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Published in:
LEADERSHIP IN HEALTH SERVICES

DOI:
[10.1108/LHS-06-2019-0031](https://doi.org/10.1108/LHS-06-2019-0031)

Published: 09.03.2020

Document Version
Peer reviewed version

Citation for published version (APA):
Vuojärvi, H., & Korva, S. (2020). An ethnographic study on leadership-as-practice in trauma simulation training. *LEADERSHIP IN HEALTH SERVICES*, 33(2), 185-200. <https://doi.org/10.1108/LHS-06-2019-0031>

An ethnographic study on leadership-as-practice in trauma simulation training

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Please cite as: Vuojärvi, H., & Korva, S. (2020). An ethnographic study on leadership-as-practice in trauma simulation training. *Leadership in Health Services*, 33(2), 185–200.

An ethnographic study on leadership-as-practice in trauma simulation training

Structured abstract

Purpose – This study aims to discover how leadership emerges in a hospital’s trauma team in a simulated trauma care situation. Instead of investigating leadership from a leader-centric perspective, or using a metrics-based approach to reach generalizable results, the study draws from post-heroic theories by applying leadership-as-practice (LAP) and sociomaterial perspectives that emphasize the cultural-historical context and emergent nature of leadership.

Design – The study was conducted in a Finnish central hospital through ethnographic observations of 14 in situ trauma simulation trainings over a period of 13 months. The data consist of vignettes developed and written from field notes. The analysis was informed by Cultural-historical activity theory (CHAT).

Findings – Leadership in a trauma team during an in situ simulation training emerges from a complex system of agencies taking place simultaneously. Contextual elements contributed to the goal. Clarity of roles and task division, strong execution of leadership at critical points, active communication and maintenance of disciplined communication helped to overcome difficulties. The team developed coordination of the process in conjunction with the care.

Originality/value – The research considers trauma leadership to be a practical phenomenon emerging from the trauma team’s sociomaterial context. The results can be used to develop non-technical skills training within the field of simulation-based medical training.

Keywords leadership-as-practice, sociomateriality, context, trauma team, simulation-based training, activity theory

Introduction

Effective leadership has been proven to improve processes of trauma care (Berlin and Carlström, 2008; Ford *et al.*, 2016, Paquin *et al.*, 2018); that is, attending to patients who have been critically injured. In smaller hospitals that do not have a specialized trauma center, trauma care processes are carried out by trauma teams consisting of doctors and nurses from different units. Members of the team change regularly, depending on who is on duty, so team members may be meeting for the first time when a trauma alarm is sounded, and the team gathers in a trauma room. The team may have only minutes to establish a shared care strategy based on information received from paramedics. A trauma team exists for only 15–20 minutes—as long as it takes to care for one trauma patient. Despite the uncertainty, haste and complexity that characterize the existence and work of a trauma team, the team is committed to a common goal: stabilizing the patient's condition so that he or she can be moved to receive further care (Berlin and Carlström, 2008; Klein *et al.*, 2006).

Trauma care is defined in a trauma protocol, according to which the leadership of a trauma team is designated as the trauma leader, usually a surgeon (Gaba, 2010), whose priority is to lead the team, not to participate in practice. Effective coordination of information and action, and good decision-making skills have been identified as strengths of a trauma leader (Leenstra *et al.*, 2015). In addition to considering the leadership of a trauma team from an individual leader's perspective, however, the leadership can also be perceived as a collective and relational phenomenon. Leadership may be regarded, for example, as coordinated, contingent, distributed, functional, flexible or shared (Brandstorp *et al.*, 2015; Klein *et al.*, 2007; Meier, 2015; Paquin *et al.*, 2018), and perceived as inextricably bound to its context (Endrissat and von Arx, 2013).

The focus of this study is how leadership emerges in a hospital's trauma team in a simulated trauma care situation when drawing from the post-heroic approaches to study leadership, specifically the leadership-as-practice (LAP) perspective (Crevani *et al.*, 2010; Crevani and Endrissat, 2016; Raelin, 2016) and sociomateriality (Hawkins, 2015; Orlikowski, 2007; Sergi, 2016). By applying the LAP and sociomaterial perspectives, the study introduces a comprehensive approach to viewing leadership in a trauma team during a care situation. This approach enables to study, reflect and develop activities of the whole team. Instead of considering leadership to be determined by a team member's individual competence, character or behavior, which are all based on a leader–subordinate or subjective–objective relationship

(Carroll *et al.*, 2007; Crevani *et al.*, 2010), “leadership” in LAP provides direction, reorientation of the flow of practice and emergent co-construction through collaborative agency (Crevani and Endrissat, 2016; Raelin, 2011). The focus, thus, is on the entire sociomaterial and sociocultural context in and through which the leadership in a trauma team emerges. “Practice” refers to a team’s cooperative efforts to provide high-quality health care (the objective) through the creation and implementation of the team’s own rules (Raelin, 2011). The LAP perspective does not aim to replace the previous leader-centric perspectives but complements them by answering the questions of where, how and why leadership is created in everyday practices (Crevani *et al.*, 2010; Raelin, 2011).

