per group were required to provide a power of 80% at 5% significance level to detect a difference between the distant supervision and direct supervision groups of 1.25 on the Ottawa GRS with a standard deviation 1.25. This difference was considered significant
because it corresponded to the difference found between the clinical performance of a PGY1 and a PGY3 resident during simulated ICU scenarios in a previous study (21).

To study the relationship between level of supervision and patient care, we conducted a one-way analysis of variance (ANOVA) on the team checklist scores of the supervised scenario with the level of clinical supervision (direct, immediately available, distant) as the independent variable. The duration of abnormal vital signs for the supervised scenario was analyzed using Kruskal-Wallis to allow for the skewness in the data. The proportions of definitive management achieved at the end of the supervised scenario were compared using chi-square test.

To assess the relationship between level of supervision and resident participation, we conducted a one-way ANOVA on the proportion of the total number of checklist items completed by the resident during the supervised scenario with the level of supervision as the independent variable.

Inter-rater reliability for the Ottawa GRS was computed by means of intra-class correlation for mean rating. The average scores of the overall performance across the raters were used as the dependent measure in the analyses. The primary analysis regarding the relationship between level of supervision and resident independent performance was conducted on the results of the Ottawa GRS during the unsupervised scenario, using a one-way analysis of variance (ANOVA) with the level of clinical supervision as the independent variable. We also conducted analyses on the individual checklist score, duration of abnormal vital signs and proportion of definitive management achieved during the unsupervised scenario as described for the supervised scenario. We tested for a cluster effect of the fellow in our analyses on the effect of the level of supervision, but found no significant effect and did not include this variable in our results.

To explore the potential predictors of the resident performance during the unsupervised (second) scenario, we performed two multivariable linear regressions using the Ottawa GRS and the individual checklist score during the unsupervised scenarios as the dependent variables. Using assumption of clinical importance, we selected a priori seven variables: 1) level of clinical supervision; 2) supervised (first) scenario checklist score; 3) percentage of the total number of items of the checklist completed by the residents during the supervised (first) scenarios; 4) number of ICU months (categorized as 0-1 versus ≥2) completed by the residents prior to the
study; 5) number of simulation sessions (categorized as 0-1 versus ≥2) completed by the residents prior to the study; 6) resident postgraduate level of training (categorized as 1-2 versus >2); 7) confidence score pre-supervised (first) scenario. We chose the final sets of predictors based on the model offering the best R-square in combination with a Mallows’ C_p statistic close to the number of parameters estimated(22). The regression assumptions were assessed using Q-Q plots of the residuals for normality, plots of residuals versus predicted values for homogeneity of the variance, and by plotting them against each predictor to assess that there are no undetected trends. Because the model is chosen based on the data, the actual p-values would be larger than those presented. Nonetheless the model gives us useful information regarding the importance of each variable as predictors of performance. We tested for an interaction between level of clinical supervision and percentage of the total number of items completed by the residents during the supervised scenarios. The interaction was not significant and therefore the final models reported do not include the interaction.

RESULTS

Baseline Characteristics
Between April 2009 and June 2010, 53 residents and 24 critical care fellows (supervisors) were recruited as participants. The baseline characteristics of the residents are shown in Table 5.1. Supervising fellows were mostly males (78%), had a mean age of 33+/- 3 years, and had completed a median of 19 (IQR: 3,36) ICU months and of 3 (IQR: 0,10) simulation sessions at the time of the study.

Level of Supervision
During immediately supervised scenarios, two residents did not call their supervisor, four residents obtained advice from their supervisor by phone only, and ten residents were eventually assisted by their supervisor at the bedside (four within five minutes of the beginning of the scenario). During distantly-supervised scenarios, all the residents called their supervisor: five immediately after an initial brief assessment, seven during the management of the scenarios, and seven after the completion of their management plan).
Patient Care during Supervised Scenarios
Lower (worse) checklist scores were obtained for scenarios completed under distant supervision compared with scenarios completed under direct or immediately available supervision (p=0.0013). No other significant difference was found during supervised scenarios (Table 5.2).

Resident Participation during Supervised Scenarios
The percentage of total checklist items completed by the residents (i.e. not by fellows or nurses) during the supervised scenarios was significantly lower during direct supervision (mean [and standard deviation] for direct: 40% [21%] vs. immediately available: 58% [16%] vs. distant: 55% [11%]; p=0.005).

Resident Independent Performance During Unsupervised Scenarios
During unsupervised scenarios, no significant differences between supervision groups were found for the Ottawa Crisis Management Global Scale, the individual checklist score, the duration of initial abnormal vital signs, or the proportion of scenarios completed with definitive management (Table 5.3). The inter-rater reliability of the Ottawa GRS was good (ICC of 0.75).

Predictors of Resident Performance During Unsupervised Scenarios
Both the team checklist score and the percentage of items completed by residents during supervised scenarios were found to be independent predictors of the Ottawa GRS on the unsupervised scenarios (F-value=7.20; p<0.0001; adjusted R²=0.38, Table 5.4), indicating that a higher number of items completed by the team and greater resident participation during the supervised scenario were independently associated with higher performance during the unsupervised scenario. The team checklist score obtained during the supervised scenario and residence level of confidence prior to the supervised scenario were identified as two independent predictors of the resident individual checklist score during the unsupervised scenario (F-value=5.93; p=0.0006; adjusted R²=0.28).

DISCUSSION
Closer level of clinical supervision has been strongly recommended as a strategy to prevent adverse events occurring as a result of the clinical inexperience of medical trainees working in teaching hospitals(5, 7). Given the practical challenges associated with the implementation of
direct supervision 24/7(9), convincing evidence of the benefits of such strategy is required. Our study adds to this evidence by demonstrating that care during ICU simulated scenarios was better under direct and immediately available supervision compared to distant supervision by ICU fellows with a median of 19 months of ICU training.

In addition, our study aimed to evaluate the impact of clinical supervision on resident participation and resident learning. Our study confirmed that direct supervision was associated with a lower proportion of tasks completed by the residents themselves (i.e. less participation in patient care) compared to immediately-available and distant supervision. However, we did not demonstrate an association between the level of supervision during a supervised scenario and resident independent performance during a subsequent unsupervised scenario based on similar content. Thus, our data suggest that although direct supervision may diminish the participation and completion of tasks directly by the resident, this was not associated with worse subsequent unsupervised performance.

At least three reasons could explain why residents appeared to learn from directly-supervised scenarios, even in face of lower participation in patient care. First, higher checklist scores obtained during directly-supervised scenarios indicate that even if the residents were not themselves carrying out as many tasks when the supervisors were at the bedside, they were exposed to a better process of care. Vicarious learning (i.e. learning by observation) is an important aspect of work-place and social learning(23, 24). During direct supervision, what was lost in practice may have been gained in observation and modeling. A second explanation for similar resident performance after less direct participation could be that residents did not significantly learn from a unique, fairly short supervised scenario regardless of the level of clinical supervision. Their baseline knowledge and skills could have been the main predictor of their subsequent performance during the unsupervised scenario.

Our explanatory predictive models of resident performance during the unsupervised scenario help to partially clarify the likelihood of these first two hypotheses. The checklist score obtained by the team during the supervised scenario was an independent predictor of resident performance (Ottawa GRS and checklist score) during the unsupervised scenario, confirming that some learning likely occurred from the supervised scenario. Given that this effect was maintained
independently of the proportion of items completed by the residents during the supervised scenario, we postulate that residents benefited from observing the team performance even when not directly involved in every step of the care. Our predictive model did not provide clear evidence that resident baseline knowledge and skills were associated to resident independent performance during the unsupervised scenario. However, we recognize that the three variables used in the model as surrogate for baseline resident performance were imperfect. Knowledge is content-specific and prolonged clinical training or ICU experience may not adequately reflect the specific abilities previously acquired by the residents and used to address the clinical scenarios of this study(25). The residents' level of confidence of their ability to complete independently specific tasks included in the scenarios was found to be an independent predictor of the checklist score for the unsupervised scenario. The level of confidence was identified in prior studies as a poor surrogate of observed performance(26). However, this variable was assessed in our study in relation to specific tasks completed in specific contexts, and may therefore better represent residents' real abilities than level of training or prior ICU experience(27).

Finally, our design and selected outcome measures may not have allowed us to detect clinically significant differences in resident independent performance between groups. Our sample size was calculated to detect a moderate difference in the Ottawa GRS. The inter-rater reliability of this measure was good, but could have potentially decreased our ability to detect very small differences among groups. In addition, the resident knowledge and skills specific to the content of the scenarios were not formally measured before the supervised scenario. This measurement could have helped us to better define the role of the residents' baseline abilities in performance during the unsupervised scenarios. Performance for both scenarios was measured on the same day and long-term performance outcomes were not measured.

CONCLUSIONS
Despite these potential limitations, our study results would seem to provide some support of recommendations for a closer level of supervision of residents' clinical activities. Some aspects of care delivered in the presence of more senior supervising physicians were of better quality than care delivered without access to a bedside supervisor. Closer supervision may also benefit residents through direct observation and modeling of supervisor behaviors. To fully understand the effects of clinical supervision on learning, we need to further study how clinical supervision
affects the specific interactions between the supervisors and the residents and the nature of resident participation occurring under different levels of clinical supervision in actual practice settings. Once these differences are more clearly established, medical educators will be better equipped to undertake the task of designing and implementing strategies to ensure that optimal learning conditions are maintained while delivering the best quality of care to acutely ill patients.

ACKNOWLEDGEMENTS

We would like to thank Sim-One, Ontario, Canada for their financial support through a peer-reviewed grant (2007).
REFERENCES


Table 5.1: Residents’ demographic data, prior ICU and simulation experience, and baseline level of confidence among direct, immediately available and distant models of supervision

<table>
<thead>
<tr>
<th></th>
<th>Direct (N=18)</th>
<th>Immediately Available (N=16)</th>
<th>Distant (N=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) mean (SD)</td>
<td>32 (7)</td>
<td>29 (4)</td>
<td>32 (5)</td>
</tr>
<tr>
<td>ICU Experience (months) median (IQR)</td>
<td>1 (0-1)</td>
<td>0.88 (0-1.5)</td>
<td>1 (0-2)</td>
</tr>
<tr>
<td>Simulation Experience (session) median (IQR)</td>
<td>1.5 (0-3)</td>
<td>1.5 (0-4)</td>
<td>3 (2-3)</td>
</tr>
<tr>
<td>Gender - Male N (%)</td>
<td>9 (50)</td>
<td>10 (62)</td>
<td>10 (56)</td>
</tr>
<tr>
<td>Level of Training N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGY 1-2</td>
<td>12 (67)</td>
<td>11 (69)</td>
<td>11 (61)</td>
</tr>
<tr>
<td>PGY ≥ 3</td>
<td>6 (33)</td>
<td>5 (31)</td>
<td>7 (39)</td>
</tr>
<tr>
<td>Subspecialty N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anesthesia</td>
<td>3 (18)</td>
<td>5 (33)</td>
<td>4 (24)</td>
</tr>
<tr>
<td>Medicine</td>
<td>4 (24)</td>
<td>1 (7)</td>
<td>3 (18)</td>
</tr>
<tr>
<td>Surgery</td>
<td>6 (35)</td>
<td>8 (53)</td>
<td>6 (35)</td>
</tr>
<tr>
<td>Emergency Medicine</td>
<td>3 (18)</td>
<td>1 (7)</td>
<td>3 (18)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (6)</td>
<td>0 (0)</td>
<td>1 (6)</td>
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<tr>
<td>Confidence Score (%)</td>
<td>75 (9)</td>
<td>70 (19)</td>
<td>78 (14)</td>
</tr>
</tbody>
</table>

IQR: Interquartile Range; SD: Standard Deviation
Table 5.2: Patient Care during Supervised Scenarios

<table>
<thead>
<tr>
<th></th>
<th>Direct (N=18)</th>
<th>Immediately Available (N=16)</th>
<th>Distant (N=19)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Checklist Score (%) mean (SD)</td>
<td>72 (12)</td>
<td>77 (10)</td>
<td>61 (11)</td>
<td>0.0013&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Duration of initial abnormal vital signs (minutes) median (IQR)</td>
<td>2.6 (0.9-4.1)</td>
<td>1.9 (0.9-4.5)</td>
<td>1.5 (1.1-2.6)</td>
<td>0.52</td>
</tr>
<tr>
<td>Definitive management (%)</td>
<td>72.2</td>
<td>50.0</td>
<td>68.4</td>
<td>0.36</td>
</tr>
</tbody>
</table>

IQR: Interquartile Range; SD: Standard Deviation

<sup>a</sup> The checklist score was significantly lower (worse) for distant supervision when compared to immediately available (p=0.016) and direct (p=0.015) supervision, but no statistically significant difference was found between direct and immediately available supervision (p=0.35).
Table 5.3: Resident Independent Performance during Unsupervised Scenarios

<table>
<thead>
<tr>
<th></th>
<th>Direct (N=18)</th>
<th>Immediately Available (N=16)</th>
<th>Distant (N=19)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ottawa GRS mean (SD)</td>
<td>4.2 (1.1)</td>
<td>4.5 (1.0)</td>
<td>4.1 (1.1)</td>
<td>0.56</td>
</tr>
<tr>
<td>Resident Individual Checklist Score (%) mean (SD)</td>
<td>68 (13)</td>
<td>73 (11)</td>
<td>65 (15)</td>
<td>0.22</td>
</tr>
<tr>
<td>Duration of initial abnormal vital signs (minutes) median (IQR)</td>
<td>2.1 (0.9-3.3)</td>
<td>1.3 (0.9-3.6)</td>
<td>1.4 (1.0-2.6)</td>
<td>0.89</td>
</tr>
<tr>
<td>Definitive management (%)</td>
<td>50.0</td>
<td>56.3</td>
<td>63.2</td>
<td>0.72</td>
</tr>
</tbody>
</table>

IQR: Interquartile Range Ottawa GRS: Ottawa Global Rating Scale; SD: Standard Deviation
Table 5.4: Multivariable Models of Independent Predictors of Resident Performance during the Unsupervised Scenarios

<table>
<thead>
<tr>
<th>Performance Measures (Unsupervised scenario)</th>
<th>Independent Variables</th>
<th>Parameter Estimate (SE)†</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ottawa GRS</td>
<td>LOS - immediately available *</td>
<td>-0.024 (0.36)</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>LOS - direct*</td>
<td>0.25 (0.36)</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Team checklist score (supervised scenario)</td>
<td>0.036 (0.012)</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>% of items by resident</td>
<td>0.025 (0.008)</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Prior number of simulations (&gt;1 vs. 0/1)</td>
<td>0.43 (0.26)</td>
<td>0.10</td>
</tr>
<tr>
<td>Resident Checklist Score Percentage</td>
<td>LOS - immediately available*</td>
<td>1.99 (4.62)</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>LOS - direct*</td>
<td>-2.08 (4.12)</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>Team checklist score (supervised scenario)</td>
<td>0.52 (0.15)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Resident confidence score</td>
<td>0.27 (0.11)</td>
<td>0.022</td>
</tr>
</tbody>
</table>

*Reference level is Distant level of supervision.

†Negative values indicate lower (worse) performance scores.

LOS: Level of Supervision; Ottawa GRS: Ottawa Global Rating Scale; SE: Standard Error
Chapter 6
Clinical Supervision And Learning Opportunities During Simulated Acute Scenarios

6 Introduction

The following paper presents the qualitative results of the simulation-based study. It has been accepted for publication in the Medical Education Journal on March 17 2014.
CLINICAL SUPERVISION AND LEARNING OPPORTUNITIES DURING SIMULATED ACUTE SCENARIOS

Dominique Piquette, MD, FRCP(C), MSc, MEd
Maria Mylopoulos, PhD
Vicki R. LeBlanc, PhD

INTRODUCTION

Medical errors involving trainees working in teaching hospitals have emerged as a growing source of concern over the last decade(1-6). Multiple gaps in the clinical supervision of junior medical trainees have been reported across disciplines: inappropriate monitoring of trainees' clinical activities, lack of guidance and advice provided by senior physicians, and failure of junior trainees to seek supervision when needed(7-10). An increasing body of evidence has demonstrated the benefits of closer supervision on patient care(11). Closer clinical supervision has therefore been promoted as a strategy to limit medical errors and to improve patient outcomes(2, 12-15). Medical organizations and regulatory bodies have primarily articulated level of clinical supervision in terms of the physical proximity of the supervisor to the bedside(2, 12). For example, the Accreditation Council for Graduate Medical Education (ACGME) postgraduate training requirements now specify that for junior trainees and in certain clinical circumstances (e.g. in acute care setting), a senior physician should be continuously or immediately available at the bedside(16).

The increased presence of supervisors at the bedside during the delivery of patient care has elicited concerns regarding the on-going use of clinical wards as primary learning environments for medical clerks and residents(17-19). Clinical training has been traditionally based on a model of progressive independence(7, 18, 20). Supervisors have been expected to tailor their level of clinical supervision to trainees' abilities and experience(18, 21). While still explicitly recognizing the need for trainees' progressive independence, the new recommendations for closer supervision clearly prioritize patients' rights for safe and timely care over trainee's need for clinical autonomy(13). However, the impact of direct supervision (i.e. supervisors' bedside presence) on trainees' ability to participate in patient care and to develop their clinical autonomy has been little
studied.

A small number of studies have shown neutral or positive effects of closer supervision on learning(11). However, these studies have considered a limited number of learning outcomes and specific clinical environments. To our knowledge, no observational studies have compared the learning opportunities created by distant supervision (e.g. supervisors immediately available by phone only) versus the learning opportunities emerging from having the supervisors at the bedside. Direct clinical supervision has generally been perceived as a positive experience by medical trainees, as long as the supervisors allow some level of participation in patient care(22). Our previous work(23) demonstrated that direct supervision was associated with better process of care, lower level of trainee participation (clinical tasks completed independently by the residents), but the same subsequent ability to care independently for a similar simulated patient. These results suggest that, although trainee's participation and autonomy during patient care are commonly assumed to be negatively affected by the supervisors' presence at the bedside, other learning opportunities may emerge from supervisors' continuous input. For example, the quality of feedback and assessment provided by the supervisors to the trainees may be improved by routine, direct observation. Thus, the balance between these different challenges and opportunities must be better defined to fully understand the effects of clinical supervision on learning.

Accordingly this research, as part of a simulation-based study involving the concurrent collection of quantitative and qualitative data investigating, sought to explore the learning opportunities created during simulated acute care scenarios completed by trainees under different levels of clinical supervision. The quantitative results of the study, focused on the effects of the level of supervision on patient care, resident participation, and a resident's subsequent ability to resuscitate a simulated patient independently, have been described elsewhere(23).

MATERIALS AND METHODS

Participants and Setting
Following institutional ethics approval, we recruited 53 participants (postgraduate level 1 to 4) among residents completing a critical care rotation in our university-affiliated health care center located in a large Canadian city. Our center receives approximately 60 residents every year for a
critical care rotation of 1-3 month duration. The residents recruited were from various medical backgrounds, including surgical, medical, and anesthesia subspecialties. The majority of them had a limited exposure to the critical care setting prior to their rotation. Residents were considered the supervised trainees for the purposes of this study.

We recruited an additional 24 critical care fellows from our center. At our hospital, critical care fellows refer to two categories of clinicians: physicians who are certified in a primary specialty and are completing a subspecialty training in critical care, and physicians who are already certified (often in other countries than Canada) in a primary subspecialty but want to obtain further training in the area of critical care. Both types of fellows usually assume primary responsibility for the care of critically ill patients under the supervision of fully licensed critical care physicians. Fellows also supervise junior trainees' clinical activities during daytime as well as during nighttime and weekend in-house calls. For the purposes of this study, fellows were considered the supervisors.

**Design**

This study represents the qualitative component of simulation-based study involving the concurrent collection of quantitative and qualitative data. Residents were asked to participate in two mannequin-based simulated scenarios scheduled on the same afternoon, one supervised and one unsupervised (23). For the supervised scenario, each resident was randomly allocated to one of 3 levels of supervision defined by the physical proximity of the supervisor: distant (supervising fellow only available on the phone), immediately available (supervising fellow initially available on the phone, but immediately available in person upon request) and direct (supervising fellow at the bedside from the beginning of the scenario). Each fellow supervised up to 3 residents, and the residents supervised by the same fellow were assigned randomly different scenarios so that the fellow was always unaware of the content of the upcoming scenario. Immediately after the completion of their first supervised scenario, residents participated in a second scenario without supervision.

To ensure a variety of scenarios for the fellows, three pairs of scenarios were developed by the principal investigator and piloted by three experienced critical care physicians. Each pair of scenarios completed by a resident related to a similar clinical presentation (hypoxemic
respiratory failure, or distributive shock, or increased intracranial pressure), but to different diagnoses (e.g. intracranial bleed and intracranial edema post-surgical resection of a tumor). Each scenario lasted 20-25 minutes. During both the supervised and unsupervised scenarios, residents had access to confederate clinicians (a critical care nurse and a respiratory therapist) who assisted them in their clinical tasks. The confederate clinicians were not aware of the details of the scenarios. They were requested to follow physicians' instructions, and to take no initiative regarding patient care unless specifically asked by the physicians (e.g. “Do you know the usual dose of this medication?”).

Data Collection
Written informed consent was obtained from each participant. All in-person and phone interactions between the trainees (residents) and the supervisors (fellows) during the supervised scenarios were video and audio recorded for transcription. Descriptions of the clinical context (e.g. patient's vital signs) and of certain actions completed by the participants during the scenarios were also included in the transcripts to provide a better understanding of the interactions that were not directly implied by the verbal exchanges between participants. Such descriptions were generated by the principal investigator during the transcription process, which relied on the review of the recording of each scenario. The 53 supervised scenarios were converted into 234 pages of transcripts for analysis.

Data Analysis
We conducted an inductive thematic analysis of the anonymized transcripts of the interactions between trainees, supervisors, and their clinical environment (including a nurse and a respiratory therapist)(24). However, the descriptions of the clinical context and behaviors displayed by the participants were also included in the analyses when they appeared essential to the interpretation of the content of the interactions. After the completion of the 53 scenarios, one of the authors (D.P.) reviewed all the transcripts and identified recurrent emerging themes using line-by-line coding. These themes were then grouped into categories. Comparisons within scenarios, across scenarios of different fellows, and across scenarios of different levels of supervision were completed(25). Upon doing so it was clear that the analysis would be facilitated by re-classifying the levels of supervision into two categories: distant supervision for the interactions occurring on the phone (during distant and immediately available supervision), and direct supervision for the
interactions occurring in person (during immediately available and direct supervision).

Following complete coding of the transcripts, the three authors reviewed a subset of the scenarios to assess for the reasonableness of the interpretation. Through subsequent discussions and revisions, the coding structure was further refined.

To explore the potential relationships between supervision and learning, we conducted a deductive exploration of our data in addition to the initial inductive analysis. We used views on knowledge and learning from situated learning theories to guide this analysis (26-30). These theories argue that knowledge is distributed across multiple individuals, socially constructed abstract signs (e.g. language), and concrete tools (e.g. computers) (26, 29). Learning is defined as the increased ability of an individual to participate meaningfully in a social practice, acquired through a greater understanding of the meaning of a given community's activities (27, 30). Using a situated approach to learning allowed us to think in terms of "contributions to patient care" and to look at different aspects of the scenarios: which participant(s) is/are contributing to patient care? Which one(s) is/are not? Who is helping the residents to contribute to patient care? How so? How do fellows respond to residents' spontaneous contributions to patient care? The views on knowledge and learning conveyed by the situated learning theory was conducive to thinking about learning and supervisor-resident relationships in different ways, to looking beyond the more traditional forms of "teaching", and to observing how access to the clinical environment was facilitated by the supervisors. By focusing on the transfer of the clinical information between participants and its use for medical management (29), each scenario transcript was analyzed based on information sharing between the trainees and the supervisors, and on their respective contributions to patient care (e.g. expressed ideas and judgments about diagnosis and management or visible behaviors aimed at assessing and improving patient's condition). These contributions allowed us to identify and analyze the learning opportunities encountered by our participants.

RESULTS

During their participation in simulated clinical scenarios, trainees were consistently exposed to learning opportunities. We conceptualized learning opportunities in three ways: as trainees' direct physical or mental engagement in patient care (opportunity for practice), as trainees' exposure or access to supervisors' contributions to patient care (opportunity for observing), or as
trainees' ability to compare their performance with a standard established verbally or demonstrated in real-time by the supervisor (opportunity for feedback).

Moreover, we identified two broad categories of learning opportunities from our data. *Incidental learning opportunities* occurred naturally, i.e. in agreement with the clinical circumstances or as part of the activities required for patient care. They demanded little purposeful efforts from the participants. The clinical circumstances, not the participants, created these opportunities. *Engineered learning opportunities* rather depended on purposeful efforts from the trainees or the supervisors. They were deliberate because they were not essential for the care of the patient.

Using this emergent framework of learning opportunities, our analysis of the data revealed three themes that contribute to our understanding of the relationship between level of clinical supervision and learning: 1) trainee's contributions to patient care: without and despite supervisor bedside presence 2) supervisor's influences on patient care: in person and despite the distance 3) trainee-supervisor interactions: beyond contributions to patient care.

1) Trainee's Contributions to Patient Care: Without and Despite Supervisor Bedside Presence.

Trainees made independent contributions to patient care consistently across scenarios, both when the supervisors were absent and present at the bedside.

In distantly supervised scenarios, trainees were initially the only ones who could interact with the clinical environment. Therefore, trainees' spontaneous contributions to patient care occurred almost universally at the beginning of those scenarios, representing *incidental opportunities for practice*:

*The resident enters in the room, expresses worries about the oxygenation, checks the FiO₂, the ECG, and asks about a chest x-ray. He reviews the blood work. He asks a few questions to the patient. [...] He decides to intubate when the saturations do not improve. He says that he thinks the patient might have aspirated, but concludes that a pulmonary embolism is more likely when he sees the normal x-ray. [...] The patient is intubated without complication. He notices the low blood pressure and requests an arterial line. He says he’s worried about sepsis. [...] Then, he decides to call the fellow.* [S29 - Immediately Available Supervision]
Further incidental opportunities for practice during distant supervision resulted from the phone interactions among trainees and supervisors. Because of their physical distance from the bedside, supervisors had to delegate most of the clinical tasks to the residents:

F: *So what I would do is just have another look at his pupil and reassess his cranial nerves, make sure you repeat his coagulogram, and assess his response to peripheral pain to see if he has any improvement in his neurological exam. And don’t give him any sedation. [...] And I would also talk to neurosurgery about this, but after the mannitol, I would just hold it and measure his osmolarity, make sure it doesn’t rise above 320. [...] After the phone discussion, the resident reassesses the patient neurologically and orders some blood work.* [S5 - Distant Supervision]

During direct supervision, the supervisors' involvement in patient care did not necessarily mean that trainees disengaged from clinical activities. Despite the supervisor's presence at the bedside, many trainees continued to make spontaneous contributions to patient care that often complemented the supervisors’ initiatives:

R: [Talking to himself] *The blood pressure is low. Ok, let’s start… PCO2 is 37. [To the nurse] Can we just verify a manual blood pressure please? And get the crash cart ready. I’ll just take care of the blood pressure by giving 5 mg of ephedrine.*
F: *Let’s give 500mL of normal saline.*
R: *Sure, we can do that. Let’s give him some fluids in case he’s bleeding. Can we… [Looking at the monitor] ST depression… Can we just print out a 12-lead? He has a cardiac history. So he has ST depressions and T waves inversions. [To the nurse] Do we have an old ECG?* [S45 - Direct Supervision]

However, the trainees' contributions were not essential to patient care when the supervisors were present at the bedside because supervisors were recognized, *de facto*, as primarily responsible for the patients. Trainees' opportunities to apply their knowledge and to practice their skills during direct supervision thus depended partially on the trainees' own initiatives or on the supervisors' need to delegate clinical tasks to the trainees. Trainees then often carried out these delegated contributions to patient care independently, while the supervisors were undertaking other tasks:

F: *Yes. We need to call cardiology. [To the resident] Why don’t you work on his airway, and I’ll call cardiology.*
*The resident gathers the material for intubation.* [S14 - Direct Supervision]

Trainees' inability to contribute to patient care during direct supervision could be often attributed to trainees' lack of knowledge or experience rather than to the supervisors' bedside presence:
F: What else do you want to do? What’s your differential? We’ll get an arterial line, a central line...

R: Mmmm...

F: So from the septic point of view...

R: So we need to do early-goal directed therapy. We need to measure a central venous pressure, but I don’t know how to do that!

The fellow asks the nurse to transduce the central venous catheter and to send a central venous gas to assess the patient's perfusion state. [S24 - Direct Supervision]

Trainees made direct contributions to patient care, spontaneously or by delegation, both during distant and direct supervision. These contributions represented opportunities for practice. However, as described in the following section, the nature of trainees' learning opportunities was frequently modified because of the supervisors' ubiquitous influences.

2) Supervisor's Influences on Patient Care: In-Person and Despite the Distance.

Through their involvement in patient care by phone or in person, supervisors limited trainees' level of responsibility for patient care and affected the nature of trainees' opportunities for practice, but they also provided 
engineered and incidental opportunities for observation.

Once both trainees and supervisors were engaged in a scenario, supervisors could exercise full control over patient care, thereby potentially limiting trainees' clinical contributions. This shift of responsibility for patient care was not only observed during direct supervision, but also through the phone interactions that took place during distant supervision. Trainees then merely acted as intermediary between the supervisors and the clinical environment, such as in this scenario where the supervisor, once called by the resident, took over the care of the patient:

F: So the major question is going to be if he’s anticoagulated or not, and again if it’s septic or cardiogenic shock that is leading to his hypotension. So make sure that there is a coagulogram on that blood work to see if he’s anticoagulated. And he should also have some cultures drawn. And with the urine output that low, obviously make sure that you have a creatinine and urea level, and I would continue to give some fluids. I wouldn’t go too quickly up on the levophed, because if this is cardiogenic, you’re going to increase the afterload and increase the work on the heart. [S11 - Distant Supervision]

During both distant and direct supervision, supervisors tended to intervene heavily in patient care when immediately concerned about the patient because of the acuity or complexity of the care:

The resident is interviewing the patient. The fellow is standing by the bedside.

R: What are his vital signs right now?
RN: The saturation is 92% on a non-rebreather mask. His blood pressure is 78/42. He had a bolus of 500cc. [worrisome vital signs]
R: Ok, and what’s his IV access?
F: Should we give him a liter of fluid right now? [S22 - Direct Supervision]

A shift of responsibility for patient care did not automatically translate into a lack of trainees' opportunities for practice. However, by preferentially delegating certain types of tasks to the trainees, supervisors could easily affect the nature of trainee involvement in patient care when present at the bedside. Physical examinations and technical tasks (e.g. intubation) were the two clinical activities consistently delegated to the trainees when such division of labor occurred. For example, in this scenario, the supervisor made most of the decisions regarding patient care, but involved the resident in the endotracheal intubation:

F: [To the nurse] Would you mind to work on a second IV access and we’ll call for the respiratory therapist and get the intubation tray ready. [To the resident] You can intubate and I’ll help you out. So we’ve got an intubation tray here. So why don’t we just connect this ambubag to the wall and give him some slight pre-oxygenation. Do we know if he’s NPO (nil per os) or not?
RN: He’s been I think.
F (To the resident): So try to bag him not too much. He’s already on 100%. [S1 - Direct Supervision]

The supervisors' contributions to patient care represented another type of learning opportunity for the trainees: opportunities for observation instead of opportunities for practice. Opportunities for observation differed according to the level of supervision. During distant supervision, supervisors were not directly exposed to the 'raw' clinical environment. As a result, they had to base their cognitive construction of the events largely on trainees' perceptions and interpretations. In the following example, the resident presented the case to the fellow as a patient suffering from unstable atrial fibrillation. While the fellow is trying to identify associated cardiac conditions, he learns for the first time about a potential diagnosis of pneumonia:

F: Do we know anything about his left ventricle function or not?
R: No.
F: Ok, and does he seem in pulmonary edema or any ST changes...
R: He has a pneumonia. The chest x-ray shows cardiomegaly, he has a right infiltrate, and may be in cardiac failure [He is not]. I am not sure. [S35 - Distant Supervision]

The supervisors' recommendations were usually appropriate based on the information provided by the trainees, but did not always represent optimal care for the patient. Indeed, trainees
potentially learned inappropriate links between clinical information and management. In addition, the direct observation of supervisors' spontaneous bedside behaviors was impossible during this form of *engineered observation*. The chronological order and flow of supervisor's decisions and actions were affected by the resident's presentation of the clinical information (e.g. order, completeness). This potentially resulted in the residents needing to exert additional efforts in order to remember how to address similar cases in the future.

