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Negotiated knowledge positions - communication in trauma teams

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*Now this is not the end.
It is not even the beginning of the end.
But it is, perhaps, the end of the beginning.
Winston Churchill*

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Abstract

Background Within trauma teams, effective communication is necessary to ensure safe and secure care of the patient. Deficiencies in communication are one of the most important factors leading to patient harm. Time is an essential factor for rapid and efficient disposal of trauma teams to increase patients' survival and prevent morbidity. Trauma team training plays an important role in improving the team's performance, while the leader of the trauma team faces the challenge of coordinating and optimizing this performance.

Aim The overall aim of this thesis was to analyse how members of trauma teams communicated verbally and non-verbally during trauma team training in emergency settings, and how the leaders were positioned or positioned themselves in relation to other team members. The aim was also to investigate the use of a communication tool, closed-loop communication, and the time taken to make a decision to go to surgery in relation to specific factors in the team as well as the leader's position.

Methods Eighteen trauma teams were audio and video recorded and analysed during regular in situ training in the emergency room at a hospital in northern Sweden. Each team consisted of six participants: two physicians, two nurses, and two enrolled nurses, giving a total of 108 participants. In Study I, the communication between the team members was analysed using a method inspired by discourse psychology and Strauss' concept of "negotiated orders". In Study II, the communication in the teams was categorized and quantified into "call-outs" and "closed-loop communication". The analysis included the team members' background data and results from Study I concerning the leader's position in the team. Poisson regression analyses were performed to assess closed-loop communication (outcome variable) in relation to background data and leaders' position (independent exploratory variables). In Study III, quantitative content analysis was used to categorize and organize the team members' positions and the leaders' non-verbal communication in the video-recorded material. Time sequences of leaders' non-verbal communications in terms of gaze direction, speech time, and gestures were identified separately to the level of seconds and presented as proportions (%) of the total training time. The leaders' vocal nuances were also categorized. The analysis in Study IV was based on the team members' background data, the results from Study I concerning the leader's position in the team, and the categorization and quantification of team communication from Study II. Cox proportional hazard regression was performed to assess the time taken to make a decision to go to surgery (outcome variable) in relation to background data, the leader's position, and closed-loop communication (independent variables).

Results The findings in Study I showed that team leaders used coercive, educational, discussing, and negotiating repertoires to convey knowledge and create common goals of priorities in work. The repertoires were used flexibly and changed depending on the urgency of the situation and the interaction between the team members. When using these repertoires, the team leaders were positioned or positioned themselves in either an authoritarian or an egalitarian position. Study II showed that closed-loop communication was used to a limited extent during the trauma team training. Call-out was more frequently used by team members with

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eleven or more years in the profession and experience of trauma within the past year, compared with team members with no such experience. Scandinavian origin, an egalitarian team leader and previous experience of two or more structured trauma courses were associated with more frequent use of closed-loop communication compared to those with no such origin, leader style, or experience. Study III showed that team leaders who gained control over the “inner circle” used gaze direction, vocal nuances, verbal commands, and gestures to solidify their verbal messages. Leaders who spoke in a hesitant voice or were silent expressed ambiguity in their non-verbal communication, and other team members took over the leader's tasks. Study IV showed that the team leader's closed-loop communication was important for making the decision to go to surgery. In 8 of 16 teams, decisions on surgery were taken within the timeframe of the trauma team training. Call-outs and closed-loop communication initiated by the team members were significantly associated with a lack of decision to go to surgery.

Conclusions The leaders used different repertoires to convey and gain knowledge in order to create common goal in the teams. These repertoires were both verbal and non-verbal, and flexible. They shifted depending on the urgency of the situation and the interaction within the team. Depending on the chosen repertoire, the leaders were positioned or positioned themselves as egalitarian and/or authoritarian leaders. In urgent situations, the leaders used closed-loop communication as part of a coercive repertoire, and called out commands and directed requests to specific team members. This repertoire was important for making the decision to go to surgery; the more closed-loop communication initiated by the leader, the more likely that the team would make a decision to go to surgery. Problems arose if the leaders were positioned or positioned themselves as either an authoritarian or an egalitarian leader. The leaders needed to be flexible and use different repertoires in order to move the teamwork forward. It was notable that higher numbers of call-outs and closed-loop communication initiated by the team members decreased the probability of making the decision to go to surgery.

Keywords: communication, discourse psychology, ideological dilemma, interpretative repertoires, leadership, non-verbal communication, position, power, team work, time, trauma team, trauma team training, silence.

Svensk sammanfattning

Bakgrund I traumateam är effektiv kommunikation nödvändig för att garantera ett säkert och tryggt omhändertagande av patienten. Brister i kommunikationen har identifierats som en av de viktigaste faktorer som leder till patientskada. Tiden är en viktig faktor för ett snabbt omhändertagande och för att öka traumapatientens chans till överlevnad och förhindra morbiditet. Traumateamsövningar är viktiga för att förbättra traumateamets samarbete, det är därför en utmaning för ledaren att samordna och optimera traumateamets prestationer.