In this study, leadership is understood ontologically as an ongoing process that emerges through a continuous flow of interactions embedded in the specific cultural context of a hospital emergency room (Crevani *et al.*, 2010; Crevani and Endrissat, 2016; Endrissat and von Arx, 2013; Orlikowski, 2007; Raelin, 2016; Sergi, 2016). In agreement with this process ontological view on leadership, data were collected through ethnographic nonparticipant observations of 14 trauma simulation trainings in a Finnish central hospital over a period of 13 months. The premise is that the LAP and sociomaterial perspectives have the potential to capture the specific and unique nature of the leadership that emerges in a trauma team as something that the team may accomplish together, and not necessarily the result of a single team member’s actions (Raelin, 2011). The sociomaterial context of trauma care is rich—technology, equipment, protocols, procedures and professional hierarchy are all needed for efficient trauma care and for team operations. This study promotes an understanding of how all of these elements come together to carry out trauma care processes, and provides starting points for further development of medical simulation-based training.

Perspectives on sociomaterial and contextual LAP

The emergence of the LAP perspective is rooted in the so-called “practice turn” of organizational and social theory (Schatzki *et al.*, 2001). This perspective can also be viewed as an aspect of post-heroic theories as it emphasizes the relational, collectivist and non-authoritarian nature of leadership (Crevani *et al.*, 2007; Denis *et al.*, 2010). At the heart of LAP is the conception of leadership occurring as a practice rather than residing in individuals. Practice is perceived as an interwoven and emergent flow of processes, in which material and discursive engagements produce shared meanings. Thus, LAP is concerned with how

leadership emerges and unfolds through day-to-day experience. All who are affected by leadership at any given time in any given way are embedded within it. To find leadership, one must look to the practice within which it is occurring (Raelin, 2011, 196; Raelin, 2016).

The LAP perspective shares similarities with the relational understanding of leadership, but broadens the role of leadership discourse to include bodily elements, artefacts and leadership emergence in forms other than verbal communication (Raelin, 2011, 2016). The “practice turn” in understanding leadership has also yielded a “material turn” with an increasing interest in “thing-ness” (Fenwick, 2010; Hawkins, 2015). Researchers have started to focus on the meanings of material context, embodiment and aesthetics in the construction of leadership (Hawkins, 2015; Salovaara and Bathurst, 2018). As Hawkins (2015, 952) argues, “material objects generate, transmit, legitimize and undo meanings associated with leadership.” Sociomaterial elements of practice are bound to the cultural and historical context in which they emerge. Referring to Endrissat and von Arx (2013), context is understood as the situation that influences leadership effectiveness, and intrinsically affects the ways in which leadership emerges. Leadership is produced by, but also produces, the context (Endrissat and von Arx, 2013, 279).

The sociomaterial perspective has the potential to broaden understanding of trauma leadership, and how it emerges in relation to practices in trauma care. It is a rich yet challenging context due to its complexity regarding situational uncertainty and haste but also authority relations, and a requirement for seamless multi-professional teamwork to ensure high-quality patient care (Denis *et al.*, 2010; Paquin *et al.*, 2018). The characteristics and aims of trauma care create a special and high-pressure context for practicing leadership compared to others. According to the trauma protocol, leadership is designated, but in practice, through considering the microlevel interactions, the reality can be presumed to be much “messier” (Denis *et al.*, 2010), and leadership emerges from the immediate situation and by the members of the trauma team regardless and inclusive of their previous role designation (Paquin *et al.*, 2018).

The LAP and sociomaterial perspectives complement and deepen each other, as materiality can be understood as being ontologically part of practices and the “execution” of leadership—materiality is at the core of practice, profoundly intertwined with the social (Fenwick, 2010; Orlikowski, 2007; Schatzki *et al.*, 2001; Sergi, 2016). Social is manifested through material, and vice versa, which gives meaning to action and performative processes by which practice is constructed. From a sociomaterial perspective, agency is not positioned as either social

(human) or material but in the intra-action of social and material (Orlikowski, 2007). Human and non-human materials have an influence on leadership actions; material objects produce, transmit, legitimize and disentangle meanings related to leadership. Therefore, agency cannot belong only to human actors; instead, it is hybrid (Hawkins, 2015; Sergi, 2016). Practice is a dynamic interplay between the members of a team, their bodies and the social structures in the hospital (such as existing hierarchies), protocols of (trauma) care, technologies and other artefacts, such as clothes, instruments and medication. This study aims to increase understanding of the specifics of practicing leadership in a trauma team during in situ simulation training. The study contributes to research on leadership, which emphasizes the importance of focusing on the context of leadership development instead of a single leader (Berlin and Carlström, 2008; Fulop and Mark, 2013).

Research design

Implications of practical, contextual and sociomaterial perspectives

Following the LAP perspective, addressing the practical, sociomaterial and contextual nature of trauma leadership with empirical research would presume collecting data from multiple trauma cases from different research sites (Kempster *et al.*, 2016; Raelin, 2011). A comparison of these various cases might result in the development of a theory of leadership, perceived through LAP, sociomaterial and contextual perspectives, as it emerges in a trauma team. Additionally, LAP literature suggests using narrative forms of inquiry, such as ethnography (Kempster *et al.*, 2016; Raelin, 2016), which capture experiences in the field through longitudinal observation and involvement with people in a particular social setting (Watson, 2011). Conducting such an ethnographic study in a hospital environment, however, raises immediate concerns regarding ethics, confidentiality, patient security and perceived disruption during care processes (Kempster *et al.*, 2016). In addition, as severely injured patients requiring trauma care are rare in smaller hospitals in Finland, designing a research setting is a challenge.