With direct access to the clinical environment, supervisors could naturally proceed with their own data collection, diagnosis, and management during direct supervision. Therefore, trainees could easily observe and model supervisors' natural ways of doing (*incidental observation*). However, the rationale underpinning supervisors' decisions and actions were not always explicitly discussed. Direct supervision allowed trainees to witness what was done, but not always to understand why it was done:

> F: [Looking at the ECG] Oh, it’s definitively different from the previous one. [Showing to the resident] He’s got a new right bundle branch block. So if we can’t get a PE study tonight, we should get an echo to assess his right ventricle... [Rationale not explained]
> RN: CT of?
> F: Chest with contrast. And he’ll need a central line, maybe vasopressors. He doesn’t need to be thrombolysed at the bedside. [Rationale for management not explained]

For any level of supervision, supervisors influenced patient care and trainees' clinical contributions. However, the potential learning benefits and constraints resulting from these influences varied according to the level of supervision. In addition to being created through the supervisors' and trainees' direct contributions to patient care, learning opportunities further emerged from the interactions among trainees and supervisors.

3) Trainee-Supervisor Interactions: Beyond Contributions to Patient Care.

Trainees and supervisors constantly exchanged clinical information during both distant and direct supervision. Some of these exchanges were not directly needed for patient care, but rather appeared focused on resident learning. These learning-directed interactions modified the opportunities for observation and practice or led to another type of learning opportunities (feedback) for the trainees.
Opportunities for observation were altered by the supervisors' provision of explanations regarding clinical events, of insights into their clinical reasoning, or of rationales for their decision-making. In this example, the supervisors expressed verbally their rationale or concerns while providing care to the patient:

*F: His blood pressure is coming down a bit, which is quite concerning because we want to maintain his intracranial perfusion [the patient is believed to have an increased intracranial pressure], so let’s start some fluid running in. [S12 - Direct Supervision]*

In addition, supervisors built on trainees' opportunities for practice by providing feedback on trainees' contributions. Because of the challenges related to the supervisors' second-hand clinical information during distant supervision, many of the phone interactions among trainees and supervisors concerned patient care. Providing feedback on trainees' spontaneous contributions from a distance appeared challenging and effortful for the supervisors. The trainees' initiatives were often communicated to the supervisors with a lack of details or when the supervisors were still trying to determine the nature of the clinical problem. Because it was difficult for the supervisors to make instantaneous judgments on trainees' proposed diagnosis or management plan, this engineered feedback, when present, was often delayed. In the following example, the resident made a suggestion (intubating) when the fellow had another priority in mind (the management of the atrial fibrillation):

*R: We got a chest x-ray and he has a right infiltrate, so I covered him with piptazo.
F: Ok. So you think maybe a pneumonia? So I’ve got a bunch of questions for you... Is that it for his past medical history?
[The fellow then asks 28 questions about the patient's condition and makes 5 suggestions in terms of management unrelated to the choice of antibiotics. The following comment is made about 15 minutes after the resident's statement about his choice of antibiotics.]
F: So in terms of his lungs, it seems like you’ve probably covered him with the right antibiotics. Piptazo here is a good choice. [S15 - Distant Supervision]*

In contrast, feedback occurred more spontaneously when the supervisors were present at the bedside. The supervisors could comment on trainees' contributions before their implementation or suggest better alternatives. Feedback, although not always explicit, was therefore more frequently immediate and specific than during distant supervision:

*F: [Looking at the chart at the bedside]. So the INR is 3.2, ok.
R: So he probably... needs some vitamin K as well.
F: Ok, and why would you like to do that?
R: I am just worried that if we need to give him later...*
F: I mean, I would say... He’s not having any bleed from the femoral line... The problem is that if you start reversing him, and he’s in atrial fibrillation, you know... He should get some antibiotics and the chances are that his INR may get wacky if we continue the coumadin. I would probably hold off further anticoagulation, but with no evidence of bleeding right now, I wouldn’t give vitamin K. [S48 - Direct Supervision]

Finally, interactions between trainees and supervisors, especially during direct supervision, fostered another form of practice: engineered practice. When the patient's condition allowed it, many supervisors actively facilitated trainees' physical or mental involvement in patient care by encouraging trainees to commit to a diagnosis or management plan. They frequently provided clues and suggestions to incite trainees to contribute to patient care in a more elaborated way than expected based on their early initiatives:

F: What do you think he got?
R: Mmmm. Well, he has some fever and some crackles on the right, so I would probably assume that this man is septic. But we don’t have the labs yet. [Resident's working diagnosis at this point is sepsis]
F: But he had surgery. He’s post-op, right? [The fellow is providing a clue to the resident]
R: So you think he might have a pulmonary embolism? [The resident is now considering another diagnosis for this patient]
F: Oh yes. [S40 - Direct Supervision]

Trainees therefore experienced different or new learning opportunities by interacting with their supervisors. Through these interactions, they were offered the possibility to increase their understanding of the clinical scenarios, their immediate ability to contribute to patient care, and, based on the feedback received, the future use of their clinical skills.

DISCUSSION

In a clinical environment increasingly concerned with medical errors and adverse events, direct supervision of junior physicians is slowly gaining acceptance as the optimal way to ensure a safe provision of care (2, 11). The impact of closer level of supervision on the learning opportunities created for trainees has been little explored. This study aimed at contributing to a better understanding of the learning opportunities created during acute simulated scenarios completed under different levels of supervision. Three main findings summarize our results: the ability of the trainees to contribute to patient care regardless of the physical presence of the supervisor at the bedside; supervisors' overt impact on the level of responsibility for patient care, and more
subtle influences on trainees' opportunities for observation and practice; and a range of learning opportunities created by the interactions among trainees and supervisors, beyond their respective direct involvement in patient care.

Our results could potentially contribute to the literature on clinical supervision and clinical learning in three ways. First, our findings provided a more detailed description of the differences in the supervisory practices between different levels of supervision during acute simulated resuscitations. We believed that comparing the behaviors of our participants with and without the supervisor present at the bedside was important to better understand the impact of closer supervision on learning. We observed that, in a simulation environment, distant supervision allowed residents to provide first-hand care, but forced supervisors to provide care by proxy, i.e. to access and intervene on the clinical environment through the resident only. Such circumstances created incidental opportunities for practice, engineered opportunities for observation, and engineered opportunities for feedback. Therefore, although distant supervision is often recognized in the medical education literature as a way to promote resident independence and autonomy, the challenges entailed by the indirect nature of the interactions between the supervisor and the clinical environment for the processes of observation and feedback should be recognized. On the other hand, direct supervision was characterized by a simultaneous access and ability to intervene on the clinical environment by both the trainee and the supervisor. These circumstances favored engineered opportunities for practice, and incidental opportunities for observation and feedback. Working alongside each other allowed participants to observe their behaviors in real-time, potentially facilitating the processes of modeling, feedback, and direct guidance from the supervisors. However, during direct supervision, the division of labor and the orchestration of the care delivery were usually within the hands of the supervisor, thereby affecting trainee's opportunities for practice. Such description of the learning processes at play during acute simulated resuscitations provided a more nuanced view of the potential benefits and challenges related to different levels of clinical supervision.

Second, our findings called for a clearer distinction between the concepts of responsibility, autonomy, practice, and participation to better understand their impact on learning. Which challenges and benefits related to trainees' ability to assume full responsibility for patient care, to exercise their clinical autonomy, to practice their clinical skills, and to participate in patient care?
Such distinction hasn't been consistently defined in the literature where the terms responsibility, autonomy, practice, and participation have been frequently used interchangeably or poorly characterized (26, 27, 31). We believe that the understanding of the impact of changing clinical environments on resident learning would be facilitated by a better clarification of these terms. Our results showed that the only circumstances in which trainees were entirely responsible for the patients, i.e. assumed full control of the medical assessment and management of the patients, were during distant supervision, before or in between their phone discussions with the supervisors. Such responsibility was shown to potentially compromise patient care, sometimes even with relatively senior trainees. Given teaching hospitals' increasing accountability for patient safety and quality of care, the risks associated with allowing trainees to assume full responsibility for patient care may be unacceptable. However, our results demonstrated that a shift of responsibility towards the supervisors did not translate automatically into a lack of autonomy, practice, and participation for the trainees. We reported that trainees were able to take multiple initiatives during the care delivered in collaboration with their supervisors and to complete many tasks without any help or assistance. Is that type of autonomy beneficial and sufficient to favor the development of an independent practice? Furthermore, many other cognitive and physical tasks were indeed completed by the trainees under the guidance of their supervisors. Although not resulting from trainees' own initiatives, these clinical situations still represented opportunities for practice, often with direct feedback. Finally, even when the decisions and the tasks were implemented entirely by the supervisors, many interactions between our participants allowed the trainees to stay engaged and to potentially better understand the meaning of these clinical activities. According to socio-cultural theories, any gain that translates in an increased ability to actively participate in the social activities of a community constitutes a form of learning (29). Our results therefore support the need to establish a better understanding of the differences, in terms of learning, between assuming full responsibility for patient care, exercising different levels of autonomy within a supervisor relationship with a senior physician, practicing technical and non-technical skills, and participating in other ways in patient care.

The third contribution of this study to the literature concerns the potential role of the trainee-supervisor interactions in the creation of learning opportunities in acute and complex clinical environments. Interactions between trainees and supervisors could positively alter certain opportunities for practice and observation. This finding is consistent with the workplace learning
theories described by Brown & Collins (32, 33), Billet (34, 35), and Eraut (36, 37). These authors have drawn upon different aspects of both cognitive and socio-cultural learning theories to identify key conditions fostering workplace learning: proper access to authentic practices and meaningful experiences; guidance and structuring of learning experiences; motivation to learn from work activities (32, 37). These authors argued that traditional learning strategies such as workplace observation and practice may not necessarily lead to learning, unless appropriately guided by more experienced individuals able to explicitly expose the significance of working activities (32, 35). Our findings illustrate that such learning strategies can be used in the acute care setting and can supplement other learning opportunities naturally resulting from trainees' participation in clinical activities. However, such interactions were not universally observed during the clinical scenarios. Some scenario details and individual characteristics appeared to impact on their occurrence. Future studies should explore the nature and the role of the trainee-supervisor interactions on clinical learning, and the influence of the clinical context on their occurrence.

Certain characteristics of this study limit our ability to extrapolate our findings to real clinical environments. Our results were based on observations made during simulation-based scenarios. Although some of the dynamics of the process of clinical supervision could be reproduced in the simulation setting (e.g. the physical distance of the supervisor from the bedside, a certain hierarchy between the participating fellows and residents who were also working together in real clinical environments, etc.), other aspects of the process of clinical supervision could not be fully integrated in the scenarios. For example, concerns about the safety of real patients may affect supervisory practices to a greater extent than concerns about the survival of a mannequin. In addition, the fact that the participants were observed and videotaped during the scenarios may have influenced their behaviors. Furthermore, this study has not observed the supervisory practices between supervisors and trainees over time. Given that the level of clinical supervision was randomly assigned to each pair of trainee-supervisor, little can be said about the processes by which a safe level of clinical supervision is established in real clinical environments, and how supervisory practices may vary over time when multiple episodes of resuscitation are completed by the same trainee and supervisor. However, despite the limitations of this simulation-based study, we believe that the concepts and relationships emerging from our findings represent interesting lines of inquiry to guide further research completed in real clinical environments.
CONCLUSIONS
Based on our results, both distant and direct supervision provided incidental and engineered opportunities for learning during simulated resuscitations of critically ill patients. However, the types of learning opportunities for practice, observation, and feedback differed according to the level of supervision. Active efforts were required from the trainees and the supervisors to maintain all types of learning opportunities during clinical supervision. Preserving a balance between patient care and learning was a challenge for both trainees and supervisors regardless of the level of supervision. The ability to maintain such balance in real acute care environments, where factors not encountered in the simulation setting may affect supervisory practices, should be further explored to ensure that trainees' learning opportunities are optimized when real patients' lives are at stake.

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Chapter 7
Mixing Results and Moving on to Real Clinical Environments

7 Introduction
The following chapter summarizes and integrates the results of the quantitative and qualitative components of the simulation study. The rationale, methodology, and methods of the subsequent naturalistic observational study are then presented.

7.1 Mixing The Results Of The Simulation Study (Study 1)
At the origin of mixed methods research was the idea of triangulation, i.e. the ability to corroborate or confirm results obtained from different data sources, methodologies, interpreters, etc.(1). However, the rationale for undertaking mixed methods research has progressively expanded to include many other purposes than triangulation, as explained in Chapter 4(2). Regardless of the specific rationale(s) pursued by the researcher, quantitative and qualitative arms of a study must be mixed at some point. This section provides a discussion on how the results of the quantitative and qualitative arms of the simulation study described in Chapters 5 and 6 can be mixed.

7.1.1 Summary Of The Results
The quantitative analysis of the simulation study described in Chapter 5 concluded that closer supervision (supervisors' continuous or immediate availability at the bedside) was associated with more comprehensive care of the simulated patient, but lower independent completion of key clinical tasks by the trainees during the supervised scenarios. The overall effect of the level of clinical supervision on trainee's learning, defined as their ability to independently complete a subsequent similar scenario, appeared neutral. Rather, the overall team performance and the trainee's independent completion of clinical tasks during the supervised scenarios were identified as independent predictors of trainee's subsequent unsupervised performance. We concluded that
the level of clinical supervision, when defined as supervisor's physical proximity to the bedside, had no direct effect on learning. However, by providing trainees with variable opportunities to observe comprehensive care delivery and to complete clinical tasks independently, supervision could affect trainee's learning indirectly.

The qualitative data collected concurrently during the simulation study was presented in Chapter 6. Our goal was to explore the learning opportunities created during simulated acute care scenarios completed by trainees under different levels of clinical supervision. We defined learning opportunities (Figure 7.1) as trainees' direct physical or mental contributions to patient care (opportunity for practice), as trainees' exposure or access to supervisors' contributions to patient care (opportunity for observation), or as trainees' ability to compare their performance with a standard established verbally or demonstrated in real-time by the supervisor (opportunity for feedback). These opportunities belonged to one of two categories: incidental learning opportunities that occurred spontaneously as part of patient care activities, and engineered learning opportunities that appeared to result from specific efforts by the participants.

![Figure 7.1: Interactions explored in the qualitative arm of the simulation study](image)

From a trainee perspective, trainee-patient interactions represented opportunities for practice, supervisor-patient interactions represented opportunities for observation, and supervisor-trainee interactions represented further learning opportunities that included opportunities for feedback (full arrows). Supervisors could also influence the trainee-patient interactions when present at the bedside (dashed arrow).
Three main findings emerged from the qualitative analysis and contributed to our understanding of the relationship between level of clinical supervision and learning: 1) trainee's contributions to patient care occurred regardless of the presence of the supervisor at the bedside 2) the supervisor could affect, by phone or in person, the occurrence and the nature of trainee's contributions, and 3) interactions among supervisors and trainees contributed to create learning opportunities for the trainees. Our observations revealed that trainees spontaneously contributed to patient care both in the absence and in presence of the supervisor at the bedside (incidental practice). However, supervisors could more easily affect the nature of trainees' contributions when present at the bedside (engineered practice). In addition, we observed that supervisor's contributions to patient care differed if the supervisor had direct access or not to the clinical information. In distant supervision, the trainee was used as a proxy to access the clinical information, and the order and logic of the supervisor's contributions to patient care could be disrupted in the process. During direct supervision, the supervisor's contributions to patient care were facilitated by their first-hand access to the clinical environment. As a result, trainee's opportunities to observe supervisor's contributions appeared more effortful during distant supervision (engineered observation) than during direct supervision (incidental observation). Opportunities for feedback was also facilitated by the direct observation, in real time, of trainee's contributions to patient care by the supervisor. We concluded from this analysis that each acute care scenario provided multiple learning opportunities to the trainees, although the nature of these opportunities varied according to the level of supervision (Table 7.1).
Table 7.1: Unique Types of Learning Opportunities According to the Level of Supervision

<table>
<thead>
<tr>
<th>LEARNING OPPORTUNITIES</th>
<th>DISTANT SUPERVISION</th>
<th>DIRECT SUPERVISION</th>
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<tr>
<td>PRACTICE</td>
<td>INCIDENTAL</td>
<td>ENGINEERED</td>
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<td>OBSERVATION</td>
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<tr>
<td>FEEDBACK</td>
<td>ENGINEERED</td>
<td>INCIDENTAL</td>
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7.1.2 Explaining the Quantitative Results With the Qualitative Results

One of the main findings of the quantitative analysis was the lack of effect of the level of clinical supervision on the trainee's learning. Learning was not measured in the qualitative arm of the simulation study because the objective of the qualitative analysis was not to confirm or disconfirm the conclusions of the quantitative study. As detailed in Chapter 4, our intention was rather to explore certain learning processes involved in clinical learning, and to potentially explain and expand on our quantitative results. In this regard, we believe that the qualitative results contributed to explain the quantitative findings of the simulation study. Learning opportunities in the clinical context were not limited to opportunities for independent practice. Opportunities for observation and feedback also emerged from clinical activities. The overall learning benefits of a specific clinical encounter therefore likely depended on the cumulative impact of these various opportunities. Each level of clinical supervision appeared associated with multiple learning opportunities. However, the nature of these opportunities varied according to the level of supervision. Potential negative effects of the level of supervision on certain types of learning opportunities appeared balanced by positive effects on other types of learning opportunities. For example, distant supervision provided incidental opportunities for practice, but required targeted efforts from the participants to create opportunities for observation and feedback. Direct supervision could alter the nature of trainees' opportunities for practice, but provided incidental opportunities for observation and feedback. The overall neutral effect of the level of clinical supervision on learning observed in the quantitative study is therefore not surprising given our qualitative results.
7.1.3 Apparent Contradictions Between the Quantitative and Qualitative Results

The only concept that was studied in both the quantitative and qualitative arms of the simulation study was the trainee's opportunities for practice of clinical tasks. In the quantitative study, the amount of practice was defined as the percentage of tasks, from a pre-determined checklist, that were independently completed by the trainee. According to this perspective, opportunities for practice appeared limited by the supervisor's bedside presence. In the qualitative study, trainee's opportunities for practice were commonly encountered both in the presence and in the absence of the supervisor at the bedside. However, trainee's opportunities for practice were defined as any opportunity to contribute to the care of the patient. These opportunities included episodes of independent practice of certain key cognitive or physical tasks, but also episodes of supported practice (i.e. contributions to patient care made with the help of the supervisor) and the completion of secondary or supportive tasks that were part of more important clinical activities. Therefore, both the quantitative and qualitative arms of the study indicated that direct clinical supervision could limit the ability of the trainees to independently complete key aspects of the care delivery. However, the qualitative analysis revealed that alternative forms of participation in patient care were possible during direct supervision.

7.1.4 New Perspectives Offered By the Qualitative Analysis

As explained in the discussion of the qualitative paper presented in Chapter 6, three key findings of our qualitative analysis contributed to broaden the scope of the results of the simulation study. First, our qualitative results provided a more nuanced understanding of the differences in the learning opportunities between direct and distant supervision. Rather than painting different levels of supervision as "good" or "bad" for learning, we highlighted, for each level of supervision, differences in the learning processes that could represent specific benefits or challenges in terms of learning. Second, the qualitative analysis revealed that trainees could contribute to patient care in multiple ways. This finding indicates a need to clarify the distinctions between the concepts of responsibility, autonomy, practice, and participation in order to better understand the impact of different forms of trainee's involvement in patient care on learning. Finally, our qualitative results provided numerous examples of supervisor-trainee interactions that did not appear to be of any immediate benefit for the care of the patient. These
interactions were interpreted as a result of participants' intention to create learning opportunities from clinical activities. In a context where direct supervision may positively affect the quality of patient care, better understanding the occurrence of these learning-directed interactions during real clinical activities could point towards strategies aimed at optimizing clinical learning during direct supervision.

7.1.5 Paradigmatic And Theoretical Considerations

As discussed in Chapter 4, mixing quantitative and qualitative results can be problematic if proper attention is not directed towards the underlying assumptions made to reach conclusions in each analysis. The simulation study described in Chapters 5 and 6 was the result of a post-positivist approach. For the quantitative arm of the study, we reviewed the literature on clinical supervision, made some hypotheses about the effects of clinical supervision on learning, defined these concepts in measurable variables, controlled other potentially confounding variables, and assumed a causal relationship (or lack of) between the level of clinical supervision and learning. We believe that our results correspond to a reality and can be generalized to other clinical contexts with certain limitations.

The qualitative analysis was added to the quantitative analysis to fulfill traditional objectives of mixed methods research, i.e. explaining, complementing, and expanding on our quantitative results(2). The planned design of the quantitative study allowed the collection of qualitative data without modification of the study. We did not define a priori a specific methodology or orientation for our qualitative analysis (generic inductive qualitative research). However, we realized during the analytical process that a theoretical framework would help to make sense of the data(3). I was already familiar with many of the learning theories from the cognitive perspective presented in Chapter 3, which proved only moderately useful for the analysis of the set of data collected during the simulation study. One of the obvious problems with the use of these theories for our data analysis was the lack of access, for the external observer, to many of the participants' cognitive processes. We could not see what the participants were thinking unless they were verbalizing their thoughts. Furthermore, the simulation study focused on a specific type of clinical activity (acute care episodes or medical crises) and on the dynamic interactions between the trainee, the supervisor, and the clinical environment, two contextual aspects of
learning generally not specifically addressed by cognitive learning theories. Therefore, I began to further explore the learning theories of the socio-cultural perspective also described in Chapter 3. The concepts of distributed knowledge, cognitive apprenticeship, situated learning, and participation in authentic activities resonated with the data. Learning opportunities were defined as different forms of contributions to patient care and interactions between the trainees and the supervisors. Participants' respective contributions to the overall activity of patient care became identifiable for the external observer.

Did our paradigmatic assumptions differ between the quantitative and qualitative stems of the simulation study, and therefore, is mixing their respective findings problematic? I would argue that mixing those results is not problematic in the context of this study. For the qualitative stem of the study, we used both an inductive and a deductive approach to achieve our objective, i.e. to explore the learning opportunities offered during scenarios completed with different levels of supervision. However, our final findings are believed to reflect a different aspect (processes rather than outcomes) of the same reality tackled by our quantitative study. We chose a specific theoretical framework to reach these conclusions, but hope that our findings apply to other acute care settings and contexts. The analysis of the qualitative findings also led to interesting findings that could not be further explored with the available qualitative data set because of the way the data was first collected, and then analyzed. As described in the following sections of this chapter, this issue influenced the orientation and the design of the subsequent observational study completed in a naturalistic setting.

7.2 From The Simulation Study To The Naturalistic Study

7.2.1 Phenomena of Interest

At the time of planning of the simulation study described in Chapters 5 and 6, a decision was made to subsequently collect data in real clinical environments. We were aware that the simulation setting was a controlled environment that was unlikely to reflect the complexity of the real clinical setting. It was important to see how the phenomena observed in the simulated environment would play out in an uncontrolled setting (e.g. the ICU). Furthermore, the additional literature review on learning (Chapter 3) required for the qualitative data analysis of
the simulation study provided different theoretical perspectives on what a learning environment should look like and should offer to the trainees. These perspectives contrasted with the reality that I had experienced in the clinical environment as a clinical supervisor. Two brief examples of these contrasts can be provided based on cognitive and socio-cultural theories. First, according to the cognitive perspective, a reflective process (labeled differently according to the specific theory) allows the learner to make sense of their experience and can be facilitated by a more experienced clinician. However, the ability to provide this kind of facilitation in real, busy, and dynamic clinical environments such as the critical care was, in my opinion, questionable. Second, according to the socio-cultural perspective, acting within a social practice unproblematically leads to learning of some kind. However, the exact mechanisms by which such learning occurs are not clearly described. Furthermore, the fact that a given behavior displayed by a learner or a supervisor can have different and potentially conflicting effects on the outcomes of the activity itself (e.g. the patient condition) and on learning is not always recognized within the socio-cultural tradition. Other struggles and challenges embedded in the use of real clinical activities as a source of learning (e.g. clinical workload, limited time interacting face-to-face with the same supervisor, etc.) have been described in Chapter 2. It was therefore important for us to explore what was happening in real clinical environments.

The learning processes described in the qualitative part of the simulation study constitutes objects of further investigation in the real clinical setting. We were interested in gaining a deeper understanding of the type of trainee-supervisor interactions observed during the simulation study that appeared mostly focused on learning, i.e. of no immediate need or benefit for the care of the patient (later called learning-directed interactions or more simply, learning interactions). In addition, we wanted to further explore the influences of the supervisor on the interactions between the trainees and their clinical environment. With real patients at risk of real complications, constraints imposed by the supervisor on the trainee's involvement in patient care could differ from the simulation environment. Finally, we were interested in better understanding how the clinical environment itself could influence the interactions between the trainees and the supervisors (see Figure 7.2).
The observational study was meant to explore the learning-directed interactions between trainees and supervisors in real acute clinical environments (full arrow), as well as the impact of the supervisors on the trainee-clinical environment interactions, and the impact of the clinical environment on trainee-supervisor interactions (dashed arrows).

Figure 7.2: Interactions to be explored in the observational study.

7.2.2 Methodological Shift

The type of research objectives pursued in the observational study was different from the simulation study. The research focus moved away from the level of clinical supervision as a primary object of research, and towards the interactions among supervisors and trainees that emerged from the process of supervision during acute episodes of care. Based on our literature reviews, these interactions were neither well defined nor thoroughly studied. We aimed to explore two aspects of the learning-directed interactions among supervisors and trainees: the learning opportunities created by these interactions, and the ability of supervisors to balance learning and patient care in real clinical environments. The limitations of the generic qualitative analysis (i.e. not informed by a specific methodology) used for the simulation study were discussed earlier in this chapter. A different methodological approach from the simulation study was therefore considered more appropriate for achieving the objective of the observational study. The implications and challenges related to this methodological shift will be discussed in Chapter 11.
7.3 Methodology & Methods Of The Naturalistic Study (Study 2)

The observational, naturalistic study described in the following sections and chapters of this dissertation was based on a constructivist grounded theory methodology. This approach to qualitative research will first be presented, followed by a detailed description of the methodology and methods used for this study.

7.3.1 A Constructivist Grounded Theory Methodology

Grounded theory methodology was first described by Glaser and Strauss in the books *The Discovery of Grounded Theory* (1967) and *Theoretical Sensitivity* (1978). Since its first description, grounded theory has evolved in multiple directions and is now considered a family of methodologies based on different assumptions and techniques. This methodological shift was consistent with the dual roots of grounded theory. Grounded theory approach to qualitative research was born from the collaboration between two sociologists representing different schools of thoughts: Barney Glaser, working within a positivist tradition at Columbia University, and Anselm Strauss, working within a pragmatist tradition at the University of Chicago. These two traditions deeply influenced the initial foundations of grounded theory.

The first iteration of grounded theory arose in a context where quantitative methods were considered the legitimate way to conduct research in the field of social inquiries. Grounded theorists denounced, with other qualitative researchers, the quantitative dominance in social studies. However, they adopted, in a paradoxical way, the strongest positivist stance among qualitative researchers. The objectivist approach shared by the first generation of grounded theorists helped to provide legitimacy to qualitative research by making explicit the strategies used during the research process. The positivist view also framed the processes of data collection and data analysis used by grounded theorists. The researcher was considered an external, objective observer of the reality, who aimed to represent and to faithfully explain empirical phenomena in an unbiased manner. Such representations were perceived as detached from any value, unproblematic, and independent of the researcher. Glaser further argued that any bias brought to the analysis by the researcher was corrected by the collection and comparison of multiple cases. The positivist views underpinning grounded theory would later be contested.
However, Glaser and Strauss laid down the common principles that would be adopted by the next generation of grounded theorists: an inductive, comparative, emergent, open-ended research process(6). Charmaz has detailed the common characteristics shared by any type of grounded theory research(6, 9):

1) data collection and analysis completed simultaneously (iterative process);
2) codes and categories emerging from the data (inductive process);
3) comparisons made between codes, categories, and concepts throughout the research process (constant comparison);
4) theories developed from the data through multiple phases leading to increased level of abstraction/conceptualization;
5) use of memo writing to elaborate on and interconnect categories;
6) theoretical sampling and saturation;
7) analysis of actions and processes rather than themes and structures;
8) attention to variations in processes.

These core characteristics differentiate grounded theory research from other types of qualitative research(11). For example, an ethnographic study provides rich descriptions of the culture of a social group, but does not aim to develop a theory. A phenomenology study looks at human experiences and meanings in great depth, but does not make comparisons between different types of similar experiences. The objective of any grounded theory is "to construct abstract theoretical explanations of social processes"(6), i.e. to develop theories about social processes that are grounded in data. However, subsequent iterations of grounded theory research differed in terms of "epistemology, methodology, assumptions about theories, and conceptual directions"(6).

Closer to its roots in pragmatism, the second iteration of grounded theory proposed by Strauss and Corbin was theoretically founded on assumptions held by symbolic interactionists: knowledge comes from interactions and actions, actions are responses to meaning attributed to interactions or to others' actions, actions are modified by contingencies and lead to consequences(12). Charmaz argued that Strauss developed, with Corbin, a post-positivist approach to grounded theory(10). Strauss and Corbin's assumptions led to the development of new technical procedures used for data analysis(9). They proposed an analysis based on context, process, and theoretical integration(8). They defined context as the conditions leading to the interactions, actions, and emotions that constitute the process under study. Processes involve the
responses to problems or circumstances emerging from these conditions. According to Strauss and Corbin, the theoretical integration is the unification of different concepts or categories through statements. Tools such as the paradigm and the conditional/consequential matrix were described to help researchers identifying the context and the consequences of the process under study(8). Strauss and Corbin, by their pragmatist orientation, recognized that grounded theorists embark in the research process with pre-conceptions, i.e. some familiarity with the phenomenon under study and its discipline, or some knowledge of the relevant background literature(6). They presented these sensitivities as additional tools potentially helpful to the research process rather than obstructive barriers to the discovery of some empirical truth(8). In this way, their post-positivist approach to grounded theory presents elements of constructivism(7). However, Charmaz argued that Strauss and Corbin's version of grounded theory is still a "method of verification" (i.e. where emerging theories are tested through further data collection and comparisons) that conveys strong positivist influences(9, 10).

Charmaz(9) and others(13, 14) have contributed to the development and diffusion of an alternative iteration of grounded theory research. Constructivist grounded theory is based on pragmatism applied to the research process and to the researcher: it adds relativism and reflexivity to traditional grounded theory(9). Constructivist grounded theory emerged from a relativist epistemology (realities are multiple), promotes a social construction of knowledge based on multiple perspectives, and take a reflexive stance on the research process. Described by Charmaz as "profoundly interactive"(10), constructivist grounded theory relies on shared experiences and relationships to develop theoretical constructions. Constructivist grounded theorists study people's actions to solve practical problems(6). They pay attention to the larger context, to the complexity, and to the messiness of the social processes(9). Their research results in careful, rhetorical interpretations or theories about the world that are considered different from theories emerging from other approaches to grounded theory: theories that are problematic, relativistic, situational, and partial(10). The practical implications of the choice of a constructivist grounded theory methodology on the design and methods of a study will be described in the following sections.
7.3.2 Research Design and Methods

7.3.2.1 Objectives

As described in the first section of this chapter, the findings of our simulation study and the literature on clinical supervision and clinical learning helped us to identify some areas of uncertainties that we sought to address in our observational study. Based on constructivist grounded theory, this study was aimed at developing a theoretical understanding of the learning-directed interactions among trainees and supervisors during acute care episodes. By learning-directed interactions, we mean interactions about medical content or activities that appear to be of no immediate need or benefit for the care of the present patient. By acute care episode, we mean a medical encounter with a new or previously admitted critically ill patient who presents physiological signs of instability (e.g. low blood pressure or decreased level of consciousness).

The choice of the learning-directed interactions as our focus of interest was made for three reasons. First, based on our simulation study, learning-directed interactions were observable phenomena that could be fairly easily located in a specific clinical context. Second, the exact nature, conditions of occurrence, and consequences of these interactions on other learning processes such as trainee involvement in patient care had been little explored in real clinical environments. Certain theoretical models encountered in the literature appeared of relevance for the understanding and improvement of clinical learning in the acute care setting. For example, the concepts of clinical supervision, cognitive apprenticeship, participation, non-formal learning, etc. contributed to our knowledge of clinical learning. However, few of these concepts had been informed by or grounded on empirical data collected in naturalistic acute clinical environments. As a result, these concepts often appeared discordant with the daily reality of the clinical learners, teachers, and educators practicing in the acute care setting. Therefore, they were of limited utility for the improvement of educational practices in such context. An increased ability to improve educational practices was, in my mind, a desirable end to our observational study. This goal provided the third rationale for choosing learning-directed interactions as a focus of study: supervisor-trainee interactions appeared to be a process that could be modified and improved based on the results of the study. With a better understanding of these interactions,
trainees, clinicians, and educators could likely get a better grasp on practical ways to improve clinical learning.

Our objective was kept broad and unstructured to offer us the flexibility required to explore our topic with appropriate depth. Qualitative research questions should be open-ended, emergent, and unfocused. The data collected during the research process was expected to provide direction and focus to the research sub questions emerging from our observations.

7.3.2.2 Choosing a constructivist grounded theory

A grounded theory approach appeared like the most appropriate type of qualitative inquiry to tackle our research objective. As mentioned earlier in this chapter, grounded theory aims to develop abstract constructions of complex social processes, such as learning-directed interactions during acute care episode. Other qualitative approaches such as ethnography could have been considered to address this topic. However, the process and results of an ethnographic study differ from those of a grounded theory study. Charmaz has compared a grounded theory approach and an ethnographic approach at three levels: studying one aspect of the life of the participants vs. paying attention to the full life of the participants, focusing on the processes vs. focusing on the structures, and developing abstract interpretations vs. providing thick descriptions. Our goal was to develop a substantive theory (rather than a formal, higher-level general theory) relating to the learning-directed interactions occurring between trainees and supervisors during acute care episodes. A grounded theory methodology was therefore selected among the qualitative approaches.

Four reasons motivated the choice of a constructivist grounded theory methodology for this observational study after the completion of a positivist simulation-based study. First, the qualitative part of the simulation study raised questions about the learning-directed interactions between supervisors and trainees that could be more fully addressed by considering the relative perspectives of different participants. Second, the analysis completed for the qualitative strand of the simulation study had oriented and focused my research interests and my views on the process that I would study. As described above, such familiarity with the topic of interest is seen as an important bias within a positivist tradition of grounded theory. Alternatively, interests,
knowledge of the literature, and disciplinary background are seen by Charmaz as "points of departure" to the research process(9). I was conscious that these sensitivities, as well as my training in critical care medicine and medical education could influence my interpretation of the data collected. Recognizing, discussing, and admitting these influences (i.e. being reflexive and explicit about them) appeared the honest way to deal with them. Such reflexivity is an integral part of a constructivist grounded theory approach. Third, the methods of coding described in the traditional and revised versions of grounded theory appeared prescriptive and restraining. Charmaz's methods of analyses (described below) appeared to offer more flexibility in terms of theoretical orientations. Finally, Charmaz clearly recognized, maybe more strongly than any other grounded theorist, the value of methodological eclectism. She considers ethnographic methods, in addition to more traditional semi-structured individual or focused interviews, acceptable ways to collect data for a grounded theory study(10). Based on these criteria, we conducted an observational qualitative study based on constructivist grounded theory.

7.3.2.3 Overview of the Study

We conducted an observational qualitative study based on constructivist grounded theory methodology. We used purposive sampling for the selection of our study sites and observation schedule, and participant observation as our data collection strategy. Between December 2010 and June 2012, two observers (myself and a research assistant) spent a total of approximately 350 hours in the medico-surgical critical care units of two tertiary academic hospitals. We observed the interactions between residents, critical care fellows, and attending physicians during 74 acute care episodes. Field notes were collected, transcribed, and analyzed using an iterative process. The identification of concepts and categories through constant comparisons directed future data collection (theoretical sampling). Discussions between investigators led to the refinement of the theoretical frameworks interconnecting concepts/categories.

7.3.2.4 Purposive Sampling

By purposively selecting our sites and periods of observations, we pursued two objectives: ensuring the occurrence, during the observation period, of the phenomenon under study (i.e. learning-directed interactions during acute care episodes), and maximizing its variability.
Observing variations of the phenomenon under study is considered important for defining concepts and elaborating theories (8, 9).

Two tertiary, university-affiliated hospitals in Toronto were chosen as study sites for three reasons. First, both academic hospitals had a high rate of admissions of critically ill and complex patients. Therefore, the occurrence of acute care episodes was expected to be regular and frequent in these hospitals. Second, both centers had been recognized for their teaching excellence, with annual teaching scores above the university average. These teaching hospitals appeared committed to the development of their trainees, and the quality of the observed supervisory behaviors was expected to represent the higher end of the spectrum of current supervisory practices. These characteristics were considered likely to be associated with a high occurrence of learning-directed interactions during acute care episodes. Finally, the two selected institutions each offered a different model of clinical supervision during resident off-hour duty. In the first center, on-call teams included an in-house resident and an in-house fellow. Fellows are physicians who have completed their subspecialty training, and pursue further their development as critical care doctors. They work more independently than residents, but are still under the supervision of an attending physician. Therefore, in this institution, residents’ clinical activities were supervised at all time by an immediately available senior physician (a fellow). In the second center, on-call teams included only an in-house resident. Fellows sometimes assumed call duties, but they were not required to stay on site overnight, and they took calls from home instead of the attending physician. Thus, residents were only distantly supervised during most of their calls. In both institutions, fellows and attending physicians could directly intervene in patient care during daytime clinical activities or at night, if they felt the need to stay at the hospital or to come back from home to take care of unstable patients. Different levels of clinical supervision had been shown to influence the nature of the learning-directed interactions in the simulation-based study. Therefore, observations were planned at different times of the day in each of the two hospitals to ensure some variability in the occurrence and nature of the learning-directed interactions.

The critical care environment was selected for three reasons. First, most acute care episodes occurring in the selected hospitals eventually involved the critical care team. When occurring on the ward or in the emergency room, a sudden or severe clinical deterioration of a patient usually
lead to a quick reference to the critical care team. By tagging the critical care resident on call (i.e. the physician receiving the calls for new consultations), we optimized our chances to observe acute care episodes. Second, the trainees’ clinical activities are submitted to a variable level of scrutiny in critical care units. The natural variation between daytime and nighttime supervision observed in most units provided an appropriate range of levels of clinical supervision for the purpose of our study. Although the emergency room is also characterized by numerous episodes of resuscitation, these units have in-house attending physicians around-the-clock, usually leading to a more direct level of clinical supervision during acute resuscitation regardless of the time of the day. Finally, the access to the critical care environment was simplified as I am a critical care physician, currently working in one of the two study sites. My knowledge of critical care physicians in the other center facilitated access to the second study site.

The observation schedule was also planned to optimize our opportunities to observe numerous and variable learning-directed interactions among participants. Six two-month periods of observation (e.g. December-January, March-April, June-July, etc.) were selected through the course of 1.5 academic years to allow for the observation of different groups of residents, fellows, and attending physicians. Residents from different subspecialty backgrounds (e.g. medicine, surgery, anesthesia, etc.) usually spend 1 to 3 months completing their critical care rotation. Critical care fellows either rotate through different ICU sites every 2-3 months (University of Toronto critical care residency program), or spend a minimum of twelve months in the same hospital (international fellowship program). Critical care attending physicians usually rotate on a weekly basis in each intensive care unit. In general, each critical care physician completed 8-16 weeks of clinical work in the ICU per year. Our schedule of observation therefore allowed us to observe certain participants on multiple occasions. We observed interactions among new participants in the study, among previously observed participants and new participants, and among previously observed pairs of participants.

Observations were planned according to a pre-determined schedule in each hospital: one to two 8-hour periods of observation at a weekly interval for four to six consecutive weeks within each two-month block planned over 18 months. Timing of the observation periods alternated between daytime, evening, and nighttime to account for different levels of supervision over the 24-hour period, and between weekdays and weekend days. Additional sessions were added as needed at
the end of each block of observation when no acute care episode occurred during a period of observation. Our intention was to observe at least 36 acute care episodes (18 episodes in each hospital). This sample was thought to provide an appropriate range of acute care episodes(8). Furthermore, the observation periods were spread enough over time to allow us to analyze the data as it was collected.

7.3.2.5 Data Collection

Data Collection Strategy
Participant observation was used to collect the data surrounding learning-directed interactions during acute resuscitation episodes(15). Participant observation involves the immersion of the researcher in the day-to-day activities of the participants(11). Different levels of participation can be assumed by the researcher during participant observation depending on the objective and underlying assumptions informing the research process(15). Participant observation offers the advantage over interviews of studying what people do instead of what they say they do(8). However, the attribution of meaning by the researcher for participants' actions may be problematic without getting some input from the participants(8). These issues will be discussed in further details in the following sections.

The Observers
I was responsible, with a trained research assistant, for the data collection. At the beginning of this project, I had been a critical care staff physician at one of the study sites for two years. This position had involved being responsible for the care of critically ill patients, as well as supervising, teaching, and assessing critical care fellows, residents, and medical students. Prior to obtaining this position, I had been a critical care fellow at the same institution for two years, after having completed my medical training in another Canadian city. I had therefore been exposed, as a medical student, resident, and fellow, to an educational system very similar to that of the participants recruited for this study. My research training, prior to the beginning of this study, included a Master in Biomedical Sciences (MSc) at the University of Montreal and a Master in Medical Education (MEd) at the Ontario Institute for Studies in Education (OISE) of the University of Toronto. The research studies completed for these degrees involved a clinical randomized controlled trial based on a positivist approach, and an interview-based qualitative
study based on a generic, inductive qualitative approach. In addition, during the completion of my PhD dissertation, I was a fellow at the Wilson Center for research in education, an institution that actively promotes research from both the quantitative and the qualitative perspectives. To prevent confusion between my role as a researcher and my role as a critical care physician among the critical care personal, I completed the observations at the hospital where I was not practicing. Observations at my hospital of practice were completed by the trained research assistant.

The research assistant selected for this project was a practicing critical care nurse with previous clinical research experience (data collection for clinical trials). This choice was made to ensure that both observers had critical care clinical experience to understand the medical content discussed (or not discussed) during the learning-directed interactions. Furthermore, as an employee of my hospital of practice, the research assistant was familiar with the organizational structures and processes involved during ICU clinical activities. Such knowledge was helpful, for example, to contact the residents on call at the beginning of an observation period or to identify key informants that could help her to keep track of geographically dispersed acute care episodes (e.g., the nurse in charge of bed flow in each ICU or the nurse in charge of triaging critical care consultation requests on the ward).

The two observers jointly completed two periods of observation at one of the study site prior to the data collection to reach a certain agreement on the phenomenon of interest (learning-directed interactions), the potential areas of interest related to the phenomenon, and the structure of the field notes. These preliminary periods of observation were discussed afterwards with a researcher (C.A. Moulton) familiar with ethnographic work in health care environments.

**Gaining Access**

I obtained research ethics approval from each critical care unit to conduct the study. However, as will be described below, the acceptability of our presence as observers for the participants varied between sites.

At the beginning of each block of observation, I introduced myself as a medical education researcher to the potential study participants at my site of observation. I explained that I was
interested in observing the interactions between the trainees, their supervisors, and their clinical environment to better understand learning in the clinical setting. A written consent was obtained from each resident, fellow, and attending physician working in the critical care unit at the beginning of the observational period for each block of observation. The research assistant proceeded in the same manner at her site of observation. Both of us interacted with participants who were aware of our clinical backgrounds as a critical care physician or nurse. When asked about our background, we were honest and revealed our clinical professional roles in addition to our research activities. We were also asked at times to provide help with specific tasks. For example, the research assistant was asked to hand some material to a resident who was doing a procedure under sterile technique or to help with some care process issues (who to call to transfer a patient from a unit to the other). I was asked at times to describe the critical care practices at my hospital or to provide a medical opinion about certain aspects of care. This later type of questions obviously gave rise to ethical issues that will be discussed below.

I was expecting some reluctance on the part of the trainees or the attending physicians to let me observe their activities. Having worked with many of the trainees during their previous rotations at my hospital, I anticipated them to feel uncomfortable during the observations, or worse, like they were the objects of some form of judgment. However, most trainees welcomed my presence with enthusiasm. They systematically alerted me when new ICU consultations were requested so that I could follow them, and appeared curious about the research study goals, preliminary findings, etc. At night, many trainees expressed relief over my presence: while realizing that I was not there in my capacity of critical care clinician, they liked the idea of having immediate access to a more experienced physician. Some of them also appeared eager to engage in informal conversations during quiet moments of a call.

The research assistant observing in my hospital had a different experience. Many participants (residents, fellows, and attending physicians) expressed concerns regarding my access to the data that she would collect. Although specifically informed that all data would be de-identified by the research assistant before being shared with me, doubts appeared to subsist in the mind of certain participants regarding my ability to relate specific interactions to specific participants. This resistance came as a surprise for me, especially the one expressed by some of my colleagues. First, my colleagues were all familiar with the ethical obligations associated with a formal
research process. Second, as a fairly junior member of the Department, I did not expect to be intimidating to them. A few data collection challenges emerged from these participants' concerns. A minority of potential participants declined being observed. Other participants consented to the study, but omitted to notify the research assistant when they were called for a new consultation or to re-assess a patient. Although some of these omissions appeared to have resulted from overwhelming workload or technical communication failures (dysfunctional phones), we suspect that concerns regarding confidentiality may have explained some of these omissions. Despite these challenges, a rich dataset was collected from both study sites.

**Periods of Observations**

I completed approximately 135 hours of observation at one study site, whereas the research assistant spent 215 hours observing at the other study site. During acute care episodes, we attempted to collect rich data including the actions, interactions, views, and feelings of our participants, as well as the contexts and structures involved in these processes(9). Our observations were focused mainly but not exclusively on the interactions between the trainees (residents or fellows) and their clinical supervisors (fellows or attending physicians). More specifically, we looked for evidence of: different ways to interact among our participants, different forms of trainee involvement in patient care, the role of the supervisors in facilitating or impairing trainee participation in patient care, the influences of the clinical environment (other health care professionals, patients, family members, artifacts) on the interactions among participants. We also attempted to identify ways by which supervisors engaged trainees in patient care when they had to directly intervene in patient management. Our critical care clinical experience was therefore essential to recognize instances where opportunities to engage trainees were seized or possibly missed, such as when a supervisor made an unintuitive decision without explaining the rationale to the trainee.

These observations were complemented, when possible, by brief on-site conversations with the trainees and their supervisors after the acute care episodes(15). These conversations aimed to clarify participants' perceptions regarding the types of interactions that occurred between them and the level of their respective involvement in patient care. They helped to enrich our own perceptions of the observed events, and to identify potential discrepancies between participants of a shared encounter.
Detailed field notes were taken in a notebook computer through the course of the observations in order to record participants’ behaviors and conversations. If data documentation was limited during the observed events, routine documentation of any missed data was completed shortly after the observed events. A record of our on-the-spot interpretive ideas and of our personal impressions and feelings was kept in addition to the descriptive data. Every month, I met with the research assistant to discuss our observations, and to clarify any aspect of her field notes that could lead to various interpretations. Furthermore, we discussed the evolving focus of the study and specific areas requiring further data collection.

7.3.2.6 Data analysis

Detailed notes collected in the field from observations and brief on-site conversations were used for analysis. The analysis was made in accordance with constructivist grounded theory methodology(12). As such, an iterative process was followed. Data analysis started as soon as the data collection was initiated.

Coding of the data transcripts used the approach described by Charmaz(9). She identified two phases for the coding process: the initial coding and the selective or focused coding. The initial coding consists of systematically naming the research material. In doing so, as suggested by Charmaz, I tried to stay close to the data, to keep an open mind, and to focus on the actions completed by the participants. Accordingly, I used gerunds as codes whenever possible(10). Line-by-line coding, as well as incident vs. incident coding were used during the analysis(9). Comparisons between data, between data and concepts, and between concepts also contributed to this phase of coding. The second phase of coding, selective or focused coding, involves the choice of codes with analytical potential. Certain codes were therefore elevated to the rank of concepts and categories because of their perceived potential to point towards fruitful lines of inquiry. Charmaz does not formally use the more prescriptive models of open, axial, and selective coding proposed by Strauss and Corbin(8) or the theoretical coding described by Glaser(4). These techniques are generally used to select the main category of a research study amongst other categories, to define the properties and dimensions of each category, and to link or interconnect these categories according to certain frameworks (e.g. conditional-consequential.
matrix(8) or families of theoretical codes(4)). As argued by Charmaz, these frameworks provide guidance during the analytical process, but may cause data to be forced within certain categories to fit with the pre-determined framework(9). Therefore, I did not use formal axial coding or theoretical coding during the analytical process. However, I adopted certain analytical tools proposed by Strauss & Corbin(8): asking questions (who, what, when, where, how, with what consequences, what if), making comparisons (constant and theoretical i.e. based on personal experiences and literature), and paying attention to the language used by the participants and the emotions displayed by them. The second phase of coding was enriched by regular meetings between myself, my supervisor (VRL), the research assistant, and another co-investigator (CAM). Our different backgrounds (respectively critical care physician and educator, medical education scientist with a cognitive psychology background, critical care nurse and educator, and clinical scientist with a surgical background) contributed to the consideration of different perspectives for the interpretation of the data.

I wrote memos to document the analytical process. As recommended by Strauss & Corbin(8) and Charmaz(9), I used spontaneous and free-style writing in the memos. I included in the memos comparisons between concepts and between categories, definitions of concepts and categories, hypotheses about relationships between categories, reflexive notes about the research process including my position as a researcher, and proposed storylines for paper drafts.

These memos helped me with the integration of the concepts and categories into theories. According to Strauss & Corbin, a theory is "a set of well-developed categories that are systematically interrelated through statements of relationship to form a theoretical framework that explains some phenomenon"(8). Another set of tools initially described by Strauss and later borrowed by Charmaz(9) was used for the early elaboration of these theoretical constructions: visual representations of the main categories and their relationships (integrative diagrams), reconstruction of the logical order of the categories that matches the flow of the empirical data (sorting memos), and story line writing.
7.3.2.7 Theoretical Sampling and Saturation

Theoretical sampling means looking for data that contributes to emergent categories/concepts/construction of theory(9). Theoretical sampling results from the need to fill gaps in early theoretical elaborations and to answer questions that emerged from the analysis of the data collected at different points in the research process. Therefore, it occurs after the initial data collection and analysis(10). Our data collection process was modified on a few occasions based on initial analyses. For example, we had planned for periods of observations during daytime, evening, and nighttime clinical activities with the objective to observe learning-directed interactions according to different levels of supervision. It became clear to me that very few learning-directed interactions were occurring by phone (i.e. when the supervisor was at home) at my study site. Therefore, nighttime observations were interrupted after a few months at my study site because of a lack of learning-directed interaction when no fellow or attending staff was present at night. Phone conversations with the trainees at night were almost exclusively focused on patient care.

Another important shift that occurred during the data collection process was based on the findings that learning-directed interactions appeared to differ in different clinical situations involving the ICU team. While waiting for acute episodes of care to occur, we often observed multidisciplinary rounds during daytime periods of observation. It appeared to me that the interactions occurring during these rounds differed from those occurring during acute care episodes. We therefore planned for further observations of the multidisciplinary rounds in both centers to specifically explore these differences.

Deciding when to end the data collection process during a grounded theory study is a complex issue. The concept of saturation has been often defined by qualitative researchers as the repeated observation of the same events/stories, or as the lack of emergence of new themes or category during additional observations(9). However, as pointed out by many grounded theorists(8, 9), a lack of new themes is insufficient to ensure that enough data has been collected for theory building(8, 10). When each category has the appropriate depth to contribute to a theory, comparisons between incidents and categories should not reveal new category properties. Strauss and Corbin(8) use the terms "conceptual saturation" to describe this situation, i.e. the full
development of each category in terms of properties and conditions that also accounts for variability of the process under study. Morse has argued that probing when such conceptual saturation is achieved is challenging (16). Within a constructivist perspective, claiming to an exhaustive account of a phenomenon contradicts assumptions made about the partiality and relativity of the theories constructed during the research process (9). Dey suggested the concept of "theoretical sufficiency" as a better reflection of the decision-making process used in practice by grounded theorists (17). We believed that we had sufficient data to provide a useful theoretical account of the learning-directed interactions during acute care episodes when we ended the data collection process.

7.3.2.8 Reflexivity

Reflexivity has been defined by Charmaz as "the researcher's scrutiny of his or her research experience, decisions, and interpretations in ways that bring the researcher into the process and allow the reader to assess how and to what extent the researcher's interests, positions, and assumptions influenced inquiry" (9). Reflexivity involves the recognition of the role played by the researcher both in the nature of his/her interactions with the participants and in the co-construction of the theoretical account of the participants' experience (18). Reflexivity was incorporated throughout this study process as illustrated by the following examples.

Earlier in this chapter, I have presented a description of my professional training and background, as well as a description of the research assistant's clinical activities. These aspects of our lives mattered for the types of questions and observations that we made and for the interpretations of what we saw and heard. For example, I noticed during my first few discussions with the research assistant that she was much more attuned to the actions/reactions of other health care professionals during the acute care episodes, whereas my focus was mostly on physicians. As a physician who had been through the process of medical training, I could relate to the experience of the residents and fellows who were involved in the learning-directed interactions. I attributed meanings to their verbal contributions and non-verbal reactions to these exchanges (probably unconsciously at time) based on my own past experiences as a medical trainee. Similarly, because of my own struggles as a clinical supervisor to balance patient care and learning during clinical activities and my own (sometimes failed) attempts to involve
trainees in the care of unstable patients, I was curious to observe strategies used by other attending physicians to achieve these goals, and empathetic towards their efforts in doing so. As a medical educator/researcher-in-training, I had pre-conceived ideas on what constitutes "good" or "bad" educational practices. However, I tried to maintain a non-judgmental stance during the observations, and to understand, from the perspective of the participants, reasons other than individual inclinations or "flaws" that could explain their behaviors.

I tried to prevent a reductionist interpretation of the data by discussing our findings at different points during the analytic process with more senior researchers from other professional backgrounds. Both the research assistant and I kept a careful documentation of personal reflections and feelings during the data collection process. I also try to indicate in the writing of the stories constructed from the data how my subjectivities contributed to the interpretations presented.

7.3.2.9 Ethical Issues

Many have described the advantages, but also the risks for the principal investigator to be an ‘insider’ in the environment under study, and to cumulate the roles of researcher and practitioner(19). Although helpful in terms of access to critical care environments and analytical insights into the phenomena under study, my position as a critical care physician and medical educator also presented ethical challenges(15, 19). Three issues were particularly relevant for this study.

First, as a critical care staff physician working at one of the study sites, one of my roles consists in supervising and evaluating the residents and the fellows during their ICU rotation. To prevent any conflict of interests (e.g. a trainee accepting to participate in the study by fear of being penalized in his final clinical evaluation), the research assistant was entirely responsible for the recruitment of the study participants and for the data collection at this study site. She removed any potential identifier from the field notes before sharing them with me. Furthermore, to ensure that I could not identify which participants were involved in specific care episodes, I received the field notes from the research assistant in clusters, weeks after she had completed a series of observations.
The two other ethical issues encountered during the research process related to the observations completed at my study site. When my professional role as a clinician was known from the participants, hierarchical and power issues arose. To deliver care while being observed by a more experienced clinician or a colleague clinician, even silently, may have represented a significant threat for some participants. The fear of being judged for the quality of their decision-making, their technical skills, or their teaching skills was likely experienced by some participants. I tried to remind participants who appeared concerned about my opinion on their work that my objective was to better understand the learning interactions in real, acute clinical environments, not to judge their performance. I tried to make empathic statements when participants appeared overwhelmed or challenged by a case, and I openly answered any spontaneous questions regarding the research process. I believe that I gained the trust of most participants who appeared comfortable in their interactions with me. No participant objected to being observed a second time after being involved in a first observational session. Actually, as mentioned earlier, some participants appeared relieved by my presence, which raises a last ethical concern.

Because my clinical experience was often known by the participants, I was asked at times to provide medical advice to residents who were lacking immediate clinical supervision. I had no privilege to practice medicine in the hospital where I was observing, and did not want to intervene in the management of patients for whom I was not responsible. I did answer some general, theoretical questions asked by some participants to the best of my knowledge, but referred them to their usual supervisor for questions regarding the care of a specific patient (e.g. "I would ask this question to your fellow/staff"). I did intervene indirectly in the care of a few patients when I felt that it could help the trainee or the patient without overstepping my role as a researcher: I gave an advice to a resident who was struggling with the insertion of a central venous catheter after omitting a step in the process; I confirmed that the resident's interpretation of a chest x-ray was appropriate while she was reporting back to her supervisor; and I suggested to a resident that she call her staff for guidance when she received the results of an investigation that was worrisome. These suggestions were well received from the participants and contributed, I believe, to the establishment of positive and open relationships with them.
7.3.2.10 Research Rigor

Numerous sets of criteria for rigor have been suggested in the qualitative literature depending on the discipline, philosophical foundation, and orientation of the work. Qualitative researchers have used different terms to discuss and assess the quality of a qualitative study such as validity, credibility, trustworthiness, and rigor (8, 11). Different procedures have also been suggested to increase the quality of qualitative inquiries: prolonged engagement and persistent observation in the field, triangulation (of sources, methods, investigators and theories), peer review or debriefing, negative case analysis, clarification of research bias/influences, member checks, rich and thick descriptions, and external audits (11).

Within the grounded theory community itself, criteria for rigor vary in scope and focus (9). Glaser suggested criteria for fit, work, relevance, and modifiability when considering the rigor of the theory emerging from a grounded theory study (5). Strauss & Corbin (8) elaborated on these criteria, proposing a list of seven criteria to assess the general research process (sampling, categories, events/actions supporting these categories, theoretical sampling, hypotheses regarding relations between categories, negative cases, selections of core category). Furthermore, they suggested six criteria to assess the empirical grounding of a study. They also emphasized the importance of fit, understanding, and utility of the theories generated. From a constructivist perspective, Charmaz developed a list of four criteria of quality: credibility, originality, resonance, and usefulness (9). Credibility relates to the adequacy of the range, quality, and depth of the observations to support the theoretical claims made by the researcher. Originality involved the novelty and significance of the findings. Resonance speaks of the level of insight about the studied lived experiences and links between larger collectivities and institutions. Usefulness indicates the potential of the work for increasing the understanding of generic processes that people can use or further analyzed in the future.

As indicated by the description of our methods, many strategies were implemented to increase the quality of our findings and interpretations. We engaged in prolonged and repeated periods of observation to obtain rich data and thick descriptions of the phenomenon under study. Purposive and theoretical sampling directed our data collection process. Two observers participated in the data collection at separate hospitals and compared their observations and interpretations. Great
attention was paid to personal thoughts, feelings, and opinions of the researchers during the data collection and analytical process. Also, discussions with the team members, who came from different perspectives and stances, helped identify potential biases, and helped refine the focus of observations and the emerging themes. Furthermore, the focus and direction of the analysis was based on an intimate knowledge of the environment and process under study, and informed by a familiarity with a range of relevant literatures. I believe that these factors established the proper conditions to construct new theoretical accounts grounded on data, and useful to the medical community. Quality issues will be further discussed in Chapter 11, after the presentation of the results of this observational study (Chapters 8, 9, and 10).
7.4 References

Chapter 8

Model of Interactive Clinical Supervision in Acute Care Environments: Balancing Patient Care and Learning

8 Introduction

The following paper explores how, through their interactions with the trainees, clinical supervisors maintain progressive levels of trainee involvement in patient care, while ensuring a safe and timely care delivery during acute care episodes. To do so, supervisors used a range of learning interactions that are described. An interactive model of clinical supervision is presented, in which both supervisors' and trainees' contributions are primordial to ensure an appropriate balance between patient care and learning.
MODEL OF INTERACTIVE CLINICAL SUPERVISION IN ACUTE CARE ENVIRONMENTS: BALANCING PATIENT CARE AND LEARNING

Dominique Piquette, MD, FRCP(C), MSc, MEd
Carol-anne Moulton, MB; BS, MEd, PhD, FRACS
Vicki LeBlanc, PhD

INTRODUCTION

The quality of care provided by medical trainees has been shown to benefit from the immediate availability of clinical supervisors at the bedside(1). However, in addition to their responsibilities towards the patients, clinical supervisors are also expected to fulfill an educational role during supervision(2). Models of clinical supervision in the literature have been largely based on a developmental approach, i.e. the understanding that trainees, as they learn, present different abilities and different educational needs(3, 4). Clinical supervisors are therefore expected to adapt their level of supervision to the characteristics of the clinical circumstances and to the trainees' levels of clinical experience(5). They should provide support and guidance during trainees' participation in patient care, but also respect the trainees' autonomy when appropriate(2, 6, 7). Bedside supervisors' ability to gradually involve trainees in clinical activities while preserving a safe care delivery has been little studied in acute clinical environments. Although closer supervision has been shown to have a neutral or positive effect on learning(1), supervisors who are present at the bedside of acutely sick patients may choose to provide unilateral care in order to minimize delays and errors(8). Such direct involvement of the supervisors could limit trainees' abilities to practice their skills, to exercise autonomy, and to develop ultimately into independent practitioners.

Further exploration is required to identify practical strategies that allow supervisors to fulfill their dual responsibility towards patient care and trainee learning. The medical education literature has identified select supervisory behaviors that are effective for learning, such as giving direct guidance, linking theory and practice, offering feedback and reassurance, providing role models, and respecting trainee's level of autonomy(2, 6). The adoption of such supervisory
behaviors has been recommended based mainly on two types of evidence: medical trainees' perceptions of clinical supervision and pedagogical implications of psychological and socio-cultural theories on learning(2, 9-11). However, the literature has not fully addressed how supervisors can simultaneously promote learning, respect trainees' need for progressive independence, and ensure optimal patient care.