To access the phenomenon under study, include variation in the research sites, enable an ethnographical study and diminish ethical concerns, in situ trauma simulation trainings were used as the research context. The medical field has a long history of adopting simulation-based training and an established tradition of utilizing various kinds of simulations in basic and continuing education (Nehring and Lashley, 2009; Rosen, 2009). In situ simulations are the most realistic forms of simulation, highly emotionally engaging and immersive (Dieckmann,

2009; Gaba, 2007, 2010), as participants practice with their real colleagues and with real equipment in a real environment (Gaba, 2007).

The effectiveness of simulation-based training is due to its learner-centered approach and active and experiential nature. Even the most difficult and demanding procedures can be developed and adapted for training, while new procedures and techniques can be developed safely, and with the opportunity for learners to make multiple attempts without the risk of causing harm (Rall and Dieckmann, 2005). Learners can practice technical skills and general competencies, including critical thinking, teamwork, decision-making, problem-solving and communication skills (Konia and Yao, 2013).

In this study, using in situ simulations as a research context would enable carrying out an ethnographic study on leadership in a sociomaterial context similar to that found in real trauma cases, but with non-intrusive access. Through longitudinal data collection, there would be multiple cases to foster theory building (Kempster *et al.*, 2016; Van Maanen, 2011; Watson, 2011), and patient security would not become an issue. From the perspective of LAP, in situ simulations provide a platform for learning and developing leadership in the context in which it emerges, and an opportunity to reflect on real-time conditions occurring during trauma care (Dieckmann *et al.*, 2009; Raelin, 2011). The in situ trauma simulation trainings are scripted to imitate real-life cases, containing similar contextual and sociomaterial structures (Gaba, 2007; 2010). The participating team is not familiarized with the scenarios beforehand, but has to be prepared to care for the simulated patient as if it were a real case. The team can use a human-like emergency patient simulator that can display neurological and physiological symptoms and responds to care procedures accordingly (Maran and Glavin, 2003).

Research question

Based on the theoretical premises of the LAP perspective, the sociomaterial and contextual understanding and their implications for the research design, the research question for this study was formulated as follows: How does leadership emerge in a trauma team during in situ simulation training?

Research setting

The ethnographic study presented here was conducted during 13 months in the years 2016–2017 as part of a larger research project, which was linked to one Finnish hospital's trauma team simulation training initiative. The study includes 14 in situ simulation trainings, which were organized monthly to practice trauma care according to the hospital's revised trauma protocol and to maintain and update required technical and non-technical skills and knowledge. The simulation trainings were held in a trauma room of the hospital's emergency unit and facilitated by a doctor. During the study, the facilitator changed a couple of times. According to the hospital's trauma protocol, the trauma team consisted of a surgeon, an on-call doctor, an anesthesiologist, a radiologist, four nurses and a porter. The members of the practice team came from different units of the hospital and were changed for each session. Additionally, two nurses operated the patient simulator according to the scenario and treatment, and two paramedic nurses from an ambulance or a helicopter delivered the patient (i.e., the human-like simulator) to the hospital as they would in a real case.

Each simulation training session lasted for two hours and consisted of three phases: 1) introduction, 2) in situ simulation training and 3) debriefing. The introduction lasted about 30 minutes, during which participants introduced themselves and their role on the team. The facilitator talked through the basics of simulation training and presented its technical and non-technical aims. The technical aims varied depending on which scenario was used. For example, the trauma team practiced the use of a pleural drain, a pelvic stabilization device and a tourniquet. The non-technical aims were considered more important in the training than the technical aims, and were the same every time. Non-technical aims included operating according to the hospital's revised trauma protocol, receiving and responding to trauma alarms, using closed-loop communication and leading the team. Additionally, the trauma room and the location of medicines and instruments were presented, and the simulator introduced. After the introduction, the trauma team members left the trauma room to wait for the trauma alarm. The paramedics left the room with the patient simulator.

Every in situ simulation training was based on a scenario created beforehand by a facilitator. During the 13 months of data collection, three different scenarios were designed to reflect realistic trauma cases typical for the hospital's region. The training started with paramedics informing the hospital's emergency unit of an incoming patient and providing a preliminary report concerning his or her condition. Next, the nurse receiving the information and documenting the details alerted the trauma team and provided them with the patient's information. Each team member was expected to respond and then arrive at the trauma room.

Every in situ training lasted about 20–25 minutes and was ended by the facilitator, usually when the patient was ready to be moved to receive further care.

The debriefing phase began immediately after the facilitator ended the scenario phase. The facilitator asked participants to describe their feelings as well as their own performance according to the learning aims set forth during the introduction phase (Dieckmann *et al.*, 2009). The debriefing discussion lasted about 1 hour.

Data collection and analysis methods

The data were collected with nonparticipant observations during 14 two-hour trauma simulation trainings. Nonparticipant observation does not include researchers' participation in the practices on site, and does not aim to check a list of predetermined behaviors or elements of the context, but to gain a holistic view of reality and to obtain realistic data containing detailed descriptions of people, communication, context, physical environment, time and events (Mullhall, 2003). This is in line with understanding leadership in a trauma team as a practical, sociomaterial and contextual phenomenon (Endrissat and van Arx, 2013; Hawkins, 2015; Raelin, 2011). The researchers focused on the practices and social relations within the trauma team, as well as the objects and artefacts that were physically or mentally present in the situation and the hospital context in which they work (Raelin, 2016).