In a previous simulation-based study, we compared the learning opportunities that emerged during acute care scenarios according to a supervisor’s proximity to the bedside(12, 13). In addition to opportunities for passive observation (minimal involvement of the trainee in patient care) and for independent practice of clinical skills (maximal involvement of the trainee in patient care), simulated acute scenarios completed under direct supervision (supervisor present at the bedside) offered trainees opportunities for partial involvement of the trainees in clinical activities. Certain types of interactions among supervisors and trainees appeared to contribute to the creation of many of these opportunities. However, the occurrence and nature of these supervisor-trainee interactions in real acute clinical environments, as well as their ability to contribute to trainees’ involvement in patient care, needed to be further characterized. Given that the immediate bedside availability of a supervisor may be increasingly justified by the demonstration of a positive effect on patient care, a better understanding for how the bedside interactions among supervisors and trainees influence trainees' involvement in patient care is essential to understanding how increased supervisor presence might influence trainee learning.

Therefore, the aim of this study was to explore the learning interactions among supervisors and trainees during acute care episodes, and thereby, better understand how bedside supervisors can contribute to maintaining trainee involvement in patient care and learning while ensuring a safe delivery of care.

**METHODS**

We conducted a qualitative study based on constructivist grounded theory methodology(14). Constructivist grounded theory is an interpretive approach that builds theory and conceptual frameworks about social phenomena using multiple perspectives and reflexivity on the part of
the researcher(14). The interpretations resulting from this type of research process are therefore considered relative and partial, but useful to address practical problems(14).

Setting and Participants
Purposive sampling(15) was used to select our study sites, participants, and observation schedule. Our goal was to observe multiple interactions between supervisors and trainees during acute care episodes (defined as new admissions or consultations for critically ill patients or acute deteriorations of previously admitted critically ill patients). The critical care setting was chosen as a study environment for three reasons: frequent occurrence of acute events, variation among hospitals in the type of supervision that occurred during daytime and nighttime clinical activities, and the critical care expertise of the principal investigator. The critical care expertise of the principal investigator provided an easier access to the clinical environments selected for the observations, and an underlying understanding of the medical content and processes of care observed during the data collection and analysis.

Study participants included residents, critical care fellows, and critical care attending physicians working in the critical care unit of two tertiary, university-affiliated hospitals in Toronto, Canada. Resident rotations in the critical care unit usually last from one to three months, whereas fellows spend from one to twelve months within the same ICU environment. Attending physicians at these study sites always work at the same hospital but rotate every week as most responsible physician for the patients admitted to their ICU. The two hospitals offer two different models of clinical supervision during resident off-hour (evening/weekend) duty: 24/7 in-house coverage by a critical care fellow versus daytime in-house coverage with nighttime phone assistance by a critical care fellow or staff physician. Both hospitals have a consistently high rate of admissions of critically ill patients and are recognized for their teaching excellence, with annual faculty and rotation teaching scores significantly above the university mean. This study was submitted for institutional ethical approval in each hospital, and written informed consent was obtained from each participant (residents, fellows, and attending physicians) at the beginning of each period of observation. The Research Ethics Board waived the need of consent for the patients, family members, and other health care professionals involved during the observed episodes of care because no data was collected about them.
Data Collection

Participant observation was used to collect the data surrounding trainee-supervisor interactions during acute care episodes (16). The principal investigator (DP, a practicing critical care physician and medical educator) and a trained research assistant (a practicing critical care nurse with clinical research experience) were responsible for data collection. To minimize potential expectations for her direct involvement in patient care and to minimize potential power relations, the principal investigator only completed observations in the institution where she was not a critical care physician and where she did not teach and assess trainees. However, both the principal investigator and the research assistant were involved in daily clinical activities by interacting with the participants, providing simple advice and assisting with mundane clinical tasks when specifically requested (e.g. passing material for a procedure or explaining who to phone to access a specific clinical service).

Between December 2010 and June 2012, 8-hour blocks of observation were completed during different periods of the day (daytime, evening, nighttime), different days of the week, and different weeks of the month. However, during the early phase of the data collection process, we decided to focus future observations on daytime periods only because very few learning-directed interactions were observed during nighttime periods in the center where no supervisor was present on site. The schedule allowed for observation of unique groups of residents, fellows and attending physicians and for the repeated observations of some of the participants. The principal investigator and the research assistant completed a total of 350 hours of observation, capturing a total of 74 acute care episodes. Prolonged and multiple engagements with the same participants were used to minimize participants' reactivity to the presence of the observer (15).

The researchers’ observations focused mainly, but not exclusively, on the nature of the supervisor-trainee interactions and on the clinical conditions surrounding those interactions. For the purpose of this study, the staff physicians were considered the supervisors in their interactions with fellows or residents, and the fellows were considered the supervisors in their interactions with residents. Interactions on the telephone were heard directly by the observer when on speakerphone or were summarized by the callers if that option was not available. In each center, when feasible, the observer completed her observations by carrying out brief, informal interviews (5-10 minutes) with the participants after acute care episodes. The goal of
these conversations was to clarify trainees’ and supervisors’ perceptions regarding the types of interactions and their respective levels of involvement in patient care. These discussions also helped to refine researchers’ interpretations of the observed events.

Detailed field notes recorded the participant’s behaviors and conversations and the manner in which supervisors engaged trainees in patient care. Specific attention was directed to several aspects of the supervisor-trainee interactions: how supervisors asked questions; how they probed trainees’ perceptions of the clinical situation; how they shared their own clinical reasoning; how they provided advice and feedback to the trainee. The observers were alert to salient or recurrent patterns. A record of on-the-spot interpretive ideas and of the observers’ personal impressions and feelings were also kept, separately from the descriptive data.

**Data Analysis**

Detailed notes collected during the field observations and from the brief on-site interviews were used for analysis. Data collection was informed by ongoing concurrent data analysis in an iterative manner (theoretical sampling)(17). For example, additional observations of the interactions between attending physicians and critical care fellows were planned when comparisons between these interactions and the interactions between fellows and junior residents revealed intriguing differences. Every month, the principal investigator and the research assistant met to discuss and compare their observations in a reflexive manner. The principal investigator coded these data using an inductive thematic approach. Constant comparison(15) of these data were conducted within an acute care episode, between acute care episodes involving the same participants, and between acute care episodes involving different participants and participants with different levels of training. Further comparisons were conducted based on the themes that emerged during the analyses. Using the concept of theoretical sufficiency(14, 18), data collection was stopped when there were no new themes to inform categories of the emergent theoretical framework. NVivo 9 software (QSR International Pty Ltd., Cambridge, Massachusetts) was used to facilitate the storage and analysis of the data.

Further refinement of the coding structure and emerging theoretical framework took place during a series of discussions held at regular intervals throughout the data collection process among the three investigators: a critical care physician (D.P.), a cognitive psychologist specializing in
medical education research (V.L.), and a surgeon and educational scientist with expertise in qualitative research using constructivist grounded theory (C.M.). Their different perspectives added richness to the analysis and ensured that multiple interpretations of the data were considered. Promising analytical ideas were documented through memos to create an audit trail of the analytic process.

RESULTS

Our model of interactive clinical supervision is based on supervisors and trainees' consistent engagement in learning interactions throughout an acute episode of care. By learning interactions, we mean interactions between supervisors and trainees that are not essential for patient care and create learning opportunities for the trainees. Our analysis revealed three themes that contributed to our understanding of interactive clinical supervision: engaging without risk, sharing care & minimizing risks, and revisiting the care provided by the trainees. Each of these themes illustrates how clinical supervisors can create learning opportunities for the trainees while optimizing patient care. The themes also clarified how the trainees' involvement in interactions with supervisors and patients further contributed to shape subsequent learning interactions.

Quotes include contributions from the critical care residents (R), critical care fellows (F), critical care attending staff physicians (S), medical students (MS), and registered nurses (RN).

ENGAGING WITHOUT RISK

When the supervisor chose to provide care to a patient because of challenging clinical circumstances or limited clinical trainee experience, engagement in certain types of interactions led to learning opportunities without any risk to the patient. The patient and the trainee played distinct roles in different types of learning interactions: during monologues and dialogues about patient care, the patient was used as conceptual material of talks and the trainee interacted only with the supervisor; during hands-off provision of care, the patient was used as recipient of care delivery (conceptually) and the trainee interacted with both supervisor and patient.

Engaging In Monologues And Dialogues About Patient Care

Acute episodes of care represented an opportunity for supervisors and trainees to discuss about patient care. Such talks could either predominantly involve the supervisor and focus on the
supervisor’s delivery of care (monologue about patient care), or involve both the supervisor and the trainee and relate to both supervisor's and trainee's prior clinical experiences (dialogue about patient care).

In many clinical situations, the supervisors verbally commented on the clinical tasks being completed. Such monologues about patient care included the verbalization of the supervisor's involvement in concrete aspects of patient care (such as the real-time description of a procedure or of physical findings) or their interpretation of visual test results. Other comments related to abstract aspects of patient care. Such comments included explanations about relationships between clinical data, about rationales for decision-making, or about clinical discrepancies complicating diagnosis and management.

*The fellow and resident are reviewing a patient likely suffering from a severe ear infection.*

*F:* Piptazo is a strong antibiotic and it is like trying to knock down a few pop cans with a tank. If we are sure that it's not a pseudomonas external otitis, then we can change the antibiotic to ceftriaxone. ENT could follow her up on Friday at the clinic. [C1_0511_2]

For both concrete and abstract clinical tasks, the supervisors clarified, through these monologues, certain aspects of the care that could have been challenging for a novice trainee to understand (e.g. interpretation of ECG findings, rationale for choice of sedation for intubation, rationale for choice of antibiotics). The previous example also illustrated that trainees were not directly invited to take part in these exchanges, but they were not discouraged from doing so either. Most residents were observed actively listening to the supervisors (i.e. looking at the physical signs or imaging described by the supervisor, nodding as a sign of understanding, looking at their supervisors without initiating other tasks), but stayed mostly silent during the explanations.

However, a few residents asked questions triggered by supervisors’ comments:

*The fellow is assessing an ICU patient with respiratory failure whose blood pressure is now dropping. While assessing the patient, he describes his findings.*

*F:* There is reasonable air entry. There is a fluctuation in the chest tubes but it is not new and is unchanged. She is wheezing so we have to rule out if this is new or old finding. Let's see if she is auto-peeping herself, which could drop her blood pressure. Her airway pressure is not increased.

*R2:* Pardon what did you say? [The resident heard the comment but was not sure which pressure the fellow was talking about.]

*F1:* The patient is on pressure-controlled ventilation. If there was a change in the airway pressure, we would see a drop in the patient’s tidal volume. [C1_01_11_05]
During these monologues, trainees were therefore left with the responsibility to ask questions to signal their lack of understanding.

Rather than being initiated by a comment, dialogues about patient care were initiated by a question from the supervisor to the trainee. These questions emerged from the immediate circumstances of a clinical encounter, but were not directly related to the immediate care of the patient. Certain questions were asked to confirm the presence of a knowledge gap in trainee's understanding prior to the provision of an explanation about the care being delivered:

- **F:** Did the patient respond to your fluid challenge?
  - **R:** A bit initially. The IV fluid replacement rate is at 50 cc/hr.
  - **F:** Have you ever tried Voluven?
  - **R:** No I have not.

*The fellow explains to the resident over the phone what Voluven is and how it works.*

In this example, the supervisor had decided to use a type of fluid (*Voluven*) in the management of this patient's hypotension, and realized that the resident may not be familiar with this product. Instead of directly providing an explanation of the nature and use of this fluid, he elected to check his assumption about the resident’s knowledge prior to providing the explanation. Such a strategy allowed trainees with prior relevant clinical experience to demonstrate their knowledge to the supervisor.

Other questions used by the supervisors appeared more as random probes of resident knowledge on a topic emerging from the clinical tasks, but not of immediate relevance for the care of the patient:

- **The fellow is demonstrating to the resident how to insert a central venous catheter.**
  - **F:** If you were unsure if your line placement was venous versus arterial, what would you do?
  - **The resident does not know the answer.**
  - **F:** If we attach an extension tube to the end of the line and if blood comes spurting out, then we know it is arterial. That is providing the patient has a decent systolic blood pressure.

*Ha! A regional anesthesia is good for this patient! Why?*

*Decreased cardiac demands?*
Supervisors who asked the trainees questions about patient care engaged them further in the learning interactions by forcing connections between a specific clinical encounter and the trainee's prior clinical knowledge. Unlike monologues from the supervisors, dialogues about patient care made the trainee's knowledge accessible to the supervisor. Teaching content could therefore be tailored to a specific trainee.

During interactions that used patients as conceptual material for talks (monologues and dialogues about patient care), supervisors and trainees talked about patient care, but trainees did not contribute directly to the care of a specific patient. Such learning opportunities thus did not imply any risks for the patients. However, monologues and dialogues about patient care did not create opportunities for trainees to apply their knowledge to a specific patient or to practice their clinical skills.

When comparing interactions among supervisors and senior trainees (fellows or PGY3-4-5 residents) with interactions among supervisors and junior trainees (PGY1-2 or medical students), we noticed that these types of rhetorical interactions were rarely observed with senior trainees. Two reasons could explain this finding. First, supervisors rarely provided unilateral, hands-on care to the patients when senior trainees were present. Senior trainees with relevant clinical experience had a greater ability to spontaneously contribute to patient care compared with junior trainees. These spontaneous contributions appeared to be the most common starting point of the interactions between senior trainees and supervisors. Second, certain supervisors reported assuming, rightly or wrongly, that senior residents and fellows with previous prolonged exposure to acute care environments understood the most commonly encountered aspects of patient care.

**Facilitating Conceptual (Hands-Off) Provision of Care by the Trainee**

Thus far, we have described interactions where supervisors and trainees talked about patient care, without direct involvement of the trainees in the care of a specific patient. Our data revealed that during the delivery of care, certain supervisors withheld their contributions to the
care of a patient in order to facilitate a trainee's cognitive contributions. A common strategy to reach this goal was to ask trainees questions that would force them to commit to a diagnosis or a management plan for the patient being discussed. Such questions could be broad or specific:

*The resident and the fellow are admitting a new patient who just had an abdominal surgery.*

*F: (To the R) So what do you want to do now?*

*R: Repeat the blood work?*

[C2_0511_1]

*The fellow is telling the staff physician the history of a patient just admitted to the ICU. After explaining which treatments had been initiated, the staff intervenes for the first time.*

*S: If she's tired, you're going to... [he pauses]*

*F: We're going to use BIPAP - the respiratory therapist is around.*

*The fellow is commenting further on the past medical history of the patient.*

*S: So... [another pause]*

*F: It's between an acute coronary syndrome and an acute decompensation of her chronic cardiac heart failure, but she's warm so it's probably chronic...*

*The staff is nodding in approbation.* [C2_1111_2]

Other types of questions from the supervisors appeared more problematic for trainees. When too vague or ambiguous, the trainee was left with the task of figuring out on which aspect of the care they were expected to comment.

*The resident and the fellow are called by the nurse about a patient who needs to be reassessed.*

*F: [The patient] vomited once just recently. She has a headache and her blood pressure rose post TPA. What are your thoughts?*

*R: I am not sure what you mean.*

*The fellow shares the connections between nausea, vomiting, and high blood pressure post TPA. If the symptoms continue, he suggests to strongly consider another CT scan to make sure that the patient is okay.* [C1_0711_1]

Here, the fellow is asking the resident about a differential diagnosis that could explain the patient's symptoms after the administration of thrombolytic. The resident’s misunderstanding of the question could relate to either his uncertainty regarding the aspect of care on which to comment, or his inability to see how these symptoms are related and potentially problematic (it was the later based on the interview of the resident). Instead of clarifying his question or probing further the nature of resident's knowledge gap (if any), the supervisor shared his explanation. Broad, open questions gave access to a trainee's ways of approaching complex acute care
episodes, but could be overwhelming for junior trainees. A trainee's hesitation or inability to provide an answer could be wrongly interpreted as a lack of knowledge. Narrower, more direct questions ensured that no confusion existed regarding what was being asked of trainees, but constrained the trainees direction of thinking.

These examples demonstrate how the supervisors encouraged trainees to contribute cognitively, and in real time, to the care of real patients. These interactions, which allowed trainees to provide conceptual input about care, share similarities with the dialogues about patient care described above. First, most of these interactions started with a question asked by the supervisor to the trainee. Second, none of these interactions presented direct risks for the patients because, when directly involving the patient, care was discussed prior to its delivery. However, dialoguing about patient care and providing hands-off conceptual care to patients differ in a significant way: only the later type of interactions constituted an actual opportunity for the trainees to practice their clinical skills, and for the supervisors to comment on these skills.

**Sharing Care, Minimizing Risks**

Our data suggest that the bedside presence of the clinical supervisor during acute episodes of care did not systematically translate into care provided unilaterally by the supervisor. Supervisors delegated clinical tasks to the trainees and trainees initiated direct interactions with the patients. Such episodes of hands-on provision of care represented an opportunity for the trainees to contribute to the care of real patients. However, it also presented potential risks for the patients. Yet, by providing tailored support-in-action, supervisors could ensure patient safety while creating further learning opportunities for the trainees.

**Facilitating Hands-On Provision of Care by the Trainee**

In addition to asking trainees to explain the care they would provide to the patient, many supervisors delegated the performance of one or many aspects of a cognitive or physical task to the trainees. Such acts of delegation took many forms: asking the trainee to assess a new patient and initiate management; asking the trainee to complete a specific task in the supervisor's presence; suggesting an approach but leaving it to the trainee to implement it; redirecting requests from other health care providers towards the trainees:
The fellow asks the resident to intubate a patient in respiratory failure. While the resident is trying to intubate, the fellow is administering the sedation, standing at the side of the bed. [C2_0412_2]

A bronchoscopy was just completed under sedation (infusion of propofol).
RN to S: Do you want to stop the propofol?
S: Let the resident use her judgment.
RN (turning to the resident) to R: So?
R: Let me write a note and see.
After her assessment, she asks to stop the propofol. [C2_0511_3]

Further to completing the tasks delegated by their supervisors, many trainees demonstrated a sense of initiative in decision-making and they spontaneously contributed to the care of the patient, even in presence of the supervisor. These spontaneous contributions, as well as the ones delegated by the supervisors, provided opportunities for the supervisors to comment about the care being delivered by the trainees. Trainees' contributions to patient care were directly observed by the supervisor or completed independently by the trainee. In both situations, trainees' contributions could become the object of further learning-directed interactions between supervisors and trainees.

Providing Tailored Support-in-Action
Trainees who engaged in the care of a patient were, at times, in need of advice, suggestions, corrections, or simple reassurance. Supervisors who were facilitating hands-off or hands-on provision of care by trainees or who were directly observing trainees' spontaneous contributions to patient care, could provide such guidance:

R: I don’t think we need lidocaine for this patient. [The tone indicated a statement, not a question.]
F: We do need lidocaine as the line is going right into the neck. I know you might not have done that with the other line you inserted but this one is in a different location. [C1_0111_3]

The fellow asks the resident to intubate a patient in respiratory failure. While the resident is trying to intubate, the fellow is administering the sedation, standing at the side of the bed.
F to R: What do you see? Are the vocal cords opened now?
R: Still closed, but I have a good view.
F: Can you try to pass the tube?
R: ...
The fellow moves to the head of the bed and look in the mouth while the resident is holding his position with the laryngoscope.

F: You can try.
The resident succeeds in intubating the patient. [C2_0412_2]

F: (To the R) So what do you want to do now?
R: Repeat the blood work?
F: What else? Knowing that we've just emptied 3 jackson-pratt... What else do you want to give?
R: Fluids?
F: Well, I would give blood!
R: OK... 2 units?
F: Yes. His INR is increased. We know he's in liver failure. They gave 6 fresh frozen plasmas in the OR, right?
R: Yes. [C2_0511_1]

In this last example, the supervisor started with a broad question (What do you want to do now?). The answer provided by the resident appeared to differ from the one expected by the supervisor, who then narrowed the object of her question (What do you want to give?). When realizing that trainees were unable to commit to a diagnosis or to devise a management plan, many supervisors provided additional support. In the previous example, the supervisor signaled her concern for abdominal bleeding based on the high drainage from an intra-abdominal tube (clinical clue). In other interactions, support provided by the supervisor took different forms, such as making explicit suggestions (e.g. Would you give a transfusion?), or offering explicit choices (e.g. Do you think it's septic shock or cardiogenic shock?). At times, the option proposed by the supervisor was actually the wrong one:

F: I reviewed the CT scan and there is a query of nodular infection but we have to think about fungus as well. He is both on high dose of vasopressors because of his hypotension and in rapid atrial fibrillation. Would you give a beta blocker?
R: No, I would give digoxin.
F: That is right. It is a nice positive inotrope or you could use amiodarone in an acute setting. I would give 1g of magnesium over a few minutes as well. [C1_0511_1]

In this exchange, the supervisor made sure the trainee was aware of the risks associated with the administration of beta blockers in patients with hypotension. This type of question could appear deceptive or misleading, but many trainees were familiar with this strategy. Our interviews with the trainees revealed that those questions were perceived as clinical clues indicating that something was probably wrong with the treatment suggested by the supervisor.
We observed differences in the supervisors’ strategies to provide support to junior trainees compared to senior trainees. In the previous examples, supervisors stayed at the bedside with junior trainees during the entire episode of care. When attending physicians were supervising senior trainees, they sometimes walked away from the bedside, but "checked in" with the trainees at regular intervals:

Two fellows and two residents are resuscitating a patient who came back from the OR unstable. They are cardioverting the patient who is in fast atrial fibrillation. The staff walks in and out of the bedside.
S: In the OR the bowel looked dusky. The echo was previously grossly normal, but I wonder if we should think about a TEE? Perhaps we could use the bedside ultrasound machine to see if the LV is tiny or not. Can we give 150 mg of amiodarone? We could also look for variations in the CVP trends.
The fellows nod their heads in agreement.
The staff leaves the bedside but stays close by.
A fellow does a bedside echo.
The staff is back at the bedside: What did you see at the bedside echo? Did you see the IVC?
F2: No, not clearly. [C1_0512_2]

Furthermore, the understanding of a clinical situation or the details of a management plan were frequently negotiated between senior trainees and supervisors rather than presented as fact by the supervisors. Disagreements between supervisors and senior trainees were not always overtly resolved verbally, and clinical decisions were sometimes made despite a lack of consensus.

A new patient was admitted earlier in the morning by the fellow and is now discussed with the staff.
S: Do you know if his x-ray was abnormal?
F: I am still reviewing the chart, given all the lines he needed, but now his chest is clear. So the abdomen is not distended. He has a bit of ascites. So if you agree I would tap it because it could be infected and they never ruled out a spontaneous bacterial peritonitis on the ward.
The staff is not answering, but her facial expression shows skepticism...
F: We would obviously try not to perforate the bowel...[he's smiling]
[...]
F: I think my main concern is his neurological status. I would CT his head and maybe his chest? Because in terms of sepsis the source is not sure. He also has this collection in the liver...
S: So obviously there is more than the level of consciousness, and maybe something else is going on... I would prefer to start with a CT head and chest rather than doing the tap for now.
F: Ok. I will update you later...
[C2_0511_2]
R(senior): I think she's wet and I would give her some Lasix.
S1: (hesitant) Hard to tell based on her x-ray... [He had mentioned earlier that the patient may have been dry].
The resident orders some Lasix despite the staff's visible skepticism.
R(senior): [After checking the urine output an hour later] She seems to respond to the Lasix. She already looks better.

Learning interactions between supervisors and senior trainees were frequently difficult to distinguish from patient care-related interactions. For example, during challenging clinical scenarios, supervisors made their clinical reasoning explicit for the trainees in a similar manner as the monologues about patient care described above. However, these thoughts could have been verbalized to help with the personal or collective resolution of a clinical problem. During these interactions, the trainee appeared to be considered more as a junior colleague who could help with the resolution of a clinical problem by brainstorming with the supervisor:

An 18-year-old male is seen immediately post craniotomy after a traumatic brain injury. The crash chart is being pulled to the bedside. The patient's heart rate had dropped to the 40's.
S: I am not sure why the lactate is up.
F: We have come down on the epinephrine. [pause] He is on levophed, epi, and dopamine. Could he be having an adrenergic response? [pause] The latest ABG is 7.37/33/187/18 The ICP waveform has artifact. [To the RN] Can we fix it? [after another pause] Let's stop the epi, and put him on Vaso.
S: Can we possibly get an ECG? [looking at the monitor] There are ECG changes. [To the fellow] Maybe he had an adrenergic response to keep his ICP up, and when they removed the bone flap, it may have resulted in a loss of that response.

This series of examples illustrated how supervisors could provide more or less support to the trainees who needed different levels of guidance for the care of a patient. Supervisors could use their bedside presence during the trainees' involvement in patient care to achieve two objectives: 1) through their interactions with trainees they could improve trainees' clinical skills, and 2) through monitoring the patient's condition and delivery of medical attention they could optimize patient care.
REVISITING THE CARE PROVIDED BY THE TRAINEE

When trainees were involved in the care of patients in absence of their supervisor, the supervisor did not have any immediate control on the quality of care delivered by the trainees and could not modify the course of the events as they were unfolding. Patients were therefore more likely to be exposed to mistakes or delays in care. In these circumstances, the learning interactions between supervisors and trainees, if any, occurred after the fact. Certain supervisors who identified gaps in trainees' management provided feedback-on-action, which could affect the quality of the care delivered by the trainees in the future.

Two fellows are performing an abdominal ultrasound on a patient and see a pocket of fluid on the left side.
F2 to F1: Just do it!
The fellow does the tap without acute complication.
When the attending staff comes back to the unit, the fellow informs the staff about the procedure.
F1: I tapped him.
S: Really? Next time, I would prefer interventional radiology being involved. Would you be able to explain the risks and benefits of such procedure to the family if you would need consent?

It appeared more challenging for the supervisors and the trainees to engage in learning interactions when the care provided to the patient did not pose specific challenge to the trainees. In such cases, brief positive feedback was sometimes offered by the supervisors (e.g. I agree with your plan), but very few supervisors attempted to further stimulate the trainees by engaging in learning interactions in relation with the case. As a result, many exchanges among experienced senior trainees and their supervisors were mostly focused on patient care, and did not contribute to create learning opportunities.

DISCUSSION

Closer levels of supervision of medical trainees have been found to be beneficial for patient care(1). However, the continuous presence of the supervisors at the bedside may modify trainees' learning experience and limit their direct involvement in the activities related to patient care. This study, by exploring the learning interactions among supervisors and trainees during acute care episodes, was aimed at better understanding how bedside supervisors could contribute to maintaining trainee involvement in patient care and learning while ensuring a safe delivery of
care. Building on our three themes of *engaging without risk, sharing care & minimizing risk,* and *revisiting the care provided by the trainee,* we developed a *model of interactive clinical supervision* in acute care environments, i.e. a proposed rational approach to physicians’ challenging dual responsibility towards patient care and learning (Figure 8.1). We argue that by interacting regularly throughout an episode of care, clinical supervisors and trainees can maintain a clinical practice that is safe for the patients and a learning environment that is stimulating for the trainees. According to this model, the starting point and the nature of the learning interactions among supervisors and trainees vary according to the level of clinical experience of the trainees. When a trainee cannot spontaneously contribute to the care of a patient, engaging in learning interactions such as *monologues about patient care, dialogues about patient care,* and *hands-off provision of care* allows progressive involvement of the trainees without risk to the patient. When a trainee has the ability to contribute to patient care, *sharing hands-on provision of care* while *providing support-in-action* allows the supervisor to control the quality of the care provided to the patient, while assisting the trainee in real time. When a trainee can assume most of the patient care independently, the supervisor, by *providing feedback-on-action,* allows the trainee to stay engaged in learning instead of focusing solely on the immediate care of the patient. The more the trainee contributes to patient care (spontaneously or as a response to the interactions with the supervisor), the easier it becomes for the supervisor to tailor the interactions to the trainee's abilities and to allow greater trainee involvement in patient care. Interactive clinical supervision therefore rests on the active participation of both the clinical supervisor and the trainee in the learning interactions: supervisors’ commitment to encouraging the highest degree of trainee involvement that is safe for the care of the patient, and trainees’ commitment to contribute to patient care to the maximum of their ability. Assuming that such conditions are met, interactive clinical supervision has the potential to positively contribute to patient care and learning in acute care environments.
Conceptual models of clinical supervision based on empirical data collected in clinical environments are lacking in the medical education literature. Dornan's process-outcome model of workplace learning, which emerged from group discussions with medical students suggested supported participation as a key process in workplace learning (19). According to this model, supported participation includes different types of trainee involvement: passive observation, active observation, rehearsed actions, and performed actions. These categories relate to the different levels of trainee involvement described in our study. For example, engaging in dialogues about patient care allowed trainees to become active observers of clinical activities, and facilitating hands-off provision of care resulted in rehearsed actions by the trainees. Dornan's model focuses on workplace learning and therefore, does not directly address the potential conflicts between patient care and learning that need to be constantly negotiated by clinical supervisors. Kennedy et al. have described a model of clinical oversight based on the observation of the supervisory activities that took place in emergency rooms and internal medicine wards (8). Four types of clinical oversight were presented: routine oversight, responsive oversight, direct patient care, and backstage oversight. Kennedy's model illustrates how clinical supervisors use different strategies to ensure a safe provision of care to the patients.
However, the educational role of the supervisor in the clinical setting was not specifically explored. Our model was aimed at better reflecting the dual responsibility towards patient care and learning expected to be assumed by clinical supervisors. Our model focuses on supervisors and trainees' respective roles in establishing, through their interactions, an optimal level of involvement for the trainees that involved a minimum level of risks for the patients.

Based on our observations, staying equally engaged in patient care and in learning appeared particularly challenging (i.e. unlikely to happen) when either the clinical supervisor or the trainee provided care unilaterally and unproblematically. In these circumstances, the number of exchanges among supervisors and trainees required for the care delivery was limited. Participants' clinical reasoning was not overtly exposed, and the potential benefits of engaging in learning interactions (e.g. filling trainees' gaps) were unlikely to be uncovered by the immediate needs of the patient. Learning opportunities could be lost without conscious attempts from the participants to engage in learning interactions.

Our model of interactive clinical supervision also illustrates the importance of the active engagement in learning and patient care on the part of the clinical supervisors and the trainees. According to this model, creating learning opportunities during clinical activities is a shared responsibility among clinical supervisors and trainees. By engaging in patient care to the maximum of their abilities, trainees allowed supervisors to make critical judgments about their knowledge and skills. Such judgments appeared essential for tailoring the level of clinical supervision provided, but also for engaging in the type of learning interactions most likely to benefit the trainees. However, by actively contributing to patient care and to the learning interactions, trainees could commit mistakes and expose their clinical limitations. The supervisors' positive and constructive responses to these limitations could be helpful in encouraging trainees to stay engaged in patient care and in learning.

Our findings allow us to add to the current literature on clinical supervision and learning in two ways. First, our results build on the conclusions made in our previous simulation-base study on clinical supervision: supervisors can maintain trainees' opportunities for participation, practice, and autonomy during acute care episodes despite their immediate bedside availability(13). This study confirms that clinical supervisors could assume full responsibility for real, sick patients
while cognitively or physically involving trainees in patient care. By interacting with trainees in different ways, supervisors could favor trainees' involvement in patient care while minimizing, when needed, the risks for the patients. These findings challenge the traditional belief that trainees' participation and autonomy are likely to be compromised by closer levels of supervision. The supervisor’s presence at the bedside favored interactions with trainees that established different levels of involvement in patient care in a way that was responsive to the trainees' spontaneous clinical contributions. We can't dismiss the possibility that some trainees who had the ability to contribute to patient care restrained themselves from intervening in presence of proactive supervisors. This might have been particularly true for trainees with an unusually advanced level of knowledge and skills for their level of training. Supervisors may have assumed the need to take over the care of the patient without explicit attempts to establish trainees' abilities. Our model therefore supports the use of the types of learning interactions that promote the exposure of inconsistencies in trainees' skills and knowledge (e.g. engaging in dialogues about patient care or facilitating hands-off provision of care), especially for trainees whose level of relevant clinical experience is unknown to the supervisors and not obvious based on their spontaneous clinical contributions. However, most trainees appeared eager to use their knowledge and skills to participate in the care of the patients. Their initiatives facilitated their supervisors' capacity to tailor their support to the trainees, as well as their involvement in patient care, according to trainees' abilities.

The second contribution to the literature of this study was a more concrete and practical description of the different types of learning interactions that can be used by the supervisors in the acute care setting to favor and optimize trainees' involvement. We provided examples of each type of interactions and explained their significance in terms of trainee's level of involvement in patient care and in terms of level of risk for the patient. Although many supervisory behaviors and bedside teaching strategies have been previously promoted in the literature, most of these recommendations have been broad and unspecific(2). For example, "providing role models"(20-22) and "giving direct guidance"(23-25) have been recommended as effective supervisory behaviors, and "asking questions"(26, 27) has been suggested as a good clinical teaching strategies. Our results illustrated how trainee's understanding of the meaning of the supervisor's behaviors can be facilitated by engaging in monologues and dialogues about patient care. Furthermore, a variety of ways to provide direct guidance was described under the theme of
providing support-in-action. Nuances were also provided regarding the different objectives that can be achieved by asking questions to the trainees: to probe their knowledge about patient care (engaging in dialogues about patient care) or to encourage them to commit to a diagnosis and management plan (facilitating hands-off provision of care). Although our study did not attempt to confirm the learning benefits of these interactions by measuring learning outcomes, we identified the distinct educational potential of different types of interactions.

CONCLUSION
Through their interactions with trainees, bedside clinical supervisors could create learning opportunities and facilitate trainee involvement in patient care during acute care episodes in ways that minimized risks for the patients. Trainees' contributions to patient care helped supervisors to tailor the type of learning interactions most likely to benefit the trainees, and to de-escalate the level of supervision without compromising patient safety. Based on our model of interactive clinical supervision, trainees do not have to be pure observers of care delivery or pure care providers during acute care episodes. Regular learning interactions among supervisors and trainees are helpful to ensure that trainees are consistently engaged in both patient care and learning.
REFERENCES


Chapter 9
Clinical Supervision During Acute Care Episodes:
Learning Against the Odds

9 Introduction

The importance of supervisor-trainee learning interactions during acute care episodes for creating learning opportunities for the trainees while providing safe and timely care to the patients was presented in Chapter 8. For the subsequent phase of observations and analyses of our naturalistic study, we chose to explore more thoroughly the moments of transition between the interactions mostly directed towards patient care and the ones mostly directed towards learning (i.e. shift to learning). By comparing acute care episodes from which numerous shifts to learning emerged with those where few could be identified, the following paper highlights contextual factors and strategies used by clinicians that related to the occurrence of the shifts to learning.
CLINICAL SUPERVISION DURING ACUTE CARE EPISODES: LEARNING AGAINST THE ODDS

Dominique Piquette, MD, FRCP(C), MSc, MEd
Carol-anne Moulton, MB; BS, MEd, PhD, FRACS
Vicki LeBlanc, PhD

INTRODUCTION

Over the last two decades, learning that takes place in the socio-cultural contexts in which knowledge will be used has been increasingly understood and valued(1-5). Workplaces, such as the clinical wards of teaching hospitals, provide learners with practical problems that structure knowledge, culture and values that inform knowledge use, and also provide learners with experienced colleagues who guide practice(1). Through opportunities for observation, practice, and direct instruction, learners working in clinical environments are expected to gain experience and develop the knowledge and skills required for independent practice(6-8). However, these clinical environments present their own educational challenges(9-12).

Access to knowledge in complex health care systems can be problematic for newcomers because the meaning of clinical activities is too often implicit and covert(13, 14). In this regard, senior clinicians are invaluable in providing role models, coaching, direct guidance and instructions to the trainees(6, 13, 15). Yet many characteristics of today's clinical environments may compromise senior clinicians' ability to support trainees' learning. Lack of time, the need to multitask, the unpredictability of clinical encounters, and learners' heterogeneity have all been identified as factors undermining clinicians' capacity to play their role as efficient clinical supervisors and teachers(9, 16, 17). Changes in clinical and training conditions such as increased workload, reduced one-to-one interactions between supervisors and trainees, and increased complexity of care have exacerbated these problems(17). The solutions proposed in the medical education literature to overcome these challenges have been mostly based on planning, delivering, and reflecting upon bedside teaching(10, 11, 18, 19) or on investing in learning strategies implemented away from the clinical context (e.g. simulation-base training)(20, 21). Such suggestions do not always appear applicable to complex, acute environments such as the...
intensive care unit (ICU), where care is delivered to numerous critically ill patients simultaneously and at a very high pace. Very few studies have addressed the specific opportunities and challenges posed by such environments.

We therefore explored the learning interactions among trainees and clinical supervisors during acute care episodes in critical care environments. We have described in a previous paper(22) how various types of learning-directed interactions during acute episodes of care could create learning opportunities and could foster trainee involvement in patient care without compromising patient safety. Despite the richness of the learning interactions observed, we noticed a significant variability in their occurrence across scenarios and between participants. The goal of this paper was therefore to better understand why certain acute episodes of care were conducive to numerous learning interactions, whereas others were not. To do so, we focused on the shifts to learning occurring during acute care episodes, i.e. the transitions from the interactions among participants directly related to the care of the patients to the interactions directed towards learning.

METHODS
This observational study used constructivist grounded theory methodology(23). Grounded theory methodology is a qualitative approach used to develop theoretical understanding of social phenomena(24). A constructivist view of grounded theory considers multitude perspectives and reflexivity as important aspects of the research process(25). A detailed description of our methods has been published elsewhere.

We used participant observation as our data collection strategy and purposive sampling to select our study sites and periods of observation. To maximize our chances of observing a variety of learning interactions during acute care episodes, we chose to observe physicians of different levels of training (residents, fellows, and attending physicians) working in the medical-surgical critical care unit of two tertiary, university-affiliated hospitals in Toronto, Canada. The principal investigator (a practicing critical care physician) and a research assistant (a practicing critical care nurse) completed 8-hour blocks of observation during daytime, evening, and nighttime clinical activities. We obtained ethical approval from each institution where this study was conducted and a written consent from each participant.
Between December 2010 and June 2012, a total of 350 hours of participant observation were completed. Our initial observations were focused on the interactions among residents, critical care fellows, and critical care attending physicians during 74 acute care episodes in the critical care environment. During those observations, the object of attention was primarily the interactions between the trainees and their supervisors that appeared to be non-essential for the care of the patient but to result from participants' purposive efforts to integrate learning into clinical activities. Short on-site interviews with the participants were also completed after the acute care episodes to clarify certain data collected and to expand our interpretations. Detailed descriptive field notes, observers' immediate interpretive reflections and personal impressions or feelings were documented during the observations and contributed to this analysis.

As part of the iterative process, field notes were transcribed and analyzed concurrently with further ongoing data collection that was guided by our preliminary analysis (theoretical sampling)(26). During the first few months of observation, we created a model to explain how the learning-directed interactions between supervisors and trainees could establish progressive levels of trainee involvement in patient care while maintaining patient safety during acute care episodes. This model has been published elsewhere(22). We observed that the occurrence of these learning interactions varied widely across scenarios and between participants. We decided to focus our observations to the moments of transition between patient care and learning-directed interactions to explore the clinical circumstances and other factors that appeared to precede the occurrence of these shifts to learning.

Grounded theory methods (line-by-line, focused, and theoretical coding; constant comparison; memo writing and audit trails; end of data collection with theoretical saturation of the themes) were used for the data collection and analysis(27). Multiple meetings between co-investigators were held to develop and refine the coding structure and the theoretical framework emerging from the data. Their different backgrounds contributed to the richness of the interpretations of the data. NVivo 9 software (QSR International Pty Ltd., Cambridge, Massachusetts) was used for the storage and analysis of the data.
RESULTS
Supervisors and trainees constantly interacted during clinical activities to fulfill their responsibilities towards patient care and towards learning. Some of these interactions were mostly directed towards patient care, while others were mostly directed towards learning (i.e. not essential or of immediate benefit for the patients). We defined a “shift to learning” as the transition from patient care-directed interactions towards learning-directed interactions. Three themes emerged from our data and contributed to a better understanding of the variability in the occurrence of the shifts to learning during acute care episodes: best conditions, worst scenarios; beyond the clinical case; and the power to change.

Quotes include contributions from the critical care residents (R), critical care fellows (F), critical care attending staff physicians (S), medical students (MS), and registered nurses (RN).

BEST CONDITIONS, WORST SCENARIOS
Based on their potential for the creation of learning opportunities, acute care episodes were perceived by our participants, right from the beginning, as "good learning cases" or "bad learning cases". Good learning cases included, for example, very acute or unusual clinical scenarios, whereas bad learning cases revolved around routine consultations without diagnostic or therapeutic challenges. We identified five specific triggers of the shifts to learning recurrently observed during "good learning cases".

Clinical Problem to be Resolved
Most acute care episodes revolved around one or many clinical problems to be resolved, i.e. identifying the etiology and the nature of a critically ill patient's condition and/or establishing a plan of care. After the initial collection of clinical data required to achieve these goals, supervising physicians frequently initiated a shift to learning:

A patient who had a massive traumatic subdural hematoma is now brain dead. The resident and the fellow are asked to see the patient in the Emergency Room for a transfer to the ICU for organ donation. During their initial assessment, the ICU team notices that the patient has a low blood pressure.

F: When a potential donor is hypotensive, we have to think about three things: giving hydrocortisone, giving vasopressin, and replacing the thyroid hormones.

[C1_0511_3]
In comparison, ICU admissions that were planned ahead of time with a known diagnosis and treatment and/or that were required mostly for monitoring (e.g. stable post-operative cases) generally did not lead to a shift to learning.

**The Rare and Unusual**

Patients presenting with unusual medical conditions or treatments often became the objects of learning interactions between our participants:

*Observer: I noticed that you spent a fair amount of time explaining/teaching to both the resident and the fellow the particulars involving the care and management of a patient with smoke inhalation. Can you share your thoughts on that?*

*S: I don't always spend that much time teaching but this case was unusual. Indeed, I had to read up on it so I thought I would share the things I learnt with the trainees.*

[C1_1111_1]

Even when the supervising physicians appeared familiar with these unusual clinical issues, explanations were at times provided to the trainees about their meaning.

**Discrepancies Between Clinical Events and Expectations**

During certain acute episodes of care, a clinical aspect emerged that was in contradiction with participant's prior understanding of the clinical situation. Such clinical inconsistencies were often objects of verbalization by the supervising physicians for the benefit of the trainees:

*A fellow is being updated about a patient seen by the resident on the ward. She wants to know who ordered the anticoagulant. She explains that she is concerned because in a patient with a large ischemic stroke, you would usually hold off the anticoagulation for at least 7 days. She further explains that usually the first medication introduced is heparin because it can be more easily reversed compared to Coumadin.*

[C1_1110_2]

**Physical Tasks or Visual Cues**

Concrete aspects of care, such as visual cues (e.g. imaging results, physical examination findings) or technical procedures and devices, often provided a trigger for the shifts to learning:

*The attending staff, fellow, and residents are assessing a trauma patient with arrhythmias and unstable blood pressure. The attending is reviewing the 12-lead EKG.*

*S: He seems to be developing a left bundle branch block. (To the residents) Do you see the bunny ears on the left side? I also see changes in 1, AVL, V5 and V6.*

*R: Yes, I see the downward terminal part. Yes, a LBBB.*

[C1_1211_1]
During particularly challenging clinical situations, triggers based on physical tasks or visual aspects of the care were, at times, the only ones leading to shifts to learning.

**Divergences of Opinions or Questions from Other Healthcare Professionals**

Acute care episodes involved many healthcare professionals whose expertise and skills positively contributed to the care of the patient. These professionals sometimes expressed views that were not aligned with our participants' understanding of a clinical situation, or verbalized questions to clarify their own understanding of a problem. Such interventions could lead to a shift to learning:

The resident attempts to intubate a patient twice but cannot get a proper view. The nurse suggests using paralytics on both occasions. The fellow requests a paralytic agent, but proceeds with the intubation while someone is getting the drug. After the intubation, the fellow explains to the resident the rationale for not using a paralytic agent and that intubating awake is sometimes the safest option.

Acute care episodes that offered many triggers for shifting to learning were also likely to present numerous hindrances. As a result, certain acute care episodes that presented one or many of these triggers did not generate any shift to learning or led to shifts that were prematurely aborted (e.g. an explanation about a procedure was initiated but never completed). Four common hindrances to the shifts to learning were repetitively observed during "good learning cases".

**Clinical Uncertainty**

During very complex, unusual clinical situations that unfolded quickly and unpredictably, supervising physicians had to make sense of the events 'on-the-spot', i.e. to co-construct with the trainees, in real time, an understanding of what was happening:

The fellow and the resident are managing a new ICU admission. The patient suffered a severe trauma with significant neurological injuries and active bleeding potentially requiring operative management after stabilization. While the timing and order of the surgical interventions are being discussed by the multiple surgical teams, the blood pressure becomes unstable. Fluids are ordered by the fellow. The resident has tried to insert an arterial line multiple times with no success. The fellow offers to try to insert the arterial line. She observes the cardiac monitor and notices the blood pressure instability. The cause of the hypotension is unclear (bleeding vs. collapse from brain herniation). The fellow asks the nurse to warm the patient. The blood pressure is responding to fluids. A neurological resident suggests to give mannitol. The fellow verifies the dose of mannitol and asks the nurse to give it. The left pupil is blown...
When participants appeared to invest all their efforts in dealing with the uncertainty of a clinical situation, they demonstrated a limited ability to initiate a shift to learning.

**Unpredictable Changes in Patient's Condition**

When shifts to learning did occur in these challenging circumstances, they were at times interrupted by an unpredictable change in patient's condition:

*The fellow, resident, and medical student are inserting a central venous catheter on a newly admitted ICU patient.*

*MS: By which port of the catheter does the guide wire go through?*  
*The fellow shows how the guide wire goes through the brown port. He's explaining how to flush the other ports with normal saline when he's interrupted by the nurse. She notices a sudden drop in the blood pressure and asks what she should do about it. The fellow suggests increasing the levophed. He never finishes his explanation about the line insertion.*

**Multiple Unstable Patients**

Taking care of multiple patients simultaneously also appeared to be associated with interactions focused on patient care rather than learning:

*The fellow is calling his staff about a new admission.*  
*F: It's a patient with a gunshot wound that just came back from the OR. [The fellow mentions the procedures done.] My main concerns are: an increased heart rate and blood pressure and an increased drainage from the intra-abdominal tube. I spoke with general surgery. The patient was fluid-depleted in the OR. We will send off some samples from the drain to assess the hematocrit. I gave two liters of fluids. I am still waiting for the postoperative laboratory results.*

*S: OK thanks, call me if you have any questions.*  
*[Afterwards, the staff reports that at the time of the call, he was dealing with a patient in the emergency room that needed his immediate attention.]*

**Interactions with Other Clinicians**

Given that many participants were involved in the care of acutely ill patients, interruptions by comments or questions about the patient from another member of the clinical team were a common distractor from shifts to learning:

*At the end of the initial assessment of a newly admitted ICU patient:*  
*F1: So we have hypovolemia and sepsis...*  
*R1: Do we know this for sure or are we just thinking this?*
Based on this series of examples, we concluded that the same acute care episodes that presented many case-related triggers for a shift to learning (e.g. challenging clinical problems, discrepancies) were also likely to present intrinsic barriers to the learning shifts (clinical uncertainty, unpredictable changes). No acute care episode thus represented perfect learning conditions: when intrinsic incentives to trigger a shift to learning were present, the means (e.g. time, mental resources) to perform this shift were often limited.

**Beyond the Clinical Case: The Participants and the Clinical Environment**

Some of the acute care episodes that led our participants to shift to learning did not present the typical characteristics of a "good learning case" or present multiple hindrances to the shifts to learning. Observations and conversations with certain participants who participated in more than one episode of care indicated that, in addition to the specific nature of a clinical case, individual participant characteristics such as trainees’ gaps and perceived individual responsibility for learning influenced the occurrence of the shifts to learning.

**Trainees' Gaps**

Supervising physicians appeared to realize the educational potential of a clinical situation when trainees' gaps became exposed through the joint completion of clinical activities or were revealed through residents' questions about patient care:

*The resident and fellow are reviewing the history of a stable patient transferred to the ICU with a gastrointestinal bleed. While writing the admission note, the resident asks about the reason for the antibiotics that were ordered by the GI team. The fellow discusses the evidence regarding the prevention of spontaneous bacterial peritonitis post-GI bleed in cirrhotic patients.* [C2_1111_02]

On the contrary, episodes of care that revealed a good understanding of the clinical situation on the part of the trainees were not often associated with a shift to learning. This situation was common during the interactions among staff physicians and senior trainees (e.g. fellows), whose knowledge and skills were usually appropriate to address routine clinical activities:

*The fellow is intubating a patient who is known to be difficult to intubate. She decides to use the glidescope with minimal sedation. The staff, who is rounding during the
intubation, comes to the bedside once it is completed. He checks the vital signs that are now normal. He asks the fellow:
S: I am assuming that the CO2 is positive and all that?
The fellow confirms. The staff tells me that he knew that the fellow would "manage this fine" and returns to rounds. [C2_0311_2]

Perceived Individual Responsibility for Learning
Some supervisors and trainees appeared to make consistent efforts to shift to learning regardless of the clinical circumstances. Participants who were repeatedly involved in learning interactions reported a strong sense of responsibility toward learning:

The fellow is commenting on her efforts to involve the resident during a potentially challenging endotracheal intubation: "My other option was to do it myself, but this is a teaching hospital and I was there watching and could take over at any moment. The resident was given the opportunity to learn in the ICU environment with back up." [C1_0512_4]

These efforts were especially required in time-sensitive situations where patient care and learning competed for participants' attention, or during routine cases presenting little intrinsic triggers for a shift to learning. However, other hindrances to the shift to learning that related to the broader clinical environment in which the acute care episodes unfolded represented additional barriers to a shift to learning.

Time Labeling
Interactions with our participants revealed that depending of the time of the day, similar acute care episodes had a different likelihood to trigger a shift to learning. Our participants had an implicit understanding of what they should be doing at certain periods of the day, and shifting to learning was not always part of these expectations. For example, interactions between home-based supervising physicians and in-house trainees (e.g. during a nighttime call) were mostly focused on patient care. Asking a question irrelevant for the care of the current patient to the supervisor on the phone at night caused discomfort to many trainees because of a fear of further interrupting their supervisor's sleep. Supervisors were also acting in accordance with this implicit time labeling. For example, a supervisor was observed trying to expedite the late review of a new consultation with the resident because of their assumption that the resident "just wanted to go home" despite resident's eagerness to "get something [educational] out of this consultation" (as reported in the interviews following the review of the case [C2_0311_3]). Acute care episodes
occurring during another scheduled activity (e.g. multidisciplinary rounds) or at the time of
hand-over between daytime and night call teams had less potential to trigger a shift to learning:

*The fellow and resident are quickly completing an emergency consultation at 6pm on
a Friday night. After questioning the patient, the fellow does part of the physical
exam himself. He asks the resident to auscultate the lungs.*

F: So?
R: Decreased air entry.

*The fellow explains to the patient her diagnosis (bug in the lungs) and tells her that
she does not need an ICU bed for now. He makes sure that the resident contacts the
medicine team and prepares to leave the hospital.*

F to observer: I just want to leave and go home... Which is not so good for teaching I
guess! [C2_1111_5]

**Rapid Turnover of the Participants in the ICU**

The lack of familiarity between supervising physicians and trainees appeared to limit
participants' ability to initiate certain shifts to learning. Supervising physicians made
assumptions about trainees' knowledge and skills that could not always be confirmed by direct
observation. In practice, the educational needs of the trainees were often inferred from their level
of training, their subspecialty, and the time already spent in the ICU.

*The staff is intubating a stable patient in presence of a general surgery junior
resident. He is giving the medication for sedation without saying aloud the type or
dose of agents used. The resident is trying to look at the syringes to see which agents
are used. The same staff was observed during another endotracheal intubation
discussing medications with a fellow.* [C2_1210_4]

Therefore, supervisors failed to initiate shifts to learning when they believed that the content was
irrelevant for trainee's future subspecialty practice, that a topic was likely to have been already
reviewed in previous formal or informal learning activities, that asking inexperienced trainees to
complete clinical tasks themselves would involve delays in patient care, etc.: 

*An attending staff comments to the observer, after an acute episode of care that did
not lead to a shift to learning.*

S: I have not worked with this group of residents and I was unaware of their skill set,
so I opted to take the lead. [C1_0612_01]

A complete absence of triggers emerging from the clinical case or from the participants was a
rare occurrence during acute care episodes. Yet, some of these clinical encounters did not
involve any shift to learning. Conditions associated with patient care or with other contextual
issues negatively affected participants' ability to shift to learning. However, as we will now
describe, none of these hindrances were found to create conditions that were impossible to overcome by our participants.

**THE POWER TO CHANGE**

Some of our participants initiated shifts to learning during acute care episodes that, by their lack of common triggers or accumulation of hindrances, appeared particularly unfavorable to a shift to learning. The following four strategies illustrate how the participants could overcome these unfavorable conditions.

**Tweaking a Routine Case**

Some participants appeared to overcome the lack of patient care-related trigger for a shift to learning by actively creating problems from routine clinical situations (e.g. by verbally extrapolating on potential complications or on alternative scenarios) or by discussing potential complications that could emerge from the current clinical situation:

*A resident and a medical student are admitting a trauma patient with a history of obstructive sleep apnea and hypertension for monitoring only. The resident shared with the medical student the prior realization of a gap in his own knowledge and potential complications that the patient may encounter.*

*R: As a medical student, I wasn't appreciating the meaning of snoring... but it causes problems.*

*MS: Like hypertension?*

*R: Yes, and pulmonary hypertension. And all those young patients wake up shivering and wild.*

*MS: Oh! I didn't know that!*

*R: Yes, and usually Demerol works well.*

[C2_0511_3]

**Turning Hindrances from Patient Care into Triggers**

Some supervisors who were visibly struggling with a clinical situation still managed to initiate a shift to learning by making their diagnostic and management struggles explicit for the trainees, thereby providing access to their clinical reasoning. The uncertainty or unpredictable changes of a clinical situation thereby became the trigger for a shift to learning.

*A young woman admitted to the ICU with a massive pulmonary embolism now presents a new episode of desaturation at 60%. After an initial bedside assessment by the fellow, the team gathers in the radiology room to see the chest x-ray that reveals a left pleural effusion. The staff appears perplexed.*

*S: Do you think she could have thrown another PE?*
F: That's unlikely no? Once she's anticoagulated... I would start her on nitric oxide. The staff is visibly thinking.
S: But why is this happening now? She had a PE and decreased right ventricular function before.
F: We could bronch to see if there is a mucous plug in the left lower lobe. I am worried about her abdomen. It could be a C.difficile colitis.
S: That's not in her lungs. Could she be shunting?
The staff and fellow go back to the bedside. The patient's saturation is better.
S: It might have just been a plug... She's fine now. [C2_1111_2]

Flagging a Trigger and Postponing the Shift

When good learning cases offered compelling triggers for a shift to learning but time or mental resources were not immediately available, some supervisors verbally flagged these triggers and committed to engage in learning interactions at a later time of the day.

A fellow is inserting urgently a line for a patient who has developed a severe gastrointestinal bleed after receiving a thrombolytic for a stroke. The fellow struggles with the line insertion and mentions to the residents that they would discuss this later. In the afternoon, the fellow is seen explaining to the residents the specific challenges encountered during the line insertion completed earlier and providing practical tricks with line insertion under ultrasound guidance. [C2_0311_1]

Re-Labeling Time

Although always in the background of any clinical activity, the implicit adjudication of time was not immutable. Certain periods could be easily re-labeled by the participants, thereby allowing learning interactions during periods usually perceived as unfavorable for learning. For example, a staff expressed to the trainee his intention to stay at the hospital until the expected arrival of a patient transferred from another hospital late in the evening. The trainee therefore reported feeling comfortable asking theoretical questions about the case being reviewed because the attending physician was not "on her way out" [C2_0411_2].

Seizing the opportunity offered by a trigger or overcoming a hindrance to initiate a shift to learning was not only a way to offer an opportunity for learning, but the very first step of a phenomenon observed during certain acute care episodes: the creation of learning momentum.

Creating Learning momentum

Conditions preceding and emerging from acute episodes of care combined to create circumstances more or less favorable for shifts to learning to occur. However, clinical
circumstances evolved throughout an episode of care and could be actively modified by our participants. We observed many clinical situations during which a shift to learning modified, in real time, the conditions of the encounter, creating a phenomenon that we referred to as learning momentum.

A shift to learning marked the initiation of learning-directed interactions. Such learning interactions could help to create learning momentum by presenting new triggers that initiated further learning interactions in different ways: by exposing resident gaps, by uncovering intriguing details of a case not previously considered by the participants, by triggering reactions, comments, and questions from other healthcare professionals, by re-labeling an episode of care as 'educational time' (e.g. a supervisor providing explicit explanations to the trainee is sending the message that this time could be used for learning), etc.

The fellow and the resident review the chart of a postoperative patient who had major blood losses in the OR and now has a low urine output.

F: What did you think about an ECG? The K is 5.5 and that 95% of people with K of 5.5 have ECG changes. Do you know what changes to expect?
R: I would look for: peaked t waves, long PR, wide QRS, and slight changes in the waveform. [...] The urea is 11.3... I am not sure if it is due to large blood loss or not.
F: That is a fair hypothesis. Any other ideas/thoughts?
R: I am concerned about the volume status. The systolic blood pressure is 95. I need a good pressure to perfuse the kidneys.
F: Yes, that is one idea. There is no central line to check the central venous pressure. Did you have a chance to assess the JVP yet?
R: I honestly did not think of that.
F: Our plan is to first rule out any postoperative complications, but we also want to be sure that nothing else is going on.
R: Yes, that is a great thought.
F: Once we've ruled out complications, then we will assess if the patient needs even more fluid. Let's also consider the following: the patient has renal failure and potentially sepsis, with a history of chronic renal failure and urinary stones. Stones do not always show up on x-ray. Calcium stones show up. Uric acid stones do not show up. There are also drug-induced stones. Lastly we can also consider infected stones [...].
The resident is nodding his head in agreement. The resident looks up the latest labs and notices the WBC is 19.5.
R: Is this a response to the blood transfusion that the patient received?
F: You should not get a high WBC count from a blood transfusion, but you can get an elevated WBC count in response to a surgery.
R: Yes. Of course... as a response to stress.
F: Ok, plus an abscess was taken out, so we want to make sure that it is not sepsis. Is it fair that we give her several days of antibiotics? I suspect the rise in creatinine is
from the lack of fluid or volume depletion in the OR. This is a fairly complicated surgery but she came out of it OK. [C1_0511_4]

Although many shifts to learning led to isolated or incomplete learning interactions for which the learning content may not have been fully grasped by the trainees, other shifts generated a series of interactions that represented multiple learning opportunities for the trainees. While any shift to learning could contribute to re-labeling time as educational time, learning interactions that revealed obvious gaps and discrepancies appeared to further contribute to the creation of learning momentum.

DISCUSSION

Medical trainees and their clinical supervisors assume a dual responsibility towards patient care and learning when working in the clinical environment(10, 19). Clinical environments offer numerous opportunities for learning, but also pose educational challenges(9, 10, 17). The goal of this paper was to better understand why certain acute episodes of care were conducive to numerous learning interactions, whereas others were not. Our findings illustrated three important points regarding the circumstances affecting the occurrence of the shifts to learning during acute care episodes: the absence of absolute best or worst acute care episodes for learning; the importance of conditions unrelated to the clinical case for the occurrence of a shift; and the power of the participants to modify, in real time, the learning conditions of a clinical encounter (Figure 9.1). Although we do no pretend to present an exhaustive list of all the potential triggers and hindrances to the shifts to learning, we believe that our results illustrate how these conditions can interact and be modified to favor or not the shifts to learning during acute care episodes. The three main themes of this paper will be further developed in the rest of this discussion. We argue that the findings related to each of these themes support the idea that by actively seizing the learning opportunities offered by certain clinical cases and by purposefully modifying unfavorable learning conditions, supervisors and trainees can address both trainees' educational needs and patient care during most acute care episodes.

Acute care episodes that presented numerous triggers for the shifts to learning (i.e. that posed inherent, new, or challenging clinical problems to our participants) were also likely to pose challenges (e.g. clinical uncertainties, quickly changing patients' conditions, multiple
interruptions). On the other hand, routine clinical situations that were perceived as 'bad learning cases' offered time and mental resources to initiate and complete more elaborated learning interactions. No acute care episode thus represented perfect learning conditions: when intrinsic incentives to trigger a shift to learning were present, the means to perform this shift were often limited. However, what was perceived by our participants as routine or challenging differed based on their level of clinical experience. When clinical supervisors had the ability to identify with the learners (i.e. to see a challenge for the trainees in a clinical situation that was, from their perspective, a routine case) or when learners came forward and asked questions about, for example, a case new to them, acute care episodes could offer both incentives and means for initiating a shift to learning. Acute care episodes therefore provided multiple learning opportunities for the trainees, but shifting from patient care to learning-directed interactions could require purposeful efforts from the participants.

In addition, our results illustrated how circumstances established prior to a specific clinical encounter affected our participants' abilities to shift to learning during an acute care episode. A strong sense of responsibility towards learning was reported among participants who consistently initiated shifts to learning in spite of challenging clinical circumstances. When conditions were unfavorable to learning, recognizing learning as a valuable goal of clinical activities appeared to make a positive difference in the occurrence of a shift. Furthermore, prior clinical experience in a given environment determined two conditions affecting the shifts to learning: an understanding of the expected goals of the interactions during certain time periods and participants' familiarity with each other.

Time has often been reported in the literature as a major impediment to clinical-based learning. However, we observed that the critical care environments selected for this study were more complex: although time was limited during certain acute care episodes, time was available when clinical encounters unfolded over hours or in between acute episodes. Time that was not specifically labeled as educational appeared less likely to lead to shifts to learning. Learner heterogeneity has also been described in the literature as a barrier for effective teaching during clinical supervision. We identified the lack of familiarity between participants as a hindrance for shifting to learning. Although modifying the structure of trainees’ clinical rotations or supervising physicians' clinical schedule could overcome this barrier, such interventions would
represent a complex change. An alternative approach would be to favor clinical interactions during clinical encounters that uncover clinical gaps among trainees and allow supervisors to target their learning shifts despite a lack of familiarity with the trainees.

Finally, our data illustrated many examples of strategies used by our participants during acute care episodes to modify, in real time, the learning conditions of a clinical situation. Such strategies illustrated the great capacity of individual clinical supervisors and learners to improve unfavorable conditions for learning despite limited time and mental resources. Furthermore, our results illustrated the importance of trying to initiate a shift to learning, even if the clinical circumstances did not allow for a coherent and in-depth discussion of a topic. In numerous acute care episodes, a simple shift to learning initiated a series of learning interactions (learning momentum) by redefining the learning conditions of an encounter and by uncovering new triggers for learning. Such clusters of learning interactions between participants, as well as their potential learning benefits, should be further investigated.