Nonparticipant observations were conducted by two researchers. Formal research approvals to study in situ simulation trainings were applied for and granted by the hospital's medical director. Permission to observe the in situ simulation trainings was also obtained from the doctor responsible for organizing them. As the participants of the trainings changed every session, the researchers introduced themselves and described the project and the themes of their study at the beginning of each training. The researchers were allowed to make written field notes, but not to record video, record audio or take photographs. Aiming to minimize harm and disturbance on site, the researchers stood quietly in the corner of the trauma room (Murphy and Dingwall, 2001), writing field notes of structural and contextual features, of all team members equally and the dialogue, resulting a chronological diary of events describing what was seen, heard and experienced (Jarzabkowski *et al.*, 2014;; Murphy and Dingwall, 2001; van Maanen, 2011). Despite this sensitivity, researchers being present during the simulation trainings may, however, have had an impact on the practices observed, and therefore, longitudinal data

collection was considered important to strengthen the validity of research (Cresswell and Miller, 2000; Kempster *et al.*, 2016).

In total, two researchers yielded 53 pages of handwritten field notes, two to four pages per training per researcher. The notes were transcribed shortly after each training to ensure that nothing was lost to memory. Following Jarzabkowski *et al.* (2014), field notes were then turned into ethnographic text to provide evidence in the field. First, the field notes were made readable and comprehensible by eliminating grammatical shortcuts and explaining acronyms. Next, the transcriptions were read and the simulation training recalled and reflected upon; detailed text explanations substituted for the lack of video and audio data, and were used to describe emotional reactions to the trainings. Finally, the data were linked to the theoretical concepts under consideration in this study. This process turned the field notes into vignettes, which are portrayals of in situ trauma simulation trainings. The length of the vignette data is 10,980 words. An example of the analysis process of developing field notes into vignettes is presented in Table 1.

INSERT TABLE 1 HERE

There are reliability issues to consider in terms of data collection. The data were produced by two researchers on site; there were two mindsets and personal histories through which the practice was interpreted. As this is an ethnographic study, predetermined observation schemes were not used (Watson, 2011), and both researchers had an individual approach to interpreting the practice and recording it according to what was perceived to be meaningful for the study. Neither researcher has expertise in the field of health care. The researchers' ability to understand, for example, "silent knowledge," specific details of the team members' roles, the organizational culture of the hospital and generally, the field of health care is very limited. The authors entered the field of study as outsiders. To achieve reliability of the research, two authors engaged in the field for 1 year, collaborated, negotiated differences in interpretations and aimed for thick and rich descriptions of practices in vignettes (Cresswell and Miller, 2000; Jarzabkowski *et al.*, 2014). Reliability of data is strengthened also through the participants' voice as the in situ simulation trainings included also the debriefing phase during which they verbalized their emotions, perceptions and experiences, and these did not have to be only interpreted by the researchers.

Throughout the process of writing field notes into vignettes, a particular focus was on protecting participants' identities. Identifying information was removed, and pseudonyms are used to refer to participants. In addition, some non-relevant details were altered (Murphy and Dingwall, 2001). For example, the in situ trainings were numbered, but not according to their chronological order. As the study did not follow simulation trainings of one trauma team during the 13-month period, but those of 14 unique teams, the order of trainings is irrelevant regarding the analysis or results. Instead, it makes identifying participants more difficult.

The analysis process was informed by cultural-historical activity theory (CHAT; Engeström, 2001), as suggested by Kempster *et al.* (2016). CHAT perceives practice as intertwined with socio-cultural and historical context and mediated with physical and mental artefacts and thus has similar theoretical premises as the LAP (Crevani *et al.*, 2010; Crevani and Endrissat, 2016; Raelin, 2016) and socio-material (Hawkins, 2015; Orlikowski, 2007; Sergi, 2016) perspectives. Thus, CHAT serves the aim of discovering how leadership emerges in a hospital's trauma team during in situ simulation training as a collective activity, and how different elements of the system contribute to the emergence of leadership (Figure 1).