Figure 9.1: Dynamic conditions affecting the occurrence of the shifts to learning during acute care episodes
CONCLUSIONS

Despite the numerous changes that have affected acute clinical environments over the last decade and the specific challenges posed by acute care episodes, trainees and clinical supervisors were able to use many of the learning opportunities that emerged from daily clinical activities. However, their ability to shift to learning in challenging clinical circumstances also depended on conditions established prior to a specific clinical situation and on their use of strategies to overcome learning barriers encountered in acute clinical environments. These results imply that pulling trainees away from the clinical context because of its inherent educational challenges is not the only solution to foster learning during postgraduate training. Trainees' learning experience could be improved in the clinical setting by developing and assessing interventions focused on the conditions identified as triggers for the shifts to learning and on the strategies demonstrated by some of our participants to overcome circumstantial barriers to clinical learning.
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Chapter 10
Integrating Patient Care And Learning During Clinical Activities: Two Contexts, Two Strategies

10 Introduction
The following paper presents two distinct models explaining how supervisors and trainees shift back and forth between patient care and learning within an episode of care. To illustrate the impact of context on the strategies used by the supervisors to integrate learning interactions within clinical activities, we compared two types of clinical situations: acute care episodes and critical care multidisciplinary rounds.
INTEGRATING PATIENT CARE AND LEARNING DURING CLINICAL ACTIVITIES: TWO CONTEXTS, TWO STRATEGIES

Dominique Piquette, MD, FRCP(C), MSc, MEd
Carol-anne Moulton, MB; BS, MEd, PhD, FRACS
Vicki LeBlanc, PhD

INTRODUCTION

Guidance and direct instruction from experts have long been recognized as key strategies to promote work-based learning(1-4). Trainees working in complex and dynamic clinical environments, where most of the knowledge is tacitly embedded in observable activities, particularly benefit from the assistance of more experienced clinicians to make sense of their experiences(3, 4). However, the clinical setting presents specific challenges for the supervisors who engage in these learning interactions with the trainees(2, 5-7). Assuming a dual responsibility towards patient care and trainee's learning requires time and mental effort from the supervisors(1, 2, 8). Such resources are often limited in busy, acute care environments(1, 7, 8).

Many general strategies have been proposed to foster learning interactions between trainees and supervisors in real clinical environments(2, 5, 9, 10). These strategies have been described mostly in the context of routine clinical activities, such as daily ward rounds or patient encounters in ambulatory clinics, and do not take into account the specificities of other clinical situations (e.g. unpredictable events during medical crises). Furthermore, the educational advantages and limitations of most of these strategies have not been investigated thoroughly in real clinical contexts.
We have described, in an earlier paper(11), how the learning interactions among trainees and clinical supervisors can contribute to learning in the critical care setting. We have also explored, in a subsequent paper(12), the transitions between patient care- and learning-directed interactions (shifts to learning) to better understand the conditions affecting the occurrence of these learning interactions. However, in neither of those papers did we explore specifically how the creation of these learning opportunities was balanced, in real time, with patient care throughout an episode of care. In this paper, we compare the strategies used by clinical supervisors to integrate learning interactions into daily multidisciplinary rounds versus into acute care episodes. The goal of this paper was to develop a theoretical model describing the integration of learning interactions into patient care activities within different clinical contexts. Furthermore, we examined the potential educational advantages and limitations associated with different strategies used for such integration.

**METHODS**

We conducted an observational study using constructivist grounded theory methodology(13). This methodology aims at the construction of theories regarding social phenomena, and relies on the consideration of multiple perspectives and on the reflexivity of the researcher. A complete description of our study methodology and methods has been described elsewhere(11).

We selected participant observation as our data collection strategy. Purposive sampling guided the choice of our study sites and periods of observation. Our objective was to observe a variety of learning interactions during acute care episodes. We chose to observe the clinical activities of physicians (including residents, fellows, and attending physicians) working in the medical-surgical critical care unit of two tertiary, academic hospitals in Toronto, Canada. Multiple blocks
of eight hours of observation were completed by the principal investigator (a practicing critical care physician) and by a research assistant (a practicing critical care nurse) during daytime, evening, and nighttime clinical activities. Each institutional ethics board approved this study, and each participant enrolled in this study provided a written consent at the beginning of each period of observation.

Between December 2010 and June 2012, the observers completed a total of 350 hours of observation that included a total of 74 acute care episodes and 12 multidisciplinary rounds. We initially focused our observations on the learning interactions among residents, critical care fellows, and critical care attending physicians during acute care episodes in the critical care environment. By learning interactions, we meant interactions among the trainees and their supervisors that appeared to result from participants' purposeful efforts to integrate learning within clinical activities; these interactions were not essential for the care of the patient (11). Detailed descriptive field notes, on-the-spot interpretive reflections, and investigators’ personal impressions and reflections were documented during the observations and form part of this analysis.

As part of the iterative process, the field notes were transcribed and analyzed concurrently with further data collection guided by our preliminary analysis. During the first few weeks of observation, we witnessed many routine episodes of care such as multidisciplinary rounds. We observed that the learning interactions occurring during these rounds were different from the ones observed during acute care episodes. We thus decided to broaden the context of our observations to include multidisciplinary rounds in addition to the acute episodes of care.
Comparing these two types of clinical situations allowed us to better understand how learning interactions were integrated in patient care-directed activities in different clinical contexts.

Grounded theory methodology and methods (theoretical and critical case sampling; line-by-line, focused, and theoretical coding; constant comparison; memo writing and audit trails; end of data collection with saturation of the themes) were employed (14). Furthermore, multiple, planned interdisciplinary meetings between co-investigators were held to provide multiple perspectives for the development and refinement of the coding structure and the theoretical framework emerging from the data. NVivo 9 software (QSR International Pty Ltd., Cambridge, Massachusetts) was used to facilitate the storage and analysis of our data.

RESULTS
We observed the interactions among critical care residents, fellows, and attending physicians during two types of clinical activities: multidisciplinary rounds and acute care episodes. Daily multidisciplinary rounds represented planned clinical events involving the systematic review of the medical issues of each patient admitted to the critical care unit. Typical bedside interactions included a brief presentation of the patient by the resident, input from the bedside nurse, updates and suggestions from other healthcare professionals (dietitian, respiratory therapist, pharmacist, physiotherapist), and a final discussion about the diagnosis and management plan by the medical team. Acute care episodes involved unpredictable, yet defined clinical events, where a newly or already admitted ICU patient experienced an immediately life-threatening condition.

This paper focuses on two models of the integration of learning interactions into patient care in acute clinical environments and explains how these models appear to be adaptive to the clinical
conditions encountered by our participants. In order to develop these models, we explored how multidisciplinary rounds and acute care episodes differed in terms of learning contexts, and how these differences affected the educational potential of each clinical situation. The quotes represent the observed interactions between residents (R), critical care fellows (F), critical care staff physicians (S), and critical care nurses (RN).

**Two Models of Integration of Learning Interactions into Clinical Activities**

Two models of integration of learning interactions into clinical activities were identified during multidisciplinary rounds and critical episodes of care: an *in series* model and an *in parallel* model. By model of integration, we mean a strategy used by our participants to include learning interactions within patient care activities and to negotiate the transitions between the two during an episode of care. Multidisciplinary rounds were commonly associated with an *in series* model of integration, whereas critical episodes of care were usually associated with an *in parallel* model of integration. These two models presented differences in the structure and content of the learning interactions that matched the specific clinical contexts encountered during multidisciplinary rounds and acute care episodes (Figure 1).

**In Series Model**

During multidisciplinary rounds, participants' interactions usually focused either on patient care or on learning, not on both simultaneously. Initial interactions among participants about the care of a patient were frequently interrupted, at some point, by a bundle of learning interactions (Figure 10.1). Such pauses, uninterrupted by discussions about patient care issues, were frequently prolonged (many minutes) and usually occurred once during the review of a specific patient. The content of these learning interactions was sometimes only loosely related to the
patient’s issue discussed at the time of the transition to learning, and usually covered one main topic in a fairly structured and organized manner. We designated those bundles of learning interactions as *learning bubbles* (in bold).

*During multidisciplinary rounds, the condition of a trauma patient is being discussed by the team.*

*RN: The lactate is 3.3.*

*The medication is briefly reviewed by the fellow.*

*S to R: So have you heard about the propofol infusion syndrome? It usually happens with high dose of propofol given over 24 hours. It is more common in males than in females because of their physiology. It causes mitochondrial dysfunction. The patients cannot utilize any oxygen. They do not produce adequate ATP and this causes muscle necrosis and they die of a traumatic death. The patients go into ventricular arrest and have high CKs, troponins and lactates. You should use no more than 50 ug/kg/min of propofol for prolonged periods of time.*

*R: Within 24 hours we can see this?*

*S: It is more common in the 24-36 hours after starting propofol. Have you seen green color pee before with propofol?*

*R: Yes. once it's diagnosed, it happens fast. His potassium and pH are OK and his lactate is 3.3.* [C1_1211_1b]

Learning bubbles emerging from different clinical situations generally followed a similar structure (e.g. clinical presentation, diagnosis, treatment of a medical emergency), and some staff physicians and fellows were observed using similar bubbles with different groups of trainees. However, very few *learning bubbles* were observed during acute care episodes. As will be described in the next section, during these critical times, participants had to simultaneously address patient's and trainee's needs.

**In Parallel Model**

Lengthy learning interactions appeared challenging to integrate into acute care episodes. During such events, patient care had to be prioritized and meaning was actively constructed ‘on the spot’ by the participants. Therefore, physicians had to keep their mind focused on patient care activities even during learning interactions. In those circumstances, we observed learning
Learning flashes provided our participants the flexibility required to fully redirect their attention on patient care at any given moment, while creating immediate learning opportunities for the trainees.
Adapting to Two Different Contexts

Multidisciplinary rounds and acute care episodes presented different characteristics in terms of priority, knowledge of the patient, and social context that called for the use of distinct strategies of integration of learning interactions into clinical activities.

Prioritizing Patient Care or Learning

Multidisciplinary rounds were perceived by our participants as clinical situations where both patient care and learning should be prioritized. Time was set apart for learning interactions and their content was sometimes planned in advance by the supervisors, allowing for more structured and elaborated interactions.

It is 12:50pm [multidisciplinary rounds usually end at 13h] and the team moves to the bedside of the next patient.
S: We're finally arriving at the patient that I wanted to teach about, but we need to be quick...
The patient daily issues are discussed and the staff then explains how this patient's condition differs from other patients with similar presentations. [C2_1111_6]

In contrast, during acute care episodes, many supervisors and trainees reported that, although the clinical setting was perceived as a learning environment, patient care would always be prioritized over learning should the patient's condition require it.

R: My level of participation was medium and I felt it was appropriate. I would have liked to do the bronchoscopy. But I did get to help a bit. I certainly understand that the urgency and the nature of the intubation required more expertise. [C1_0612_1]

During acute care episodes, participants' minds could never venture too far from the immediate needs of the patient, leading to short, patient-focused learning interactions.
Building an Understanding of the Clinical Situation Before or During the Interactions

During multidisciplinary rounds, the most senior physicians of the team had already gained an understanding of the clinical issues and trajectory of most patients prior to the bedside interactions. Clinical issues discussed on rounds appeared to them as routine, well-defined problems that could be approached in a structured manner. Meaning could then be attributed quickly to the new clinical information.

During multidisciplinary rounds, the case of a recently admitted patient with respiratory failure is being discussed. The staff asks the resident who presented the patient:

S: What do you think we're treating here?
R: A community-acquired pneumonia?

The fellow and the staff then spend a few minutes elaborating on why in this specific case many factors complicate the diagnosis that may have appeared at first as a pneumonia, but now, based on the lack of improvement of the patient, seems to be something else. [C2_0311_2a]

Rounds also provided a retrospective perspective on prior decisions and actions and an opportunity to revisit their value.

A patient with catastrophic intracerebral bleed who is now palliative is being discussed on rounds.

R: I asked to monitor the fibrinogen levels and see if more cryoprecipitates are needed.
F: What do you want to achieve with that? I mean... is it going to change anything?
R: Well... for acute bleed, it's shown to decrease the bleeding.
F: But for her... [given that the goals of care are now focused on comfort]
R: Fair. [C2_0412_4]

Supervisors therefore had solid grounds to build their learning interactions with the trainees and could easily verbally transmit their understanding and approach to a clinical situation.
Such retrospective perspective was not available during acute care episodes. Every participant, including the most senior physicians, had to construct the meaning of the clinical encounter "on-the-fly". They had to determine and dynamically reassess the nature and management of poorly defined problems. As new clinical information became available to the participants over minutes or hours, meaning was constructed. Clinical reasoning and management was discussed in real-time, and then implemented rather than discussed after the fact.

A patient admitted to the ICU with a Kaposi sarcoma (bleeding lesions of the respiratory and gastrointestinal tracks) is suddenly dropping his blood pressure. The resident who was first called by the nurse quickly calls the fellow.

F: Ok, so let's go through the differential diagnosis of shock. We have sepsis, hypovolemia...

The resident is writing orders and asks to put the IV fluid under pressure. The fellow reviews the CT scan of the abdomen done earlier, and discusses with the resident her interpretation of the CT findings. The fellow notices huge pleural effusions on the CT. The resident mentions that they were tapped and looked bloody.

F: So what do you think?

R: He's hypovolemic and we'll see how he responds to fluids and blood.

F: Well... the only thing is that he's never dropped his blood pressure so fast even when he was bleeding. The hemoglobin is one thing, but the blood pressure looks like a massive bleed.

R: But wouldn't we see something [some blood]?

F: Not necessarily. Maybe it was caused by the nasogastric tube insertion...

The blood pressure is still in the 60's. The resident is doing a physical examination and confirms the loss of fresh blood per rectum.

F: What about the platelets?

RN: Nothing was given yet.

F: We need a fibrinogen level too.

The resident is on the phone with the GI team.

R to F: They're coming down. They didn't really know about the lower GI lesion.

F: I think he's going in disseminated intravascular coagulopathy.

As illustrated in this episode, supervisors could still initiate learning interactions, but often had to go back to the clinical situation to find answers to their own questions.
Interacting in the Public or Private Space

During multidisciplinary rounds, interactions between participants occurred in a very public space. Trainees had to expose their views in front of up to a dozen of clinicians, including junior and senior physicians, as well as other healthcare professionals. A common understanding and management plan of each clinical situation had to be openly negotiated.

*During multidisciplinary rounds, the staff brings up the need for an ophthalmology consultation for a patient with positive cultures for yeast in the abdominal fluid, but not in the blood.*

*S: Has ophthalmology seen the patient?*
*R: My understanding from yesterday's discussion was that the consultation was needed only if the blood cultures were positive...*

*S: [The tone is serious.] That's ok. I would have done it if I was the resident taking care of this patient, but you're in charge. You don't have to listen to me as long as there is a rationale. It was to decide on the antibiotic duration anyway. The blood cultures are not always very sensitive.*
*R: I guess we can ask them to see the patient. Not a problem. [C2_0311_2b]*

These small-group discussions could lead to a prolonged and extensive coverage of a topic, but also to the exposure of divergences of opinions. The public display of divergence of opinions was less likely during acute care episodes for at least two reasons. Staff physicians and trainees were more often involved in one-on-one interactions during acute care episodes. Other clinicians could frequently hear these interactions, but were usually busy with the completion of their own clinical tasks. In addition, the uncertainty characterizing critical events made it less likely for physicians to have definitive views on a problem and suggestions in terms of diagnosis and management from any member of the team were usually welcomed.

*The fellow is trying to advance the guidewire during the insertion of a central venous line in an ICU patient who is clinically deteriorating. He seems to encounter a lot of resistance. The fellow is trouble shooting the problem and explains verbally what he is trying to do.*

*F: It is weird because there seems to be a good blood flow.*
*R: Maybe there is a clot?*
*F: The resistance is before the 25 cm mark and we are well past the cephalic vein. The fellow tries three more times, unsuccessfully.*
After deciding to abandon the line insertion on that side, the group concludes that the other large catheter present at the same site may have impeded their line insertion. [C1_0111_3]

In summary, differences observed between multidisciplinary rounds and acute care episodes in terms of priorities, prior knowledge of the patient, and public displays of the interactions created different contexts for which different strategies of integration of learning interactions into clinical activities were more or less possible. Time-pressure was obviously a determining factor in terms of priority setting and ability to integrate learning interactions into clinical activities. However, other factors such as a supervisor's level of understanding of a clinical situation and of the consequences of medical decisions, as well as the number of individuals involved in the exchanges, ultimately affected the structure of the learning interactions between supervisors and trainees.

**Complementary Educational Potential and Challenges**

Both the clinical context and the strategies used by our participants to integrate learning interactions into clinical activities had educational implications for the trainees. Three dimensions of the typical learning interactions encountered in each of these models were considered: explicitness and generalizability of the learning content, relevance for the trainees, emphasis on trainees' knowledge gaps and their consequences.

**Explicitness and Generalizability of the Learning Content**

During multidisciplinary rounds, the lack of clinical urgency allowed lengthier exchanges among participants about a specific topic. Therefore, supervisors had more time to make the meaning of specific aspects of care explicit. The content of the learning bubbles was not necessarily limited
to the issues arising from the care of the current patient, and frequently involved exchanges regarding the relevance of these issues in a broader clinical context.

A patient with a white blood count in the 60's [very high] and a query of Clostridium difficile colitis is discussed on rounds.

S: What would cause a WBC that high?
R: ...
F: I would always think of a differential diagnosis with a WBC that high. Other than C. diff - because if the increased WBC is associated with any abdominal symptoms, it is C. diff as proven otherwise - but what else could it be? Which other tests would you do?
R: Some hematological problem.
F: Anything else infectious?
R: ...
F: I always think about deep seeded abdominal infections like liver abscesses or a perforated viscus... And also a patient with abnormal spleen function or asplenism. Which test would help with that diagnosis?
R: Platelet level?
F: Yes... a blood smear to see Howell-Jolly bodies! [C2_0412_4]

In contrast, during critical episodes of care, learning interactions were closely related to a specific patient and appeared of immediate relevance for patient care. However, how to apply this learning content to other clinical contexts was generally not openly discussed. Time was usually lacking for the supervisors to engage in a structured exchange with the trainees on a given topic or to be explicit about the meaning of every aspect of their clinical reasoning and management.

The fellow and the resident are assessing a new patient in the Emergency Room with a low blood pressure.
F: Did they [the Emergency team] finish giving the blood?
R: No, they stopped halfway through.
F: They must be wondering if something went wrong halfway through the blood transfusion. The point I am trying to make is that he is unwell and he has neutropenia and an infection. He will not feel better right away. Maybe his pressure dropped from his infection.
R: The emergency physician thought perhaps a pulmonary embolism or an aortic dissection.
F: We should also be thinking of shock, his last lactate was 3. He has minimal urine output, and now that he is on levophed, his mental status has improved. The
history is a bit unclear. He also has a headache and is unwell. If he is in shock, he will have decreased LOC and decreased urine output.

[The diagnosis of shock does not exclude the diagnoses of pulmonary embolism or aortic dissection, but as a manifestation of these conditions, would affect the urgency of their management. Such relationships were not explained to the resident, who may conclude from the fellow's explanation that shock is the diagnosis instead of the other two conditions.] [C1_0511_1]

Learning bubbles and learning flashes also differed in terms of relevance for the trainees.

**Relevance for the Trainees**

Learning bubbles could be tailored to trainees' needs when the learning interactions uncovered trainees' knowledge gaps.

An ICU patient on chronic hemodialysis is ready for the ward. On rounds, the nurse mentions that the Nephrology consultant has suggested transfusing a unit of blood for a hemoglobin at 79 and recent signs of cardiac ischemia.

*S (to the R): What do you want to do with the hemoglobin? I am not sure about the transfusion of one unit of blood... even if there was cardiac ischemia... there was no active change on the EKG...*

*R: So more than one unit?? [The staff is smiling and some residents are laughing because the resident's answer was opposite to what the staff was implying earlier.]*

*S: No, no unit at all! [still smiling]*

The fellow introduces the topic of the TRICC trial (a study on transfusion in the ICU).

*F (to the Rs): So what do you think it showed?*

*R: No effect?*

*F: Right.*

*A lengthy discussion follows on the risks of unnecessary transfusions.*

[C2_0412_4]

On the other hand, as illustrated by the previous examples of learning flashes, unless trainees' knowledge gaps were inadvertently uncovered by their involvement in clinical activities, learning interactions during critical episodes were triggered mostly by issues emerging from the medical situation. These interactions were therefore not necessarily adapted to the learner's needs, especially if the supervisors were not familiar with the trainees.
Emphasis on Trainee's Knowledge Gaps

The public display of the learning interactions that occurred during multidisciplinary rounds could create discomfort for trainees whose knowledge gaps were exposed. Furthermore, learning interactions around decisions or actions that had been implemented before rounds and had led to negative consequences for the patient could further increase the public embarrassment experienced by the trainees.

On rounds, the team discusses a patient with intra-abdominal sepsis that has only positive cultures for fungus in the abdominal fluid. He has on-going fever, but has been off vasopressors for the last 24 hours. The resident believes that the patient is still hypovolemic and fluid responsive.

S: So what was the rationale of giving Lasix this morning?
R: I don't know. I didn't order it.
F: I did give the Lasix, because he's very swollen and was getting albumin.
[The staff is frowning and slowly shaking his head.]
S: Ok, so where do you want your fluid balance today?
F to the R: What do you think?
R: I still don't think that he's passed the septic phase. I would still aim for a positive balance.

Everyone agrees (nodding heads) including the staff and the fellow. [C2_0311_2b]

Although the trainees involved in such interactions did not openly verbalize any negative feelings when asked afterwards, the researchers perceived awkwardness in certain exchanges of this type observed during multidisciplinary rounds.

By contrast, when trainees' knowledge gaps did become obvious to the clinical supervisor during an acute care episode, they were not exposed in front of the complete ICU team. The general uncertainty that predominated during these episodes also appeared to mitigate trainees'
discomfort with providing "wrong" answers, especially when senior physicians weren't sure themselves about what to do. Furthermore, clinical decisions and actions were discussed with the trainees in real-time, before their implementation. If the trainee suggested a strategy that could have been harmful to the patient, negative consequences could be prevented by an immediate correction from the supervising physician.

The fellow and the resident are reviewing with the staff physician a newly admitted ICU patient. The fellow now suspects a diagnosis of serotonin syndrome. He updates the staff physician about the need for a CT scan of the chest and sinuses and an OGD to rule out a flare of a previously known diagnosis of ANCA vasculitis.

The fellow suggests intubating the patient before proceeding with these other investigations. He gave a dose of Ativan to the patient and noticed that her heart rate came down.

S: I agree. Benzo, benzo, benzo. I will also want a Foley, an arterial line, and a call to Poison Control about an antidote. I would also put an esophageal probe to get the exact temperature.

The team is getting ready to intubate.

S to F: What are you giving [for sedation]?
F: Fentanyl and propofol. No succinylcholine.
S: Yes. I wouldn’t use that. (smiling)
F to R: I'll give the meds and you intubate. You've done one direct laryngoscopy before?
R: Yes.
F: So the most important is the approach to the tongue.
He's showing with the laryngoscope the proper technique and then reviews the material and anatomy.
F to R: I will give you 2 attempts and then I will do it. But I will show you what I see.
The fellow orders incremental doses of sedation but the patient is still biting.

The resident attempts to intubate twice but can't get a proper view. The fellow proceeds with the intubation.

Afterwards, the resident asks: Shall we give more fluids?
F: The blood pressure is normal. She's getting blood. We'll see.

Later...
S: She'll need a lot of fluids...
F: But she will need to be dialyzed...
S: We'll need to dialyze again by tomorrow I think.

The fellow calls the GI team who doesn't think that doing an OGD will help with the diagnosis of vasculitis.
S: I thought they could tell based on the aspect of the lesion... [C2_0512_1]

In such critical context, the feedback received by the trainees fit into the flow of the activities required to resolve the clinical situation.
Considered in isolation, many educational interactions occurring during multidisciplinary rounds and during acute care episodes could be considered problematic in terms of learning. However, when considering the larger learning experience of trainees, both contexts appeared to provide them with complementary learning opportunities.

DISCUSSION

The ability of clinical supervisors to create learning opportunities during acute care activities has not been fully explored (2). This study's objective was to identify and compare practical ways by which clinicians integrate learning interactions into patient care during multidisciplinary rounds and acute care episodes in the critical care environment. Two models of integration emerged from our data: patient care and teaching were usually done in series during multidisciplinary rounds and in parallel during critical events (Table 10.1). These models correspond to stereotyped bundles of learning interactions occurring in different clinical situations. We recognize that every learning interaction did not necessarily fit in these models, and that each model could at times be observed in atypical clinical situations (e.g. a learning bubble during an acute care episode). However, the two models described generally appeared to represent adaptive ways of dealing with the different contextual constraints posed by multidisciplinary rounds and critical episodes of care.

Other authors have described various types of cognition and learning based on the time available during clinical activities (7, 8, 15). Eraut has referred to reactive learning and deliberative learning to describe, respectively, the recognition of emerging learning opportunities when time is limited and the structured reflection upon work-based experiences when time is available (8).
Hoffman has similarly identified different patterns of learning (just-in-time vs. self-reflective learning) based on different clinical contexts(7). The processes of reflection-in-action (thinking while doing) and reflection-on-action (thinking after doing) and the associated types of learning described by Schön also reflect the notion that cognition and learning differ based on the time available to act(15). However, our results illustrate that time was not the only contextual factor affecting the types of learning interactions observed during different clinical activities. The socially pre-established priority of goals during each activity, the ability of the supervisor to make sense ahead of time or in real-time of a clinical situation, and the public display of the interactions affected supervisors' ways of integrating learning interactions into clinical activities. Furthermore, our results illustrated how different clinical contexts and models of integration potentially had different educational consequences.

The *in series* model reflected the ability of our participants to focus equally on patient care and learning, and included the benefits of having some understanding of a clinical situation prior to the relevant learning interactions. These conditions allowed more elaborate and structured exchanges between participants: *learning bubbles*. The content of learning bubbles was usually explicit, could potentially be applied to future clinical encounters, and could be tailored to specific trainees. Irby has described a similar concept following the interview and observation of rounds of six general internal medicine attending physicians(16). He identified a time-efficient teaching strategy used by his participants named *teaching scripts*: a series of memorized collections of 3-5 teaching points with supporting material and an understanding of the usual sources of learners' misunderstanding(10). Some of the learning bubbles observed in the critical care environment presented the characteristics of teaching scripts. Others appeared to have been created in the moment and may never be used again. Our data also revealed that by putting
learner's knowledge gaps and their consequence at the center of public attention, multidisciplinary rounds sometimes created a learning environment that appeared uncomfortable for the trainees. Such potential negative educational consequences should be further explored.

In contrast, the *in parallel* model of integration of learning interactions was adapted to the uncertain and dynamic circumstances of critical events during which patient care had to be prioritized over learning. This model allowed clinicians to keep track of the patient condition and still be engaged in learning interactions closely related to patient care. During critical episodes of care, learning interactions were a by-product of patient care activities, and trainees' knowledge gaps could be addressed without negative consequences for the patients. However, the content of the multiple short learning flashes that characterized the *in parallel model* of integration was not structured as a coherent whole and left many aspects of a clinical encounter unexplained. Furthermore, the generalizability of the content of these learning interactions to other clinical situations was usually not made obvious for the trainees.

Accordingly, we would argue that the two strategies used by our participants to integrate learning interactions into routine and critical episodes of care should be equally valued to ensure that learning interactions are maintained regardless of the clinical circumstance. When a trainee’s educational experience is considered as a whole, the relevance of both strategies becomes obvious: the shortcomings of the learning flashes intensively situated in particular clinical events can be overcome by the broader view provided by the learning bubbles created on rounds (or during other routine clinical activities surrounding acute crises), while the alignment of participants' understanding of a given situation may be easier to negotiate in the context of the general uncertainty prevailing during critical episodes of care.
CONCLUSIONS

Our study illustrates that learning interactions can be integrated within many kinds of clinical activities, including the most time-sensitive and mentally demanding ones. However, the differences between such learning interactions and the ones that take place in more structured clinical situations need to be recognized and better understood by medical educators and by clinical supervisors. Further work is needed to demonstrate our ability to teach different models of integration to clinical supervisors and to measure the learning impact of such interventions. The same way optimal patient care depends on a series of interdependent and complementary clinical activities, effective and efficient clinical learning within a clinical environment will depend on the appropriate integration of complementary educational interactions within a broad range of clinical activities characteristic of that environment.
Figure 10.1: Models of integration of learning interactions within clinical activities
Table 10.1: Models of integration of learning interactions within clinical activities: clinical context, structure of learning interactions, and educational implications

<table>
<thead>
<tr>
<th>Model of Integration</th>
<th>Clinical Context</th>
<th>Structure of Learning Interactions</th>
<th>Educational Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Series</td>
<td>Patient care and learning equally prioritized</td>
<td>Learning Bubbles</td>
<td>Explicit learning content repositioned in a more general context</td>
</tr>
<tr>
<td></td>
<td>Pre-constructed, retrospective view on clinical events</td>
<td>Long duration</td>
<td>Opportunity to tailor interactions to trainees' needs</td>
</tr>
<tr>
<td></td>
<td>Public interactions</td>
<td>Mostly structured and explicit content</td>
<td>Public display and attention on knowledge gaps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not necessarily directly related to the clinical case</td>
<td></td>
</tr>
<tr>
<td>In Parallel</td>
<td>Patient care prioritized</td>
<td>Learning Flashes</td>
<td>Learning content left implicit, but highly relevant to the clinical case</td>
</tr>
<tr>
<td></td>
<td>Co-constructed, prospective view on clinical events</td>
<td>Short duration</td>
<td>Limited opportunity to tailor interactions to trainees' needs</td>
</tr>
<tr>
<td></td>
<td>Behind-the-scene interactions</td>
<td>Unstructured and only partially explicit content</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intimately related to the clinical case</td>
<td>Knowledge gaps incidentally exposed and not emphasized during interactions</td>
</tr>
</tbody>
</table>
REFERENCES


Chapter 11
Discussion

11 Introduction

This program of research was initiated with three general objectives in mind: to study the effects of the level of clinical supervision on patient care and trainee learning during acute care episodes, to explore the learning opportunities emerging from the clinical activities performed in acute care environments, and to better understand the tensions between patient care and learning experienced by the medical trainees and the clinical supervisors working in acute care environments. These general areas of interest stemmed from my personal experiences as a past medical trainee, and as a current clinical physician, clinical supervisor, and medical educator. Furthermore, such areas had been relatively unexplored in the literature. A lack of empirical grounding to many of the theories and recommendations regarding clinical supervision and clinical learning indicated a need for more naturalistic studies, particularly in the acute care setting. The findings emerging for this program of research have contributed to a better understanding of the process of clinical supervision in the acute care setting in a way that could lead to an improvement in clinical learning.

In the first section of this chapter, I will put into perspective the findings of the observational study in relationship to the conclusions drawn from the simulation-based study. I will then summarize the findings of the observational study. Next, I will discuss the combined theoretical and practical implications resulting from the conclusions of these two studies. I will end this chapter with personal reflections about the methodological issues encountered during this program of research and the future directions of this research endeavor.

11.1 Summary Of The Findings

11.1.1 Relationship Between the Simulation and Observational Studies

I have summarized, in Chapter 7, the results of the simulation study focused on the level of clinical supervision. The quantitative results indicated that direct clinical supervision (supervisor
present at the bedside) did not negatively affect trainees' learning. Direct supervision limited the number of tasks completed independently by the trainees, but provided opportunities for observing more comprehensive care. The qualitative arm of the simulation study explored, in more depth, how the level of clinical supervision influenced the learning processes involved in the clinical activities occurring during acute resuscitation scenarios. Numerous learning opportunities were identified during both distant and directly supervised scenarios, but they differed in their nature. Distant supervision was associated with numerous incidental opportunities for practice, but created engineered opportunities for observation and feedback. Direct supervision also provided incidental opportunities for practice. However, their nature could be altered by the supervisors (opportunities to practice certain types of clinical tasks). In addition, direct supervision provided incidental opportunities for observation and feedback, as well as opportunities for practice specifically created by the interactions between trainees and supervisors (engineered practice). Beyond the trainees' and supervisors' direct involvement in patient care (respectively opportunities for practice and observation), the interactions among the supervisors and the trainees led to many learning opportunities during the simulated scenarios.

This latest finding constituted the starting point for the subsequent observational study. The learning-directed interactions among supervisors and trainees became the focus of observations in real clinical environments. Because patient care appeared to benefit from direct supervision in our simulation study and in the literature, most of the observations in real acute clinical environments occurred when the supervisors were immediately available or continuously present at the bedside. During the observational study, particular attention was also paid to the contextual factors at play during the learning-directed interactions among our participants. Such factors could not be explored in the simulation setting given its limitations in faithfully representing the complexity of dynamic clinical environments.

11.1.2 Summary Of The Findings Of the Observational Study

The observational study focused on the learning interactions among supervisors and trainees. A review of the literature on clinical supervision and the results of the simulation study led me to question the relationships between the bedside presence of a supervisor, the learning-directed interactions, and the trainees' involvement in patient care. More specifically, I was interested in
the following questions: what do those learning-directed interactions look like during real supervisory practices, what do they do, which kind of learning opportunities do they create, how do these interactions influence trainees involvement in patient care, and how do supervisors maintain optimal care to the patients while allowing trainees to be involved in patient care? I partially addressed these questions in Chapter 8.

Chapter 8 introduces a model of interactive clinical supervision based on different types of learning interactions among supervisors and trainees during acute care episodes. This model proposes that by consistently engaging in these different types of learning interactions, supervisors and trainees can facilitate both progressive trainee involvement in patient care and safe and timely care delivery. Together, supervisors and trainees engaged in monologues and dialogues about patient care, and in hands-off and hands-on provision of care. Furthermore, supervisors provided support-in-action and feedback-on-action in response to trainees' contributions to patient care. The supervisors usually initiated the learning-directed interactions, but the trainees were not passive players during acute care episodes. Their own initiatives in contributing to patient care also influenced the nature of their interactions with the supervisors. These spontaneous contributions made by the trainees also appeared to provide supervisors with a useful way to gauge which supervisory behaviors could maximize trainees' involvement in patient care and be sufficient to ensure patient safety. The theoretical and practical implications of these findings will be further discussed in the sections below.

While focusing on the learning interactions as part of the supervisory process, it became obvious that the occurrence of these interactions varied considerably across episodes of care and across participants. Learning interactions among supervisors and trainees did not occur in a vacuum, and complex, dynamic individual and contextual elements were likely related to this variability. The early periods of observations and analyses of our observational study revealed that the transitions between the interactions directly related to the care of a patient and those directed towards learning were very informative, especially in better understanding how acute care physicians negotiated a balance between patient care and learning. Shifting to learning therefore became the social process under scrutiny during the second part of the observational study.
Chapter 9 discussed how different factors, within an acute episode of care, interacted dynamically to create circumstances more or less favorable for the shifts to learning. Clinical cases that presented, by their nature, multiple triggers for shifting to learning (e.g. clinical problem to be resolved, the rare and unusual, discrepancies between clinical events and expectations, physical tasks and visual cues, and questions or divergence of opinions from other healthcare professionals), also frequently posed multiples challenges (clinical uncertainty, unexpected changes in patient's condition, caring simultaneously for multiple patients, interacting with other clinicians). As a result, "good clinical cases" did not always lead to shifts to learning. In addition, other individual or contextual factors unrelated to the clinical case appeared respectively to favor (trainee's gaps, perceived individual responsibility towards learning) or prevent (time labeling, rapid turn-over of the participants in the ICU) the shifts to learning. Despite these challenges, our participants employed multiple strategies to shift to learning in seemingly unfavorable circumstances: tweaking a routine case, turning hindrances related to patient care into triggers, flagging a trigger and postponing a shift, re-labeling time. The participants had therefore the power to modify and overcome some of these clinical and contextual challenges and to contribute to the creation of learning momentum.

Chapter 10 discussed a theoretical account of different ways to integrate learning and patient care during acute care episodes compared to multidisciplinary rounds. During multidisciplinary rounds, patient care and learning were addressed in series, with structured and focused learning bubbles interrupting patient care. During acute care episodes, participants stayed simultaneously involved in patient care and learning (in parallel model). Learning flashes were interspersed in clinical activities. When considering the contextual elements of these clinical situations that appeared to differ, three factors (priorities, supervisor's construction of meaning of a case, and public display of the interactions) were perceived as related to the use of a model over the other. The participants' strategies for integrating learning and patient care appeared adaptive to these factors. The two models of integration of learning and patient care generated different kinds of learning opportunities for the trainees, with specific strengths and limitations in terms of explicitness and generalizability of the learning content, relevance for the trainees, and emphasis on trainee's gaps. The results of these three successive phases of observational data collection and analysis are summarized in Table 11.1.
Table 11.1: Summary of the findings of the observational study

<table>
<thead>
<tr>
<th>Questions Addressed</th>
<th>Chapter 8</th>
<th>Chapter 9</th>
<th>Chapter 10</th>
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<tbody>
<tr>
<td>What are the types of learning interactions among supervisors and trainees emerging from clinical activities during acute care episodes?</td>
<td>Learning-directed interactions as part of the process of clinical supervision</td>
<td>Why certain acute episodes of care lead to numerous learning-directed interactions whereas others do not?</td>
<td>How can supervisors integrate learning and patient care in real time?</td>
</tr>
<tr>
<td>How does supervisor bedside presence influence trainee involvement in patient care and learning?</td>
<td>Level of trainee involvement in patient care</td>
<td>Which type(s) of interventions could potentially be implemented to facilitate the shifts to learning during clinical activities?</td>
<td>Are there some clinical situations more favorable to learning interactions than others?</td>
</tr>
<tr>
<td>How do supervisors escalate and de-escalate supervision?</td>
<td>The variability in the occurrence of the shifts to learning and the factors related to this variability</td>
<td>Integrating learning and caring - importance of clinical context &amp; consequences on learning</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Focus of the paper</th>
<th>Main themes</th>
<th>Main arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning-directed interactions as part of the process of clinical supervision</td>
<td>Engaging Without Risk</td>
<td>Supervisors can establish different levels of trainee involvement in patient care through consistent learning interactions.</td>
</tr>
<tr>
<td>Level of trainee involvement in patient care</td>
<td>Sharing Care, Minimizing Risk</td>
<td>Trainee involvement in patient care allows supervisors to adapt their supervisory behaviors to optimize learning and patient care.</td>
</tr>
<tr>
<td></td>
<td>Revisiting the Care Provided by the Trainee</td>
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<td></td>
<td>Model of Interactive Clinical Supervision</td>
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<td></td>
<td>Best Cases, Worst Scenarios</td>
<td>No clinical case is the &quot;perfect&quot; teaching case, and all clinical cases present educational potential.</td>
</tr>
<tr>
<td></td>
<td>Beyond the Clinical Case: The Participants and the Clinical Environment</td>
<td>The clinical case, the participants, and the clinical environment dynamically interact to influence the shifts to learning.</td>
</tr>
<tr>
<td></td>
<td>The Power to Change</td>
<td>These conditions can be actively modified by the participants: initiating a shift to learning frequently leads to more shifts to learning.</td>
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<tr>
<td></td>
<td>Creating a learning momentum</td>
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<tr>
<td></td>
<td></td>
<td>Different ways to balance learning and patient care are adaptive to different contexts and lead to different consequences.</td>
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<tr>
<td></td>
<td></td>
<td>Both models of integration may be useful for the trainees, and could be taught to supervisors.</td>
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The next two sections will present an integration of the results from the simulation and the observational study. The following section focuses on the theoretical contributions of this work, and the subsequent section presents practical implications related to our findings.

11.2 Theoretical Contributions

This section will present the contributions of this work to the current understanding of the multifaceted relationship between clinical supervision and clinical learning. I will summarize my own understanding of the clinical learning opportunities emerging from the process of clinical supervision (in the acute clinical setting). I will also discuss how these views relate to the different learning theories presented in Chapter 3. Figure 11.1 to 11.4 provide a visual summary of the qualitative results of this program of research.

11.2.1 Views On Clinical Learning As a Result of Clinical Supervision

The results of the two studies in this program of research illustrate four important particularities of the learning opportunities resulting from clinical supervision. First, the type of learning opportunities resulting from supervision in the clinical environment appeared to rely heavily on an interactive process among the supervisors, the trainees, and the clinical environment. Supervisors, trainees, and clinical environment were mutually and reciprocally active: they reacted and adapted to each other, and influenced each other. Numerous findings from our studies supported this conclusion. The simulation and the observational studies illustrated the shared responsibility of the supervisor and the trainee for engaging in patient care and in learning interactions. Both could initiate discussions and actions contributing to the care of a patient and to learning; both responded and adapted to each other's initiatives. As detailed in Chapter 8, supervisors could engage in a monologue about patient care or facilitate hands-off care delivery from the trainees, but trainees could also initiate a dialogue about patient care by asking a question and could spontaneously contribute to patient care. These initiatives could become objects of support or feedback by the supervisors. In addition, Chapter 9 illustrated how both supervisors and trainees could affect the conditions favoring or impeding the shifts to learning. Both trainees and supervisors experienced the consequences of each other's actions. For
example, in Chapter 10, I discussed how the strategies used by the supervisors to balance patient care and learning in different clinical situations could affect trainee's type of learning opportunities.

A second characteristic of clinical learning during supervision emerged from the study findings: **learning and patient care overlapped at times, but were, at other times, distinct activities that competed for participants' time and attention.** This conclusion was well illustrated by the qualitative findings of the simulation-based study. The incidental opportunities for practice, observation, and feedback provided by the clinical activities completed during the resuscitation scenarios were intertwined and consistent with the natural process of care delivery. These learning opportunities emerged from the clinical activities, and appeared to require little efforts from the participants. However, creating learning opportunities in other clinical scenarios appeared more challenging for the participants (engineered learning opportunities): the natural flow of the clinical activities needed to be modified or interrupted to accommodate learning. In addition, during the observational study, shifts from patient care-related interactions to learning-related interactions could be identified, showing that all interactions were not initiated with the intention to equally contribute to patient care and to trainee's learning. The divide between performance (optimizing patient's condition) and learning (optimizing trainee's understanding and management of patient conditions) was visible in many acute care episodes. A distinction between conditions related to the nature of the clinical case that facilitated learning and those that potentially impeded learning could also be made (Chapter 9); clinical activities did not always lead to the creation of visible learning opportunities. Furthermore, distinct types of clinical activities had different priorities, which resulted in different ways of integrating learning and patient care, with different educational consequences for the trainees (Chapter 10).

When patient care and learning did not overlap, clinical supervisors and trainees had to invest more efforts to create learning opportunities during clinical activities. The idea that **learning is possible but demanding in certain clinical situations** was illustrated by our model of interactive clinical supervision (Chapter 8). When one of the participants was uneventfully delivering unilateral care to the patient, the lack of supervisor-trainee interactions required for patient care appeared to obscure the utility of engaging in learning interactions. Supervisors and trainees' motivation to use every clinical encounter as material for learning appeared important to
maintain a balance between learning and patient care. Similarly, a *perceived individual responsibility for learning* was described in Chapter 9 as a factor facilitating the shifts to learning in conditions unfavorable for learning. Such responsibility was seen as one of the motors of participants' efforts to use strategies to overcome these unfavorable conditions.

Our findings also illustrated that **many types of contexts matter for clinical learning.** Learning opportunities took different forms in the course of our two studies, and appeared to change according to the circumstances. For example, the same scenarios completed under different levels of clinical supervision during the simulated study provided different types of learning opportunities for the trainees. Therefore, the level of clinical supervision could be considered a contextual factor affecting clinical learning. Chapter 9 and 10 further illustrated that learning should be understood in specific socio-cultural environments, but also in specific clinical situations within these environments. The ability of our participants to shift to learning appeared to depend on factors related to the specifics of a case, but also to broader contextual issues related to the culture of an institution or health care system (e.g. *perceived individual responsibility for learning* or *time labeling* in Chapter 9). However, similar socio-cultural environments could also lead to differences in the type of learning interactions encountered depending on the types of clinical situations experienced (Chapter 10: *learning bubbles* vs. *learning flashes*). Accordingly, the planning of studies and interventions related to clinical learning should take into account these different types of contexts.

Figure 11.1 illustrates the clinical environment as a context where both patient care and learning opportunities result from the interactions between supervisors and trainees. Figures 11.2, 11.3, and 11.4 represent how different parts of this program of research contributed to the understanding of the complex, multifaceted relationships between the different roles played by the supervisors, the trainees, and the clinical environment during clinical activities in the acute clinical setting.
Figure 11.1: Providing patient care and engaging in learning in the acute care environment.

Supervising in the acute clinical setting involves facilitating trainee's learning and managing patient risks. These activities can overlap or be distinct. Learning in the clinical environment involves contributing to patient care and engaging in learning interactions. These activities can overlap or be distinct. Both care delivery and learning emerged from the interactions between supervisors and trainees. Providing patient care and interacting towards learning also depend on other contextual factors that may affect supervisor-trainee interactions. When care delivery and learning are distinct, shifting to learning allow supervisors and trainees to re-focus their interactions on learning.
Figure 11.2: Different types of learning opportunities in the acute clinical setting created by the interactions between supervisors, trainees, and the clinical environment.

Provisions of care by the supervisor and by the trainee respectively create opportunities for observation and practice for the trainees. Trainee's contributions to patient care and to learning interactions also provide opportunities for feedback. Learning opportunities can vary according to the clinical circumstances (e.g. level of supervision). Supervisors can facilitate learning by engaging in learning interactions that facilitate trainee's contributions to patient care. Trainees' contributions to patient care or to the learning interactions can become the object of further learning interactions and allow supervisors to tailor their level of clinical supervision. (see text Chapter 6 and 8)
Figure 11.3 Conditions affecting the ability of supervisors and trainees to shift to learning.

Factors related to the clinical case, broader socio-cultural context, individual supervisor, and individual trainee influence the shift to learning. Shifting to learning itself can modify the circumstances of the interaction between the supervisor, the trainee, and the clinical environment, leading to further shifts to learning. (see text Chapter 9)
Figure 11.4: Integrating patient care and learning during multi-disciplinary rounds and acute care episodes.

When patient care and learning do not overlap, supervisors need to balance the two types of activities in real time to assume their dual functions of facilitating learning and managing patient risks. This balancing act differs according to the clinical situation. (see text Chapter 10)

11.2.2 Contributions to Learning Theories

This program of research focused on the interactions between the supervisors and the trainees, as well as on supervisors and trainees' involvement in clinical activities as a source of learning. This approach relates to many learning theories presented in Chapter 3, including social cognitive learning theory, experiential learning theories, socio-cultural learning theories, and theoretical frameworks of workplace learning. In order to locate this work within these multiple learning theories, I will briefly discuss the commonalities and discrepancies between my theoretical account of clinical learning and these learning theories.
11.2.2.1 Social Cognitive Learning Theory

Bandura presented modeling and enacting as the two mechanisms involved in social learning(1). The study findings revealed that this division could represent an oversimplification of the learning process. The observation of the supervisors' behaviors by the trainees (vicarious learning) could occur with or without visible involvement of the trainees: supervisors delivered care independently while being observed by the trainees, delivered care independently while commenting about patient care for the trainees (monologues about patient care described in Chapter 8), or delivered care with abstract or concrete contributions to patient care from the trainees. Supervisors also provided different levels of monitoring, support, and feedback when trainees directly contributed to patient care. Although I also believe in establishing a divide between learning opportunities that do and do not involve trainees' direct contributions to the care of a specific patient, both the observation and enactment of care delivery by the trainees took many forms in our studies. Recognizing different forms of observation and enactment was valuable in understanding how supervisors could maximize trainee learning according to their level of clinical involvement, and how supervisors could ensure patient safety while fostering an optimal level of trainee involvement in patient care.

My findings also relate to Bandura's notion of personal agency, goals, and outcome expectations(1). Factors related to individual participants (supervisors and trainees) appeared related to the occurrence of the shifts to learning in certain clinical circumstances (Chapter 9). Our observational study was not designed to explore the motivations and individual goals or expectations of our participants. However, the fact that many shifts to learning occurred during clinical encounters that appeared unfavorable to learning (e.g. see the power to change in Chapter 9) suggested, in my opinion, that learning interactions were valued by the participants. As a result, I believe that shifting to learning met some of the participants' expectations, encouraging them to engage further in learning interactions (as seen in case of learning momentum in Chapter 9).

11.2.2.2 Experiential Learning Theories

Experiential learning theories focus on how meaning is created from experience(2). The role of reflection in experiential learning theory has been predominant(3). This program of research was
not designed to explore the role of reflection in learning. Trainees were not specifically asked about their thought process during the simulated or naturalistic clinical encounters. However, ways by which clinical experiences in the acute care setting (i.e. interactions with the clinical environment and with clinical supervisors) could contribute to trainee's construction of meaning were explored. The types of interactions, socio-cultural conditions, and clinical circumstances that influenced the visible co-construction of meaning by the supervisors and the trainees were also described.

Schön's concepts of knowing-in-action, reflection-in-action, and reflection-on-action also echoed our findings(4). I observed supervisors' verbalization of their reasoning process (see section on monologues about patient care in Chapter 8), which appeared similar to the reflection-in-action described by Schön. Such verbalization became accessible to the trainees and could contribute to their construction of meaning. However, I perceived difficulties on the part of the supervisors to engage in learning-directed interactions when their knowing-in-action failed (see section on clinical uncertainty in Chapter 9). For example, Chapter 10 addressed the act of integrating patient care and learning by the supervisors. These findings illustrated that when knowing-in-action was problematic for the supervisors (e.g. when facing a medical crisis rather than a structured patient review on multidisciplinary rounds), their immediate ability to shift to learning may have been limited. Engaging in structured learning interactions appeared easier for the supervisors when knowing and/or reflecting had already occurred in their mind.

Different ways to engage trainees in clinical activities were described in Chapter 8. Schön had similarly described different modes of coaching (follow me, joint experimentation, and hall of mirror) in professional workplaces(5). The first two modes of coaching (follow me and joint experimentation) relate to the vicarious and enactment types of learning described by Bandura, and were relevant for the clinical activities observed in our studies. However, the professionals observed by Schön (none of whom were health care professionals) did not have to balance learning with patient safety. The results of this program of research presented the broader roles of the clinical supervisor in supporting, but also responding to trainee involvement in patient care in a manner that do not compromise the quality of care.
11.2.2.3 Socio-Cultural Theories

As detailed in Chapter 3, socio-cultural theories of learning share common characteristics including a focus on the tight connections between learning and social activities in socio-cultural contexts(6). I conducted a high-fidelity simulation study and an observational study with the intent of observing naturalistic clinical activities and exploring how the acute clinical context influences clinical learning. The concepts of situated learning(7) and cognitive apprenticeship(8) informed my understanding and interpretation of the data. However, the findings also contrasted with socio-cultural theories at multiple levels.

As mentioned earlier, the provision of care and learning during clinical encounters are two distinct social activities that sometimes overlap in time and place, while at other times are completed separately. The situated learning theory described by Lave and Wenger(7) considers participation in social activities and learning as equivalent. Although I did not formally assess learning in the observational study, I did observe that all clinical encounters, including those that involved trainees in the care of patients, were not equal in terms of learning opportunities. Some acute care episodes did not lead to any learning interactions among supervisors and trainees, or led to interactions that were more or less adapted to a specific trainee. Therefore, to say that allowing trainees to participate in clinical activities will automatically lead to learning seems like an oversimplification. Indeed, Wenger subsequently specified that although any participation in the activities shared by a community of practice results in learning, the nature of what is learned can vary greatly(9). Accessing an acute clinical practice may have provided trainees with learning opportunities that were not visible to the external observers (e.g. vicarious observation, opportunities for reflection and self-monitoring, etc.). However, engaging in learning interactions enabled clinical supervisors to create different types of learning opportunities; such engagement required time and cognitive resource that were then not available for patient care, a fact also recognized by Wenger(9).

I also attempted to provide a more nuanced account of the concept of participation than the one described in the literature. When participation is defined as a negotiation of meaning of a clinical encounter rather than used to establish a theoretical distinction between modeling/observing and doing/acting, then all forms of learning interactions described in Chapter 8 (e.g. monologue and
dialogues about patient care, hands-off and hands-on provision of care, support-in-action and feedback-on-action) count as forms of trainee participation. This view is consistent with the situated learning theory(7). However, a distinction between different forms of participation matters, in practice, for at least two reasons. For the supervisor, hands-on care delivery by the trainees involves potential risks for the patients that need to be managed. For the trainees, different forms of participation may achieve different educational goals more or less adapted to their specific needs.

Lave & Wenger also established a distinction between talking about and talking within as a mean to promote participation and/or a sign of integration to a community of practice(7). They considered talking within as the only way to involve trainees in social activities. I would argue however, that the monologues and dialogues about patient care described in Chapter 8 could promote learning. Even if these interactions related to broader issues than the specific care of a patient, they were still triggered by a concrete aspect of the clinical situation experienced by the participants (and maybe should be referred as talking about from within).

As mentioned previously in this chapter, the study findings also bring some nuances to the concept of context. Both Chapters 9 and 10 discussed how contextual factors relate to learning. Context can refer to the specifics of a clinical case (e.g., how unusual or challenging a case was for the participant), to the socio-cultural context of a type of clinical unit (e.g., how different types of clinical activities are usually scheduled during the day) or of a specific ICU (e.g., for how long do the trainees and supervisors rotate in an ICU), or to the characteristics of a type of clinical encounter (e.g., medical crises vs. routine rounds). Billet has similarly mentioned the difference between social-cultural and situational contexts(10). According to our results, context was related to learning at different levels. During a specific clinical encounter, trainees could learn the relationships between clinical information and management. Such relationships could hold true in similar clinical situations and be highlighted by the supervisors for the trainees. Furthermore, I observed that local and broader socio-cultural contexts influenced the occurrence of learning-directed interactions among supervisors and trainees. Finally, certain types of clinical contexts within acute care environments appeared more appropriate for certain types of learning-directed interactions.
Issues of identity construction and power were not specifically explored during this program of research. However, the data offered a few insights worthwhile of mention. For example, the construction of a new identity is an integral part of the learning process described in situated learning theory(7). I did not collect observational data to speak of this phenomenon, but I did observe a strong inclination on the part of the trainees to contribute to patient care whenever possible. This willingness to contribute to patient care may have been a manifestation of their desire to belong to the community of practice in which they were learning. Importantly, trainees' contributions also helped their supervisors to tailor their learning interactions and to adapt their level of supervision according to the trainee. Additionally, the notions of trust and power are believed to play an important role in the interactions occurring in learning environment(11). These factors were not a specific object of my attention during these studies but appeared to emanate from certain interactions. For example, the public display of the learning-directed interactions was interpreted as one of the contextual factors during multidisciplinary rounds that had consequences in terms of learning. Exposing one's own gaps in knowledge or committing mistakes in front of peers and other health care professionals appeared comfortable for the trainees only when a non-judgmental and open atmosphere was established prior or during the interactions. The fact that trainees were being assessed at the end of their rotation by those same supervisors who were meant to help their learning may have affected the trainees' ability to perceive such openness. These issues deserve further exploration in future studies.

11.2.2.4 Workplace Learning

Many workplace learning theories emerged from observational data in work environments. Not surprisingly, the results of this program of research relate to many concepts presented in this literature. Eraut has explored the concept of tacit knowledge and the potential challenges related to the learning of this kind of knowledge(12). For example, he pointed out that the communication between experienced and novice workers may be limited by the senior workers' inability to articulate things that they know unconsciously(13). On the contrary, I observed many supervisors verbalizing their thought process during routinized clinical activities. As indicated in the previous section however, supervisors appeared to struggle to engage in learning interactions when they encountered non-routine problems that required them to make sense of a situation on-the-spot. Some supervisors were then able to think aloud (see Chapter 9, section on Support in
Action), whereas others appeared to focus on patient care until they had made sense of a clinical situation.

Eraut’s description of reactive vs. deliberative non-formal learning (14) relates to the types of learning interactions (learning flashes vs. learning bubbles in Chapter 10) resulting from the strategies used by supervisors to integrate patient care and learning in different clinical situations (acute episodes of care vs. multidisciplinary rounds). The learning flashes could be considered a form of reactive non-formal learning, and the learning bubbles a form of deliberative non-formal learning. However, Eraut has not specifically explored if certain clinical situations could facilitate a specific type of non-formal learning for reasons other than the time available for learning. Our results showed that other contextual factors (e.g. prior knowledge of the patient) could contribute to the types of learning interactions emerging from specific types of clinical activities.

Eraut also distinguished between learning processes at work and spontaneous learning activities (13). He categorized the mechanisms of learning into questions, problem-solving, mistakes, and feedback (13). These general categories appear insufficiently informative to help supervisors and trainees to foster learning in the clinical environment. Working in an acute care setting involved a broad range of interactions with varying degrees of focus on learning. Chapter 8 presented a classification of the learning interactions based on the level of trainee involvement in patient care, and a description of different ways by which supervisors could facilitate progressive levels of involvement in patient care while maintaining a safe care delivery. Furthermore, how these interactions were integrated in specific clinical situations was also discussed in Chapter 10. I believe that such an approach is more informative for the future implementation of educational strategies in the acute clinical setting, as will be described in the following section.

11.3 Practical Contributions

In the first chapter of this dissertation, I explained how the changes that occurred in the health care system and medical education system have raised concerns regarding our ability to create learning opportunities during clinical activities and to maintain a balance between service and
education in the current clinical environment. By studying the supervisory practices in the acute care setting, I intended to further explore the kind of learning environment experienced by today's medical trainees. This section addresses concrete implications of these studies for the educators, supervisors, and trainees working in acute clinical environments. Some of these practical contributions resulted directly from my study conclusions, while others are potential consequences of my findings that deserve further exploration.

Based on the findings of this program of research, I conclude that, in the acute care setting where patients’ clinical conditions are often complex and potentially life threatening, a closer level of supervision is more likely to provide the best quality of care. These findings can be added to an increasing body of literature showing that closer supervision improves patient care (15).

Academic hospitals that continue to rely on junior trainees for the first-line delivery of care during off-hours (nighttime or weekends) in acute care environments should seriously consider modifying their organizational structure to ensure 24/7, in-hospital coverage of these clinical areas by very senior trainees or attending physicians. Such coverage is more likely to ensure a safe and timely care delivery.

The study results also indicated that direct supervision has the potential to create numerous learning opportunities for the trainees. However, many factors related to the clinical context or to the specificities of a case can interfere with participants' ability to engage in learning interactions. At times, for the supervisors to provide direct care to the patient can be the simplest or the quickest way to achieve a safe care delivery. The lack or limited number of learning interactions observed during certain episodes of care indicated that direct supervision presents the risk of limiting trainee involvement in patient care and learning opportunities. The model of interactive supervision described in Chapter 8 may therefore rest on supervisors' commitment to maximizing trainees' involvement in patient care during clinical activities, in accordance to the trainees' clinical abilities and to the clinical circumstances. By this, I mean selecting the type of learning interactions that involves the greatest level of trainee involvement and that is safe for the patient (e.g. engaging in dialogues about patient care instead of monologues about patient care whenever possible). Furthermore, supervisors' ability to build on trainees' contributions to patient care by providing support-in-action and feedback-on-action could ensure that trainees are not only performing clinical tasks, but are also continuously improving their clinical skills. In
addition, the study findings indicated that trainees' capacity to contribute to patient care to the
limit of their abilities helped supervisors to adjust their level of supervision and tailor their
teaching to trainees' needs. Both supervisors and trainees' commitment to learning may therefore
be required for direct supervision to represent a safe way to deliver care and a fruitful learning
experience for the trainees.

The second phase of the observational study revealed that multiple conditions more or less
favorable for shifting to learning interact in real clinical environment (Chapter 9). Such
conditions could represent important knowledge for the clinical supervisors and the trainees. By
recognizing, in real-time, common clinical triggers to a shift to learning (e.g. the rare and
unusual, discrepancies between clinical events and expectations, physical tasks or visual cues),
supervisors and learners could initiate more shifts to learning. Other conditions favoring the
shifts to learning, such as an individual perceived responsibility for learning, could also become
the focus of faculty-development program activities. Some of the conditions that hindered the
learning shifts were amenable to change, either in the moment of the clinical encounter or at an
organizational level. Supervisors and trainees' awareness of strategies used to modify these
conditions could contribute to re-focus certain clinical activities (e.g. sign-over between on call
and daytime teams) on learning. Other factors, such as the ability for the supervisors and trainees
to know each other, may require broader changes in the organization of the work schedules. For
example, supervisor-trainee interactions may benefit from a prolonged presence of the same
attending staff in the ICU (two weeks of clinical duty at a time instead of one week).

The last part of the observational study addressed the act of integrating patient care and learning
in specific types of clinical situations in the acute care environment (Chapter 10). These findings
illustrated that every learning interaction in the clinical environment was unlikely to fully fulfill
trainees' educational needs because supervisors had to negotiate challenging clinical
circumstances. However, multiple types of learning experiences over time could provide
complementary learning opportunities for the trainees (e.g. a series of acute care episodes and
multidisciplinary rounds). The learning interactions observed during acute care episodes
(learning flashes) appeared to represent a part of the spectrum of learning experiences
encountered by the trainees during their clinical rotations. When complemented by more
structured and explicit interactions (learning bubbles) at other times of the day, learning flashes
could contribute to trainees' learning in unique ways. If the learning benefits of these learning interactions are confirmed, the development of a curriculum in acute care environments should consider both types of learning opportunities, i.e. learning flashes and learning bubbles. Such a curriculum could ensure that the limitations of one type of learning opportunities are purposefully compensated by other types of learning opportunities occurring in different clinical circumstances (e.g. elaborating on the teaching points made during a medical crises during the following multidisciplinary round or hand-over).

In summary, this program of research adds to the literature on clinical supervision and on clinical learning in three important ways. First, the findings indicate that thinking narrowly in terms of the dual role of the clinical supervisor as an object of modeling and as a teacher is limiting. Conceptualizing the supervisor as a facilitator of trainees' involvement in patient care and as a promoter of trainees' reflection on their contributions to patient care helps us to think about integrating learning in every aspect of clinical activities. In addition, these findings allowed us to provide more than a list of behaviors to adopt to promote learning in the clinical environment. I conceptualized the learning interactions in terms of degree of trainee involvement in patient care. I did not provide a static model of clinical teaching strategies as offered by other authors. Many of those models attempt to control the unpredictability and changing nature of the clinical environment by imposing a format of interactions resembling formal types of teaching. I rather looked at different types of interaction focused on learning and at the adaptive integration of these learning interactions in specific clinical environments. Supervisors, in order to interact effectively, must not only understand how learning works, but also understand the context in which learning occurs, and how this context affects their ability to interact. Finally, I reinforced the fact that trainees were not passive agents during the learning-directed interactions. By assuming their roles and responsibilities towards learning during clinical activities, trainees could dramatically affect the learning benefits of their interactions with the supervisors.
11.4 Other Reflections

11.4.1 Methodological Issues

11.4.1.1 Common Criticisms of Mixed Methods Research

Mixed methods research has been criticized from many perspectives (16). The challenges related to the integration of two paradigms (e.g. positivist and constructivism) or the adherence to a new, evolving paradigm (e.g. pragmatism) to inform the mixed research process have been discussed in Chapter 4. Some authors have questioned the utility of this focus on paradigmatic issues in mixed methods research (17, 18). They suggested the use of a broader view of the concept of paradigms, i.e. as a stance of shared beliefs of a community about the types of questions asked, the methods used, etc. In Chapter 4, I identified pragmatism as the paradigm underpinning this mixed methods program of research and I believe that my work respected its principles. First, this work was initiated and guided by practical questions about clinical supervision and learning in real clinical environments. Second, I adapted, throughout the research process, the methodology and methods in function of the research questions that emerged from the findings. I used an experimental approach to determine the effects of the level of clinical supervision on patient care and learning because a well-defined concept of level of clinical supervision was found in the literature and used by medical regulatory bodies. However, an interpretivist approach was judged more appropriate to explore the complexity and variability of the learning opportunities created during the process of clinical supervision. Finally, I consider our findings useful but provisional; and although emerging from the interactions between specific researchers and specific participants, of potential value for other clinicians, trainees, educators. As a clinician, educator, and educational researcher, my background, influences, and values resulted from belonging to two communities: the medical education community and the critical care community. This program of research addresses relevant questions for these communities in a way that would be valued by them.