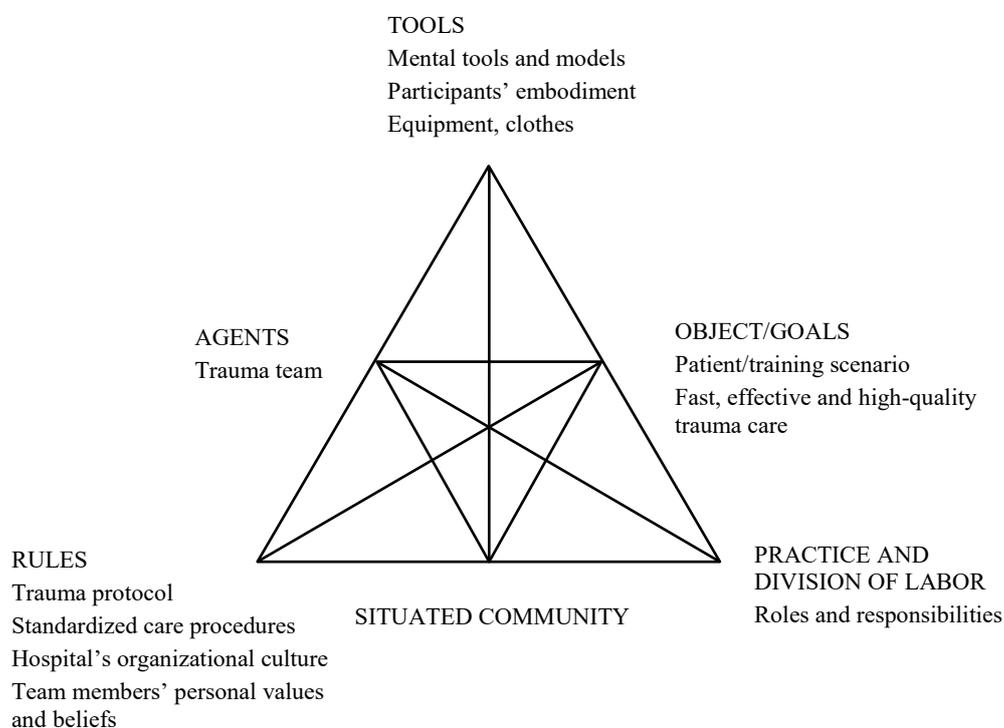


Figure 1. Activity system of trauma leadership as practice

Doctors and nurses who operate as members of a trauma team carry with them their history, lived experience as medical professionals, as well as values and opinions concerning trauma care. They work in a hospital with a unique organizational culture and are accustomed to perceiving their roles and division of responsibilities in a certain way. In this case, they are also aware that this is a training, not a real case. The patient requiring care is always unique, and the injuries—in this study, the patient simulator and the scenario designed for the in situ trainings—determine the starting point for the team's work. The trauma room is real, and designed and equipped to provide a space in which only the most severely injured patients are treated. The team shares the common goal of treating the patient as fast and efficiently as possible according to the trauma protocol. The pattern is transformed over time and through the adoption of new elements that collide with the existing ones (Engeström, 2001; Kempster *et al.*, 2016; Raelin, 2011).

The elements of CHAT yield the units of analysis, which were coded in the vignettes at the beginning of the analysis process. To maintain richness of descriptions from the site (Jarzabkowski *et al.*, 2015; Van Maanen, 2011), notions of atmosphere and encountered challenges in practice were also coded. Qualitative analysis software NVivo was used in the analysis. The list of codes is available in Appendix 1, and it presents the corpus of evidence from which the ethnographic stories are yielded (Jarzabkowski *et al.*, 2014). After individual elements were identified in the vignettes, the dynamics between them were considered through the CHAT framework to see how leadership emerged through the flow of the teams' practices, the use of physical and mental artefacts, and how the team responded to the evolving course of practices in a sociomaterial context (Engeström, 2001; Kempster *et al.*, 2016).

Results

The analysis revealed three central aspects of the emergence of leadership during in situ trauma simulation trainings: a) fluent cooperation steered by the trauma protocol, b) breaches in practice and overcoming challenges, and c) changes in the protocol. The following detailed explanations of these aspects include direct quotes from vignettes written during the analysis process. Participants' names have been changed to protect their identities. In parentheses is the number of the simulation training.

Fluent cooperation steered by the trauma protocol and the plan of care

The trauma protocol appears to create the basic framework for the organization of a team's work, bringing together experts from different healthcare areas and creating a structure for task division within the team. Because team members are expected to be familiar with the protocol and their own roles on the team, these were not explained during the introductions to the simulation trainings. An exception was made if the trauma leader attending the simulation training was inexperienced in that position, in which case tasks and tools were introduced in more detail.

During the introduction, the facilitator talks about leadership and its meaning: "so that someone has control of things." The facilitator goes over the trauma leader's tasks: "talk out loud, make a plan, sum up." (T8)

The goal of cooperation among the members of trauma teams was not explicitly expressed during trainings, and seemed to be intrinsic; team members did not necessarily know the details of other members' tasks or how incoming information would affect their decision making. Each member had a cognitive aid card that listed their own tasks within the team but not that of the others.

The trauma leader says during the debriefing that this was the first time for him as a trauma leader. "The case felt realistic, but I do not know what the nurses' tasks are here." (T4)

Team members made their roles visible to others by writing their names on a board mounted on the rear wall of the trauma room that displayed a list of trauma team roles. The team donned vests, the color of which identified their role, which was also printed on the back. During the hectic, rapidly proceeding trauma situation, however, team members seemed to pay little attention to their surroundings, and it was not clear how significant the meaning of the vests or the board was for communication.

The trauma leader decides that a pleural drain needs to be used and gives an order by using the doctor-on-call's first name. The trauma leader observes the situation from the monitor. (T3)

According to the trauma protocol, the team leader's tasks are creating the team, building a strategy, and gathering and sharing information. The rest of the team is responsible for hands-on treatment. In practice, the ways in which trauma leaders acted and settled in that role varied

considerably, depending, for example, on their work experience and personality. In general, a clear care strategy seemed to facilitate the flow of process.