Another important question to consider at the end of a mixed methods project is to determine if the time and money invested in collecting mixed data was worthwhile, or as Charmaz put it, if the result "is more than the sum of its parts" (19). I believe that the use of both qualitative and quantitative approaches allowed me to answer different questions and to consider my research topic from different perspectives. Practically, the completion of the simulation-based study
provided an answer to the effects of the level of clinical supervision on patient care and learning, as well as a clear focus to the initial observations and a familiarity with the types of interactions encountered. I was therefore able to obtain more focused observational data right from the initial observations. However, achieving a true integration of the results was challenging. This mixed methods program of research was not designed with the objective of triangulating the findings. Some findings of the simulation-based study were further explored in the observational study and the concepts defined in one study were used in the subsequent phase of our research program. The first sections of this chapter attempt to relocated these findings within a broader literature and within the practical clinical context.

11.4.1.2 Quality Issues in Mixed Methods Research

Feilzer spoke of the quality of mixed methods research as the achievement of two objectives: the representativeness of an objective or subjective reality and the utility of the findings for the community concerned with the object of research(20). Many aspects of representativeness have been addressed in the discussion section of the previous chapters. The utility issue has also been tackled in the previous sections of this chapter by illustrating how these findings can inform the current literatures and the clinical and educational practices in the acute care setting. However, I would like to add a few specific remarks regarding the observational study and the use of a constructivist grounded theory methodology.

I realized during the later phases of analyses of the observational data that I was very concerned with the ability of the participants to reflect in real-time on the learning processes experienced during clinical encounters. I was also worried that the supervisors and the trainees would attempt to manage my impression of them. Furthermore, I realized that I was (maybe overly) concerned about adding to the stress or burden of certain trainees or supervisors by asking too many questions during very acute encounters. Many factors may have contributed to these concerns, including my own personality, and a certain empathy for the struggles experienced by the participants in certain clinical situations. As a result, the theoretical accounts presented in the previous chapters may have relied heavily on my own construction of meaning rather than a true co-construction with the participants. Their perspectives may be under-represented in this work. Charmaz has recognized the need not to rely only on participants' views to make sense of a social
process(19). She acknowledges that participants' overt statements may not necessarily represent the best data and that participants may take things for granted and manage their impression(19). However, constructivist grounded theory is concerned with the representation of multiple perspectives, and with the hindsight, I would have spent more time discussing my interpretations of the interactions being observed with the participants. The fact that the presentation of some of the results at conferences and rounds elicited a positive reaction from trainees and clinicians who seemed to relate to the findings indicated that at least some of my interpretations were representative of their experiences.

Charmaz and others have highlighted a common weakness of grounded theory studies: the lack of theorization(21). Detailed descriptions of social processes sometimes predominate over theoretical analysis in many grounded theory studies(19). I have attempted to strike the right balance between over-interpretation of my data and lack of theorization. Chapters 8, 9, and 10 included numerous quotes to illustrate each of the interpretations that contributed to the elaboration of a theoretical framework or model. These quotes provided the readers with examples of data that contributed to my conclusions. My interpretations of the data were also discussed with the other investigators involved in this study. In addition, I have tried to achieve a higher level of abstraction in the summary provided at the beginning of this chapter by integrating the multiple stories emerging from the observational study.

Charmaz also described four criteria of quality to assess constructivist grounded theory: credibility, originality, resonance, and usefulness(21). I believe that the data collected during the observational study were sufficient in quantity, in depth, and in focus to ground my theoretical interpretations. More than 350 hours of observation allowed me to collect numerous examples of learning interactions between supervisors and trainees during 74 acute episodes of care. I observed many participants on more than one occasion interacting with the same or with different participants. I witnessed many types of clinical situations in two different clinical environments. Furthermore, the successive phases of observation focused respectively on the types of learning interactions observed during clinical supervision, the conditions that affected the occurrence of these learning interactions, and the integration of learning and patient care in two different clinical contexts allowed me to adequately explore each topic. During the analysis, I paid attention to the fit and relevance of the codes used, and I applied the grounded theory
methods as recommended by different grounded theorists (22). Multiple discussions with experts in qualitative research facilitated this process. Some of my findings overlapped with prior theories and prior studies conducted in other workplace environments. I've tried to highlight the originality of my findings in the previous sections of this chapter. During the observations, I attempted to see beyond the obvious and to focus on context to achieve resonance. Thus far, the presentation of our results indicates a good response from the audiences who appear to relate to the results. I hope that our findings will be useful and applicable in real clinical environments. However, there are some limitations to the two studies included in this program of research. These limitations will be addressed in the next section.

11.4.2 Specific Limitations of this Program of Research

The three main objectives of this program of research related to the concept of clinical learning. Learning to become a clinical physician involves multiples roles that have been increasingly described, defined, and measured in the medical education literature. The CanMEDS framework represents an example of these multiple roles (23). Defining and measuring clinical learning in function with each of these roles appeared overwhelming. I decided to restrain the focus of this work to the role of medical expert, defined as the application of medical knowledge, clinical skills, and professional attitudes in the provision of patient-centered care (23). Therefore, the results are not informative of the learning processes and opportunities offered to trainees regarding other roles important to develop in the course of medical training. Furthermore, the observational study focused mostly on one type of learning opportunity provided by the clinical environment, i.e. those related to the interactions with the supervisors. It is not to say that other sources of learning are not present or important in the clinical environment. The focus on the interactions between supervisors and trainees was thought to offer multiple possibilities of targeted interventions to improve clinical learning in acute care setting. In addition, our studies focused on the learning of two types of trainees (residents and fellows) in acute care environment, not on the lifelong learning of practicing physicians. Moreover, the residents participating in these studies had characteristics that may not be shared by other trainees: relatively short rotations in a specific ICU environment, primary affiliation to a training program different from critical care (e.g. surgery or anesthesia), and short exposures to numerous staff physicians. Finally, it is worth mentioning again that learning outcomes were not measured
during the observational studies. Interpretations made from the results concerned the learning opportunities created by specific encounters. The real impact of the creation of these opportunities on the trainees' ability to further contribute to patient care was not measured and should be the object of future studies.

11.4.3 Future Directions

Two lines of inquiry appear worthwhile to pursue based on the conclusions of our simulation-based and observational studies. First, certain aspects of the learning interactions in the acute clinical setting should be further explored. Second, educational interventions based on these results could be designed, assessed, and implemented to improve trainees' learning experience in the acute medical setting.

11.4.3.1 Better Understanding Learning In Acute Clinical Environments

A better understanding of the learning interactions between supervisors and trainees could be gained from obtaining the perspectives of clinical supervisors and trainees involved in these interactions. As mentioned in the previous sections, our observations were mostly focused on the behaviors displayed by the participants, rather than on their motivations, thoughts, and reflections on the learning process. Conducting in-depth interviews of supervisors and trainees to obtain their perspectives on some of the findings would contribute to the richness of our conclusions. For examples, other triggers or hindrances for shifting to learning could be identified, factors contributing to the development of a sense of responsibility towards learning could be explored, as well as certain issues related to trust and power affecting learning-directed interactions.

The design of the studies did not allow me to observe and clarify the impact on learning of different levels of trainee's involvement in patient care. Future studies could explore perceived and visible effects of different types of learning interactions on trainees. For example, we could compare the differences between hands-off and hands-on provision of care in terms of trainee's level of confidence and future ability to complete similar clinical tasks. We could also explore if providing care independently while being observed by a supervisor modifies trainee's cognitive
processes, level of confidence, and learning benefits. Additionally, the different ways for the supervisors to integrate learning and patient care in different clinical situations led to variable learning opportunities for the trainees. Trainees’ ability to seize these opportunities and to improve their capacity to contribute to patient care needs to be further explored.

The role of context (situational and socio-cultural) in clinical learning is likely much broader and more complex than presented in my conclusions. To tackle this complexity, future studies could compare learning-directed interactions in similar clinical situations across contexts (e.g., routine rounds in medicine compared to critical care; medical crises in the emergency room compared to operative room, etc.) or in similar contexts across different socio-cultural environments (e.g. academic vs. non-academic hospitals, North-American vs. European countries, etc.). Such comparisons would provide rich data to observe further variations of the learning interactions according to context.

11.4.3.2 Intervening to Improve Learning in Acute Care Environments

I believe that these findings provide useful clues for the design and the implementation of educational interventions aimed at improving clinical learning. New knowledge regarding the capacity of certain types of learning interactions to involve trainees in patient care, the triggers of the shifts to learning and the strategies to overcome hindrances to these shifts, the different ways to balance patient care and learning in different clinical situation, the importance of trainees' involvement in patient care to guide supervision, etc. could be shared with supervisors and trainees. Studies exploring the changes in behaviors resulting from this knowledge could be designed, as well as studies looking at the best way to share this knowledge and to practice new supervisory skills. Ultimately, measuring the impact of these interventions on trainees' ability to care for acute patients and on actual patient outcomes would represent evidence in favor of the utility of these interventions.
11.5 Conclusion

Today's clinical environments are different than the ones experienced by medical trainees a few decades ago. This program of research focused on the current supervisory practices in acute clinical environments to explore the effects of different levels of clinical supervision on patient care and learning, the learning opportunities emerging from clinical activities, and the tensions between patient care and learning experienced by the clinicians working in acute care environments. After the completion of two successive and complementary studies (a simulation-based, mixed methods study and a naturalistic, observational qualitative study), we reached five main conclusions:

1- direct supervision was associated with more comprehensive care delivery and a neutral effect on learning;
2- both direct and distant supervision provided learning opportunities for practice, observation, and feedback, but the types of opportunities (incidental vs. engineered) differed according to the level of supervision;
3- supervisors and trainees' consistent engagement in learning interactions of different types (monologues and dialogues about patient care, hands-off and hands-on provision of care, tailored support-in-action and feedback-on-action) can foster progressive levels of trainee involvement in patient care while maintaining safe care delivery;
4- factors related to the clinical case, the individuals, and the clinical environment interacted dynamically to create conditions (often modifiable) more or less favorable to shifting to learning;
5- different clinical contexts led to different models of integration of learning interactions into clinical activities (in series vs. in parallel models), and resulted in different formats of learning interactions (learning bubbles vs. learning flashes).

This program of research revealed that today's acute clinical environments continue to offer multiple learning opportunities for the trainees, even during direct supervision. The learning benefits resulting from different types of learning opportunities and learning interactions need to be further characterized. Additionally, the best strategies to help clinical supervisors and trainees to better understand and carry out their roles during supervision, and the impact of these initiatives on learning outcomes should be further explored.
11.6 References


Copyright Acknowledgements

During the scenario development phase of the study, face and content validity were optimized by the following: two ICU attending physicians with more than five years of clinical experience reviewed the scenario content; each scenario was piloted by three different staff physicians to ensure similar degrees of difficulty and to establish scenario-specific checklists including required actions; two other ICU staff physicians independently reviewed and approved the checklists' content without further modifications.

### Scenario Synopsis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Original Supervised Scenario</th>
<th>Modified for Unsupervised Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>62 year-old (y.o.) man, 6hrs post-meningioma resection by the neurosurgery service, who develops acute decreased level of consciousness, decreased saturation, and high blood pressure due to post-operative bleeding. (level II ICU unit)</td>
<td>45 y.o. man, 18hrs post-isolated traumatic brain injury, who develops subacute decreased level of consciousness, decreased saturation, and high blood pressure due to progressive cerebral brain edema. (level II ICU unit)</td>
</tr>
<tr>
<td>B</td>
<td>76 y.o. female, post-op day 3 of a hip replacement surgery who develops mild temperature, tachycardia, shortness of breath and low blood pressure due to a pulmonary embolism. (ward)</td>
<td>81 y.o. male, post-op day 2 of a colon resection for a colon carcinoma who develops shortness of breath, tachycardia and low blood pressure due to cardiac ischemia. (ward)</td>
</tr>
<tr>
<td>C</td>
<td>83 y.o. female, from a nursing home who presents with decreased level of consciousness, desaturation, and low blood pressure due to an aspiration pneumonia. (emergency room)</td>
<td>79 y.o. female, with multiple comorbidities who presents with decreased level of consciousness, desaturation, and low blood pressure due to bowel ischemia. (emergency room)</td>
</tr>
</tbody>
</table>
# SCENARIO A1 (Increased ICP - Supervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
<th>R or F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **T1 TIME LOW O2 SAT MENTIONED TO THE RESIDENT**  
(when resident walks in the simulation room) | | | |
<p>| Increases FiO2 to 100% | | | |
| Calls for the respiratory therapist (for the ETI) | | | |
| Puts an oral airway or starts bag-mask ventilation | | | |
| <strong>T2 TIME FIO2 100% AND ORAL AIRWAY/BMV REQUESTED</strong> | | | |
| <strong>Questionnaire</strong> | | | |
| Asks for signs of seizures (witnessed abnormal movement) | | | |
| Asks about narcotic use (dose &amp; time) | | | |
| Asks for blood sugar since decreased LOC or does accuchek | | | |
| <strong>Physical Exam</strong> | | | |
| Performs a neurological exam (including pupils and response to pain) before ETI | | | |
| Performs chest auscultation before ETI | | | |
| <strong>Treatment of Increased ICP</strong> | | | |
| <strong>T3 TIME DILATED RIGHT DILATED PUPIL MENTIONED TO THE RESIDENT</strong> | | | |
| HOB at 30-45 degrees | | | |
| Administration of a bolus of mannitol or hypertonic saline | | | |
| Hyperventilation (target CO2 &lt; 30) | | | |</p>
<table>
<thead>
<tr>
<th><strong>T4 TIME BOLUS OSMOTIC FLUID AND HYPERVENTILATION REQUESTED</strong></th>
<th></th>
</tr>
</thead>
</table>

**Endotracheal Intubation**

- Preoxygenation
- Readiness to treat hypotension during ETI (pressors mixed and ready to use)
- Analgesia and sedation administered (re: query high ICP)

<table>
<thead>
<tr>
<th><strong>T1b TIME SAT O2 &lt; 92% IF FAILED ETI</strong></th>
<th></th>
</tr>
</thead>
</table>

- Confirmation of the ETT placement (auscultation and CO2+chest X-ray requested – at least 2/3)

<table>
<thead>
<tr>
<th><strong>T2b TIME SUCCESSFUL ETI (CO2 +)</strong></th>
<th></th>
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</thead>
</table>

**T5 TIME MAP < 65**

- Fluid bolus and/or vasopressors administration once MAP lower than 65 (or were ordered preemptively before the ETI)

<table>
<thead>
<tr>
<th><strong>T6 TIME FLUID BOLUS OR VASOPRESSORS ORDERED</strong> (same as T5 if ordered pre-ETI)</th>
<th></th>
</tr>
</thead>
</table>

**Specific Measures**

- Neurosurgery consultation requested
- CT scan of head requested

| **T7 TIME TO FINAL DIAGNOSIS (Increased ICP/intracerebral bleed or edema)** |  |
## SCENARIO A2 (Increased ICP - Unsupervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T1 TIME LOW O2 SAT MENTIONED TO THE RESIDENT (Resident walks into the room)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases FiO2 to 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calls for the respiratory therapist (for endotracheal intubation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puts an oral airway or starts bag-mask ventilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T2 TIME FIO2 100% AND ORAL AIRWAY/BMV REQUESTED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Questionnaire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for signs of seizures (witnessed abnormal movement)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for recent narcotic use (dose &amp; time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for blood sugar since decreased LOC or does an accucheck</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Exam</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performs a neurological exam (including pupils &amp; response to pain) before the ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultates the chest before the ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Treatment of Increased ICP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T3 TIME DILATED LEFT DILATED PUPIL MENTIONED TO THE RESIDENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOB at 30-45 degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration of a bolus of mannitol or hypertonic saline</td>
<td></td>
<td></td>
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<tr>
<td>Hyperventilation (CO2≤30)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**T4 TIME BOLUS OSMOTIC FLUID AND HYPERVENTILATION REQUESTED**

<table>
<thead>
<tr>
<th>Endotracheal Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoxygenation</td>
</tr>
<tr>
<td>Readiness to treat hypotension during ETI (pressors mixed and ready to use)</td>
</tr>
<tr>
<td>Analgesia and sedation administered (re: query increased ICP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T1b TIME SAT O2 &lt; 92 % IF NO SUCCESSFUL ETI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmation of the ETT placement (auscultation and CO2+chest Xray requested – at least 2/3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T2b TIME SUCCESSFUL ETI (CO2 +)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>T5 TIME MAP &lt; 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid bolus and/or vasopressors administration once MAP lower than 65 (or were ordered preemptively before the ETI)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T6 TIME FLUID BOLUS OR PRESSOR ORDERED (same as T5 if done pre-ETI)</th>
</tr>
</thead>
</table>

### Specific Measures

<table>
<thead>
<tr>
<th>Neurorsurgery consultation requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT scan of head requested</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T7 TIME TO FINAL DIAGNOSIS (Increased ICP/intracerebral hemorrhage or edema)</th>
</tr>
</thead>
</table>
### SCENARIO BI (Post-op respiratory failure – Supervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
<th>R or F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T1 TIME LOW O2 SAT MENTIONED TO THE RESIDENT</strong> (when resident walks in the simulation room)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases FiO2 to 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calls for the respiratory therapist (for endotracheal intubation)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>T2 TIME RT REQUESTED FOR ETI/BMV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Questionnaire</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for chest pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for respiratory symptoms (dyspnea and/or cough and/or secretions)</td>
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<tr>
<td>Asks about or checks use of DVT prophylaxis since the admission</td>
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<tr>
<td><strong>Physical Exam</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Auscultates the chest prior to ETI</td>
<td></td>
<td></td>
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<tr>
<td>Checks the extremities or asks about leg swelling/perfusion status</td>
<td></td>
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<tr>
<td><strong>Review of Relevant Information</strong></td>
<td></td>
<td></td>
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<tr>
<td>Reviews the ECG prior to ETI</td>
<td></td>
<td></td>
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<tr>
<td>Reviews the chest X-Ray prior to ETI</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Endotracheal Intubation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoxygenation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readiness to treat hypotension during ETI (pressors mixed, ready to use)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Step</td>
<td>Description</td>
<td></td>
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<tr>
<td><strong>Safe use of analgesia and sedation</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>T1b TIME SAT O2 &lt; 92 % IF FAILED ETI</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Confirmation of the ETT placement (auscultation and CO2+chest Xray requested – at least 2/3)</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>T2b TIME SUCCESSFUL ETI (CO2 +)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T3 TIME MAP &lt; 65</strong></td>
<td>Fluid bolus and/or pressor administration once MAP lower than 65 or preemptively before the ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T4 TIME FLUID BOLUS OR PRESSOR ORDERED (same as T3 if administered before the ETI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Specific Measures</strong></td>
<td>CT scan chest (PE study) requested</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T5 TIME ETI COMPLETED (CO2 +)</strong></td>
<td>Call made to surgical team to discuss patient’s condition/contraindication to IV heparin Administration of a therapeutic dose of heparin IV/SC</td>
<td></td>
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</tr>
<tr>
<td><strong>T6 TIME THERAPEUTIC HEPARIN ORDERED</strong></td>
<td></td>
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<tr>
<td><strong>T7 TIME TO FINAL DIAGNOSIS (Pulmonary embolism)</strong></td>
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</tbody>
</table>
### SCENARIO B2 (Post-op respiratory failure – Unsupervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 TIME LOW O2 SAT MENTIONED TO THE RESIDENT (when resident walks in the simulation room)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases FiO2 to 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calls for the respiratory therapist (for endotracheal intubation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T2 TIME RT REQUESTED FOR ETI/BMV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Questionnaire</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for chest pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for respiratory symptoms (dyspnea and/or cough and/or secretions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks for abdominal symptoms (pain and/or diarrhea, nausea, vomiting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Exam</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultates the chest prior to ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examines the abdomen prior to ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Review of Relevant Information</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviews the ECG prior to ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviews the chest X-Ray prior to ETI</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Specific Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiology consultation requested</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Call made to surgical team to discuss patient’s condition/ contraindication to IV heparin</td>
<td></td>
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<tr>
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<td>----------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>TIME ECG IS SEEN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Administration of ASA/IV heparin</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>TIME ASA or IV heparin ORDERED</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Endotracheal Intubation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoxygenation</td>
</tr>
<tr>
<td>Readiness to treat hypotension during ETI (pressors mixed and ready to use)</td>
</tr>
<tr>
<td>Safe use of analgesia and sedation</td>
</tr>
<tr>
<td>T1b TIME SAT O2 &lt; 92 % IF FAILED ETI</td>
</tr>
<tr>
<td>Confirmation of the ETT placement (auscultation and CO2+chest Xray requested – at least 2/3)</td>
</tr>
<tr>
<td>T2b TIME SUCCESSFUL ETI (CO2 +)</td>
</tr>
<tr>
<td>T5 TIME MAP &lt; 65</td>
</tr>
<tr>
<td>Fluid bolus and/or pressor administration once MAP lower than 65 or preemptively before the ETI</td>
</tr>
<tr>
<td>T6 TIME FLUID BOLUS/RBC OR PRESSOR ORDERED (same as T3 if administered before the ETI)</td>
</tr>
<tr>
<td>T7 TIME TO FINAL DIAGNOSIS (Acute Coronary Syndrome)</td>
</tr>
</tbody>
</table>
# SCENARIO C1 (Sepsis – Supervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
<th>R or F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T1 TIME LOW BP MENTIONED TO THE RESIDENT (when the resident walks in the simulation room)</strong></td>
<td></td>
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</tr>
<tr>
<td>Bolus of IV fluids (at least 500cc of crystalloid)</td>
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</tr>
<tr>
<td><strong>T2 TIME BOLUS OF IV FLUID/IV VASOPRESSORS ORDERED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirms appropriate IV access</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Requests or mentions the need for an arterial line before ETI</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Requests cvp to be transduced</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Repeats IV bolus or starts vasopressors in response to ongoing low BP despite first fluid bolus before the ETI</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Physical Exam</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultates the chest before ETI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examines the abdomen before ETI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Review of Relevant Information</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviews the ECG before ETI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviews the chest X-Ray before ETI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T3 TIME LOW O2 SAT MENTIONED TO THE RESIDENT (OR NOTICED)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for BMV/ETI timely recognized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T4 TIME TO BMV/ETI REQUESTED</strong></td>
<td></td>
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<tr>
<td><strong>Endotracheal Intubation</strong></td>
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<tr>
<td>----------------------------</td>
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<td></td>
<td></td>
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<tr>
<td>Preoxygenation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Readiness to treat hypotension during ETI (pressors mixed and ready to use)</td>
<td></td>
<td></td>
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<tr>
<td>Safe choice of analgesia/sedation selected</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>T3b TIME SAT O2 &lt; 88 %</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Confirmation of the ETT placement (auscultation and CO2+chest Xray requested – at least 2/3)</td>
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</table>

<table>
<thead>
<tr>
<th><strong>T4b TIME SUCCESSFUL ETI (CO2 +)</strong></th>
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<tbody>
<tr>
<td>IV bolus administration or IV vasopressors when MAP&lt;65 post-ETI (or preemptively)</td>
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<table>
<thead>
<tr>
<th><strong>Specific Measures</strong></th>
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</thead>
<tbody>
<tr>
<td>Blood, sputum, and urine cultures all ordered</td>
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</table>

<table>
<thead>
<tr>
<th><strong>T5 TIME CHEST XRAY SEEN</strong></th>
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<tbody>
<tr>
<td>IV antibiotics administration with appropriate coverage for CAP (including atypical, i.e. macrolide or quinolone)</td>
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</table>

<table>
<thead>
<tr>
<th><strong>T6 TIME IV ANTIBIOTICS ORDERED</strong></th>
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<tbody>
<tr>
<td>Central venous gas requested (or mentioned but not requested because of the location of the central line)</td>
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</table>

| **T7 TIME TO FINAL DIAGNOSIS (Community-acquired pneumonia/septic shock)** |  |
## SCENARIO C2 (Sepsis – Unsupervised)

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td><strong>Acute Resuscitation</strong></td>
<td></td>
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<tr>
<td>T1 TIME LOW BP MENTIONED TO THE RESIDENT (when the resident walks in the simulation room)</td>
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<tr>
<td>Bolus of IV fluids (at least 500cc of crystalloid)</td>
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<tr>
<td><strong>T2 TIME BOLUS OF IV FLUID/IV VASOPRESSORS ORDERED</strong></td>
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<tr>
<td>Confirms appropriate IV access</td>
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<tr>
<td>Requests or mentions the need for an arterial line before the ETI</td>
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<td></td>
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<tr>
<td>Requests cvp to be transduced</td>
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<tr>
<td>Repeats IV bolus or starts vasopressors in response to ongoing low BP despite first fluid bolus before the ETI</td>
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<tr>
<td><strong>Physical Exam</strong></td>
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<tr>
<td>Auscultates the chest before ETI</td>
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<tr>
<td>Examines the abdomen before ETI</td>
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<tr>
<td><strong>Review of Relevant Information</strong></td>
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<tr>
<td>Reviews the ECG before ETI</td>
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<td></td>
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<tr>
<td>Reviews the chest X-Ray before ETI</td>
<td></td>
<td></td>
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<tr>
<td><strong>T3 TIME LOW O2 SAT MENTIONED TO THE RESIDENT (OR NOTICED)</strong></td>
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<td></td>
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<tr>
<td>Need for BMV/ETI timely recognized</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T4 TIME TO BMV/ETI REQUESTED</strong></td>
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</tbody>
</table>
### Endotracheal Intubation

| Preoxygenation | | | |
| Readiness to treat hypotension during ETI (pressors mixed and ready to use) | | | |
| Safe choice of analgesia/sedation selected | | | |

#### T3b TIME SAT O2 < 88 %

- Confirmation of the ETT placement (auscultation and CO2+chest Xray requested – at least 2/3)

#### T4b TIME SUCCESSFUL ETI (CO2 +)

- IV bolus administration or IV vasopressors when MAP<65 post-ETI (or preemptively)

### Specific Measures

- Blood, sputum, and urine cultures all ordered

#### T5 TIME SEPSIS MENTIONED AS POSSIBLE DIAGNOSIS

- IV antibiotics administration with appropriate coverage for abdominal sepsis (including gram negative and anaerobes)

#### T6 TIME IV ANTIBIOTICS ORDERED

- Central venous gas requested (or mentioned but not requested because of the location of the central line)

- General surgery consult or abdominal CT scan

#### T7 TIME TO FINAL DIAGNOSIS (Abdominal sepsis/bowel ischemia/peritonitis)
Appendix 2

Self-Confidence Scale Based on Bandura's Principles

Please, rate how certain you are that you can resuscitate and stabilize a patient with unstable vital signs right now?

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot do at all</td>
<td>Moderately can do</td>
<td>Highly certain can do</td>
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Help Available
With an attending staff at the bedside
With an ICU fellow at the bedside
With an attending staff immediately available at the bedside on request
With an ICU fellow immediately available at the bedside on request
With an attending staff available on the phone for advices
With an ICU fellow available on the phone for advices

Location
In the ICU
In the emergency room
On the ward

Patient condition
With an abnormal level of consciousness only
With an abnormal blood pressure only
With an abnormal oxygen saturation only
With more than one abnormal vital signs
Appendix 3

Ottawa Crisis Management Global Rating Scale for non-technical skills

EVALUATION CRITERIA:

This evaluation scale is directed towards assessing competence in crisis management (CM) skills and care of critically ill patients. The standard of competence has been set at the senior resident level, i.e., the third-year resident who has had prior ICU experience, and through experience as a junior hospitalist physician, has proven experience in managing crisis. As there exists a requisite base of medical knowledge required to effectively manage crises, this will also be evaluated. However, the focus of evaluation will be on crisis management skills. The skills listed below comprise essential aspects of crisis management. In the simulation case scenario sessions, performance in each of these areas will be assessed, in addition to the amount of prompting or guidance required during the case scenario sessions.

The following criteria will be evaluated:

LEADERSHIP SKILLS
Stay calm and in control during crisis
Prompt and firm decision-making
Maintain global perspective ("big picture")

SITUATIONAL AWARENESS
Avoid fixation error
Rearranges and re-evaluates situation constantly
Anticipates likely events

COMMUNICATION SKILLS
Communicates clearly and concisely
Uses directed verbal/non-verbal communication
Listens to team input

PROBLEM SOLVING
Organized and efficient problem solving approach (ABC's)
Quick in implementation (Concurrent management)
Considers alternative during crisis

RESOURCE UTILIZATION
Calls for help appropriately
Utilizes resource at hand appropriately
Prioritizes tasks appropriately

OVERALL

Staff: ____________________________ Date: ____________________________

Time: ____________________________

OVERALL PERFORMANCE

1 2 3 4 5 6 7

Novice: all CM skills require significant improvement
Advanced novice: many CM skills require moderate improvement
Competent: most CM skills require minor improvement
Clearly superior; few, if any CM skills that only require minor improvement

I. LEADERSHIP SKILLS

Loss of calm and control for most of crisis; unable to make firm decisions; cannot maintain global perspective
Loses calm (temporarily) during crisis; delays in making firm decisions (or with family); rarely maintains global perspective
Stays calm and in control for most of crisis; makes firm decisions without delay; usually maintains global perspective
Remains calm and in control for entire crisis; makes prompt and firm decisions without delay; always maintains global perspective

II. PROBLEM SOLVING SKILLS

Cannot implement ABC's assessment without direct cues; uses sequential management despite cues; fails to consider any alternative to crisis
Incomplete or slow ABC assessment; mostly uses sequential management approach unless cues; gives little consideration to alternatives
Satisfactory ABC assessment; without cues mostly uses concurrent management approach with minor deviation, considers some alternatives in crisis
Throughout quick ABC without cues; always uses concurrent management approach; considers most likely alternatives in crisis

III. SITUATIONAL AWARENESS SKILLS

Become fixated easily despite repeated cues; fails to recognize and re-evaluate situation despite repeated cues; fails to anticipate likely events
Avoids fixation error only with cues rarely re-evaluates situation without cues; rarely anticipates likely events
Usually avoids fixation error with minimal cues; reassesses and re-evaluates situation frequently with minimal cues; usually anticipates likely events
Avoids fixation error and re-evaluates situation without cues; consistently anticipates likely events

IV. RESOURCE UTILIZATION SKILLS

Unable to use resources & staff effectively; does not prioritize tasks or ask for help when required despite cues
Able to use resources with minimal effectiveness; able to prioritize tasks and ask for help when required with cues
Able to use resources with moderate effectiveness; able to prioritize tasks and ask for help with minimal cues
Clearly able to utilize resources to maximal effect; sets clear task priority and skills for help early with no cues

V. COMMUNICATION SKILLS

Does not communicate with staff; does not acknowledge staff communication, never uses directed verbal/non-verbal communication
Communicates occasionally with staff; but unclear and vague; occasionally listens to but rarely interacts with staff; rarely uses directed verbal/non-verbal communication
Communicates with staff clearly and concisely most of time; listens to staff feedback; usually uses directed verbal/non-verbal communication
Communicates clearly and concisely at all times, encourages input and listens to staff feedback; consistently uses directed verbal/non-verbal communication