The trauma leader positions herself in front of the team standing in a semi-circle. She sums up the situation and gives orders. She looks directly to the team member she is speaking to. (T8)

In debriefing, the trauma leader says he tries to stay back, but it feels challenging for him not to participate in care procedures. (T13)

During the simulation trainings, and before the patient arrived, the trauma leader positioned himself or herself in the trauma room a few steps back from the foot of the patient's bed, observing, gathering information from the paramedics' and trauma nurses' reports. After the patient arrived, information was obtained from monitors attached to the patient and by listening to the communication among the team members during the care process. The rest of the team stood closer to the patient and moved around while carrying out procedures, asking questions and communicating the patient's status, and any changes in status, to the others. In debriefings, the nurses in particular emphasized the importance of structure and clarity during team operations. Clear and well-directed instructions and explicated work division would increase their efficiency; they would know when to wait for their turn and when to proceed. Ideally, the team leader would assess individual members' workloads and reassign tasks if needed, but in practice, the reassignment was sometimes decided by someone else.

The anesthesiologist says, "You take over his task and start assisting me with the intubation." (T9)

Maintaining a shared understanding of the status quo and using effective closed-loop communication strategies within the team were emphasized, as they would steer the practices and help to maintain a calm yet efficient atmosphere in the room. Closed-loop communication means that addresses should be kept short, calm and decisive, and aimed directly to a member of the team by using real names or role names. The recipient then closes the loop by acknowledging the message. This communication strategy was presented to the teams during the introduction of the simulation training, with the goal of ensuring that commands, requests and task assignments would not be left open ended.

Breaches in practice and responding to challenges

The difficulties experienced by teams in establishing and communicating a clear strategy and order of procedures seemed to create a trauma room atmosphere that was hectic and occasionally chaotic. The flow of practice was also affected by the clarity of the member's team role definition and an individual plan for carrying out his or her tasks. The ability of teams to practice and respond to challenges was tested, especially if the patient's condition changed so rapidly that the care strategy needed to be altered and communicated fast. At difficult moments, decisiveness seemed to be the most effective tool for maintaining further cooperation.

The trauma leader starts to act, but slowly and does not clearly assess the situation. Other team members are uncertain in their roles as well, the nurses are glancing at one another and searching for their place. The communication is not targeted; names are not used. The situation seems confusing. The team seems to be doing the right things, but not fast, and they are not communicated. Roles are unclear, and the trauma leader seems to find it hard to take his place. The anesthesiologist takes over and starts to give nurses orders and communicate to the trauma leader what she is doing. (T12)

To overcome difficult moments during the sometimes-challenging trauma care process, several established mental models seemed to help. The tools introduced at the beginning of each simulation training included "the 5-second rule" and the "take 10 know 10" rule. The first rule means that the trauma leader should take 5 seconds to briefly examine the status of the arriving patient, after which the paramedics can give their report. The second rule can be used at critical points when the team is not exactly sure how to proceed with the care; use 10 seconds to gather information, then think and decide what to do within the next 10 minutes.

The meaning of physical tools for flow of practice became evident when a procedure was tricky or involved a risk of failure. The focus of the whole team at such times seemed to be on the tool or artefact: if it should be used, if it is available, who should use it and when or how it should be used. Examples of such tools or artefacts were a stretcher, a cervical collar, intubation equipment and a pleural drain. Cooperation among team members was challenged in these moments as the decision how to proceed and determining the actual procedure to be used had to be made quickly. Although decision making was identified mostly as the trauma leader's task, the decision maker in these hasty situations was sometimes someone else.

During debriefing, the team has a discussion about decisions made. The facilitator asks, "Who decided that the patient stays on the stretcher?" The anesthesiologist responds, "I decided that. I thought it would be pointless to move the patient to bed and back to stretcher again as in cases

like this it is probable that the patient needs to be moved to another hospital due to an intracranial wound. Moving may also cause heavy bleeding.” The facilitator says, “I think it was a good assertive decision, and it took you forward.” (T1)

The reflective characteristic of trauma simulation training seems to provide participants with the opportunity for strategic development in trauma care and the creation of a shared understanding of variables of a complex situation.

The team discusses roles. It seems that the task division between the trauma leader and the doctor on call is not clear. This causes a lack of clarity also for nurses as they do not know with whom to communicate in different situations, who to address. Someone says that if something is unsure, one has to ask, to communicate and not just settle with a messy situation. It is concluded that simulation trainings seem to help considering the multiple aspects in trauma care. (T2)

This kind of discourse occurred especially during the debriefing discussions after each simulation training. Viewpoints from different fields of medicine were discussed, and the members of the trauma teams were able to learn from each other. It seemed at times that these discussions were dominated by doctors, who engaged in discussions of certain procedures, and how they should be carried out in a trauma case.

Developing the protocol and the practice

Although the trauma protocol clarifies the trauma leader’s role as the head of the trauma team, it also states that the order of examination and the care process can be negotiated with an anesthesiologist. In practice, various social and contextual factors seemed to affect this decision making. For example, if the trauma leader was inexperienced, the anesthesiologist seemed occasionally to have the main responsibility of leading the team. If the trauma leader was highly experienced, for example the shifting of leadership role between the two was sometimes verbalized during the process:

The trauma leader is discussing the patient’s condition with the anesthesiologist and uses the closed-loop communication protocol by making defining and confirming questions: “Did you say that...” The trauma leader sums up the situation, calls the anesthesiologist by her name and asks, “Claire, should we intubate?” The anesthesiologist looks at the trauma leader, nods and responds, “Yes.” The trauma leader raises his voice a little bit to address the whole team, “OK, the trauma leadership transfers to Claire.” The anesthesiologist starts to assign tasks to nurses. (T3)

The idea of transferring leadership from a trauma leader to an anesthesiologist arose in some debriefing sessions. In complicated cases, it was considered helpful if the trauma leader could participate in care; however, leadership should be transferred to the anesthesiologist in such a way that the entire team is aware of the change.

The trauma protocol does not define the role of paramedics during trauma care. Their task is to deliver the patient to the hospital, after which they are free to leave. However, if they are not dispatched on another call, they would be available to assist. As paramedics cannot leave before the patient is moved from a stretcher to a bed, they usually stand and wait at the back of the room. The possibility of assigning some tasks to paramedics, such as documenting the care process, was discussed several times during the trauma simulations.

The paramedics reflect on their role during training, "I didn't really know whether or not to be active." The facilitator responds, "Let's stop here for a while. I see the paramedics' role as an active one, even proactive." (T11)

As the 13 months of data collection proceeded, the simulation trainings yielded changes in the trauma protocol and the physical environment of the trauma room. Some task divisions were reorganized. The trainings revealed, for example, that some nurses had too many responsibilities assigned to them, and there were others who could help. As there is limited space in the trauma room, team member positions within the room were also considered, which resulted in the need to make some rearrangements.

We enter the trauma room before the training starts. There is now a new, big digital display mounted on the wall that presents the patient's vital information. The display is positioned on an angle above the patient so it can be seen everywhere. New cognitive aid cards concerning the tasks and duties of trauma team members have been made available to doctors and nurses to carry in their pockets. The facilitator notes that there have been some changes in how tasks are divided among some nurses, and that the room has been equipped and rearranged accordingly. For example, medications have been moved to another side of the room and there are some new cupboards and shelves on the wall. (T6)

From the LAP perspective, leadership seems to emerge during care processes when any team member treating the patient leads by *acting* in that specific moment. The entire material environment of a trauma room is seamlessly part of the practices.

The trauma leader instructs, "Next, listen to the heart rate." Team members are working effectively, constantly verbalizing what they are doing: "Can someone open an IV line?" "Yes,

I did it already.” The anesthesiologist starts to lead the care. He is telling everyone what is going on, what he is doing and what the others should do. The trauma leader follows the situation closely in the background, ready to participate if needed. He is the leader of the entire team, but reality dictates that someone else lead the practical operations. (T7)

In this sense, trauma leadership is intertwined with practices and care processes. According to the trauma protocol, it is a designated role within a team and at the same time a practice that emerges on a micro-level through actions directed by the trauma protocol, team members' expertise and the objectives of trauma care. Leadership stems from having initiative, which is required of trauma team members; a multitude of tasks and duties are carried out simultaneously in a complex situation. The tools contribute to leadership through those with the knowledge and skills to use them. They can act on their own initiative toward a common goal and if needed, take the lead of a practical operation.

Discussion and conclusions

A hospital's trauma team is unique and striving to attain the goals presumes multiple operations to be carried out simultaneously (Berlin and Carlstöm, 2008; Paquin *et al.*, 2018). According to this study, leadership in the trauma team during in situ simulation training seems to emerge from this complex system of agencies. Contextual elements (such as various tools, the trauma protocol and the role divisions described and defined within it) contribute to the goal. Leadership agency was apparent when team members acted independently in their professional roles, carried out their tasks and participated in multi-professional discourses before, during and after the care process, but also when they stayed back, waited their turn and kept quiet (Hawkins, 2015; Salovaara and Bathurst, 2016). Mental models seemed to help at the intersection of theory and practice by allowing the team to take the time necessary for tacit knowledge to surface or to make explicit theories accessible (Raelin, 2011). This confirms previously reported results (Meier, 2015), according to which leadership practices are context-dependent and embedded in clinical work that is a mix of shared and individual forms of practice and other activities. According to Meier (2015, 1127), relational practices ensure the coordination and flow.

In the in situ trauma simulation training, clarity of roles and task division, decisiveness at critical points, active communication and maintenance of the closed-loop communication protocol helped overcome difficulties. Paquin *et al.* (2018, 122) argue likewise that in crisis

medicine the overall management of the team is needed in difficult, complex situations, but in individual, concurrent treatments, leadership seems to be distributed. The meaning of artefacts for emergent leadership in the in situ trauma simulations seemed to be central. Skills and knowledge needed in using medical equipment seemed to produce operational leadership, and the body and positioning in the trauma room made roles within the team visible. Agency manifested in the use of material artefacts, and at times, they seemed to steer the process forward (Sergi, 2016). Materiality is rarely addressed in studies on leadership (Sergi, 2016, 239), but this study suggests acknowledging it, particularly in studies carried out in materially rich contexts, such as hospitals.

According to Raelin (2011), a core characteristic of the LAP perspective is to orchestrate possibilities for developing leadership through collaborative learning. This is also the heart of in situ simulation training, and the meaning of debriefings following each training is considered particularly important (Dieckmann *et al.*, 2009, 287). This study provides implications for developing medical simulation training in the future and highlights the importance of developing non-technical skills (see also Paquin *et al.*, 2018). There are firmly established protocols and procedures in trauma care, and developing teams' operations takes time and effort (Berlin and Carlström, 2008). Through considering trauma care from multiple perspectives, and verbalizing existing structures that may seem axiomatic, participants have a possibility to learn to test their mental models and assumptions about the trauma team's operation, and reflect upon their work and the environment through intertwining sociomaterial and practical perspectives (Endrissat and von Arx, 2013; Fenwick, 2010, 2014; Orlikowski, 2007; Schatzki *et al.*, 2001). Regular trauma simulation training seems vital, as it provides an effective platform for developing trauma care through repeated practice and inter-professional discourse (see also Fenwick, 2014; Paquin *et al.*, 2018). The challenge for educators is to facilitate learning and development that requires the commitment of all participants equally, regardless of their position in the hospital hierarchy (Dieckmann *et al.*, 2009).

Conducting research through ethnographic nonparticipant observations of in situ simulation trainings provided an opportunity to approach leadership in a setting that was as close to natural as possible, without compromising patient safety. It is critical to understand, however, that simulated situations are true but not real. The team members may not have experienced the simulation training as a real case, and this may have affected how they acted in practice.

An ethnographical study does not aim to yield generalizable results and the research setting limited the possibilities for theory building. The research was conducted in one country and one hospital, which can be perceived as a limitation regarding the call for variety in research sites that enable theory building (Kempster *et al.*, 2016). The results suggest possible aspects to consider in leadership research in other high-intensity and complex contexts, but with careful consideration as the urgency, unpredictability and the cultural features in the trauma care setting highlight the contexts' special nature. The hospital has its own history, culture and ways of working, and the researchers entered the site from outside. The results cannot be attached to a single trauma team's simulation training, but come from an entity of 14 trauma simulation trainings that link inextricably to a place and a period of time in history. Thus, the research setting cannot be repeated. The study can be seen as a step toward theorization, which aims to outline abstract explanations of trauma leadership from a practical perspective. As research-based knowledge accumulates in the future, these reflections may come closer to the reality of practitioners, and the theory can be perceived as having practical adequacy. (Kempster *et al.*, 2016).

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Table 1. An example of elaborating field notes into a vignette

<p><i>Field notes</i></p> <p>An emergency section > tension, quiet discussion. [...] PM arrive, start reporting > TL touches and interrupts 'Wait a minute' > 5s-rule 'Ok, now you can report' > report</p>
<p><i>Vignette</i></p> <p>The atmosphere in the trauma room is very tense. Everybody looks serious and all are speaking quietly while getting ready to start the training. An emergency section alarm has been called out and the team seems to be a bit nervous as to how things will turn out. [...] Team members quietly await the arrival of the trauma patient, most of them bracing against tables or walls. The paramedics arrive in a hurry with the patient lying on a stretcher. One of the paramedic nurses starts giving the report immediately, still walking, as they enter the trauma room. The atmosphere in the trauma room becomes even more tense as the doors open. Everybody gets ready to act by stepping forward and by assuming their positions around the stretchers in the trauma room. The orthopaedic surgeon, acting as the trauma leader, has been standing by the door but now takes a few steps forward, following the paramedics further into the room. He interrupts the paramedic nurse giving the report by seizing his shoulder kindly from behind and saying 'Wait a minute'. The paramedic nurse stops talking and turns to look at the trauma leader, who checks the patient's condition by following the five-second rule. The trauma leader checks the patient's heart rate and breathing. He touches the patient on the shoulder and checks to see if he is conscious: 'Hey, are you awake?' The patient responds by moaning. He also makes sure there are no heavily bleeding massive wounds. The trauma leader then turns to the paramedics, looks directly at them, nods slightly and says: 'Ok, now you can report.'</p>

Appendix 1. The coding scheme

Division of work/ practices	create a strategy (65), ask (60), order (36), guide (25), summarize the situation (25), discuss (17), answer (16), call colleague by title (12), arrive (10), call colleague by first name (7), listen (6), stand (6), gather the team (5), look (5), call colleague without using title or first name (4), address the patient (4), move something (4), inspect (4), prepare (4), move oneself (4), observe (4), touch (2), greet (2), externalize an error (1)
Tools	official VIRVE radio (31), report (22), 5-s rule (15), name board (15), medication (13), vest (12), closed-loop protocol (12), trauma room (12), intubation equipment (11), pleural drain (11), pelvic stabilization device (10), trauma alarm (9), bed (9), blood (9), tourniquet (9), paramedics' alarm (9), ABC protocol (8), vacuum mattress (8), IV line (7), stretcher (6), monitor (5), 10-s-10-min (3), cervix collar (3), ultrasound (3), x-ray (3), laboratory test results (2), lead vest (2), arterial cannula (2), sphygmomanometer (2), task card (2), battery (1), stethoscope (1), intraosseous needle (1), phone (1)
Rules	trauma protocol (9), deviating from trauma protocol (13)
Subject/team	trauma leader, anesthesiologist, anesthetic nurse, trauma nurse, doctor on call, laboratory nurse, radiologist, radiology nurse, porter
Community	paramedics, hospital unit, doctor on call
Object/goal	patient simulator/high-quality trauma care according to trauma protocol
Challenges	unclear of the plan of action (15), flaw in communication (12), lack of knowledge (6), technical problem (6), lack of skill (3), problem with the trauma room (2), challenge with time (2)
Atmosphere	vivid (6), messy (5), peaceful (4), tensed (2), hasty (3), nervous (2), confused (1), idleness (1), concerned (1), chaotic (1)