Syfte Det övergripande syftet med denna avhandling var att analysera hur deltagare i traumateam kommunicerade verbalt och icke-verbalt under traumateamsövning vid akut omhändertagande, samt hur ledarna positionerade sig eller blev positionerade i teamet i förhållande till andradeltagare. Syftet var även att undersöka om och i så fall hur kommunikationsverktyget closed-loop communication användes samt tid till fattat beslut att gå till operation i förhållande till specifika faktorer i teamet och ledarens position.

Metod Arton in-situ traumateamsövningar spelades in med ljud- och videoinspelningarna på akutmottagningen vid ett sjukhus i norra Sverige och analyserades. Varje team bestod utav 6 deltagare: två läkare, två sjuksköterskor samt två undersjuksköterskor. I de arton teamen, totalt 108 deltagare. I delstudie I analyserades kommunikationen emellan deltagarna i teamet inspirerat av diskurspsykologi och Strauss begrepp "negotiating orders". I delstudie II kategoriserades och kvantifierades kommunikationen i relation hur teamet använde "call-out" och "closed-loop communication". I analysen inkluderades teamdeltagarnas bakgrundsdata samt resultat från studie I beträffande ledarens position i teamet. Poisson regression analys utfördes för att analysera "closed-loop communication" (utfallsvariabel) i förhållande till bakgrundsdata samt ledarskapsstil (oberoende variabler). I delstudie III användes kvantitativ innehållsanalys för att kategorisera och organisera teamdeltagarnas positioner och ledarnas icke-verbala kommunikation i det video-inspelade materialet. Ledarnas icke-verbala kommunikation såsom; blickriktning, taltid och gester identifierades var för sig i sekunder och presenterades i proportion (%) av tiden för traumateamsövningen. Även ledarnas röstnyanser kategoriserades. Analysen i delstudie IV baserades på teamdeltagarnas bakgrundsdata, resultat från studie I beträffande ledarens position och teamets kommunikation som kategoriserats och kvantifierats i delstudie II. Cox proportionella hazard regression användes för att analysera tid till fattat beslut till operation (utfallsvariabel) i förhållande till bakgrundsdata, ledarens position i teamet och "closed-loop communication" (oberoende variabler).

Resultat Delstudie I visade att ledarna i traumateamet använde tvingande, undervisande, diskuterande och förhandlande repertoarer för att förmedla kunskap och skapa gemensamma mål för prioriteringarna i arbetet. Repertoarerna användes flexibelt och skiftade beroende på hur akut situationen var samt hur teamdeltagarna interagerade. Genom att använda dessa repertoarer, blev ledaren positionerad eller positionerade sig som auktoritär eller jämlik ledare i teamet. Delstudie II visade att closed-loop communication användes i en begränsad

omfattning under teamövningen. Call-outs utfördes oftare av teammedlemmar med elva eller fler år i yrket samt de med erfarenhet av trauma det senaste året, jämfört med medlemmar utan sådan erfarenhet. Skandinaviskt ursprung, ledare i en jämlik position och erfarenhet av två eller flera strukturerade traumakurser var förknippat med en mer frekvent användning av "closed-loop communication" jämfört med dem utan sådan bakgrund, position i teamet eller erfarenhet. Resultatet i delstudie III visade att de ledare som hade tillgång och kontroll i den inre cirkeln använde blickriktningar, intonationer, verbala kommandon och gester för att stärka sina budskap. När ledare talade tvekande eller var tysta uttryckte de en otydlighet i sin icke-verbala kommunikation och andra deltagare tog över ledarens arbetsuppgifter. Delstudie IV visade att ledarens "closed-loop communication" var viktig för att snabbare komma till beslut att gå till operation. Åtta av 16 team tog beslut att gå till operation inom tidsramen av traumateamsövningen. "Call-out" och "closed-loop communication" som initierades av teammedlemmar minskade däremot sannolikheten att ta beslut att gå till operation.

Konklusion För att förmedla och tillvarata kunskap i teamet använde ledarna olika repertoarer för att skapa gemensamma mål. Repertoarerna var både verbala och icke-verbala samt flexibla. Ledarna använde dem beroende på hur akut situationen var och för att tillvarata teamdeltagarnas kunskap samt föra arbetet framåt. Utifrån vald repertoar positionerade sig ledaren eller blev positionerad som jämlik eller auktoritära ledare. I akuta situationer använde ledaren en tvingande repertoar, genom att ge ordinationer med hjälp av closed-loop communication eller riktade frågor till särskilda teamdeltagare. Därmed kunde ledaren positionera sig eller blev positionerad i en auktoritär position. Teamledarens closed-loop communication var viktig, ju fler closed-loop communication som initierades av ledaren desto högre sannolikhet att beslut att gå till operation skulle tas inom ramen för teamövningen. Problem uppstod om ledarna positionerade sig eller var positionerad antingen som auktoritär eller jämlik ledare. För att föra arbetet framåt behövde ledarna vara flexibla och använda olika repertoarer. Viktigt att notera var att antalet call-out och closed-loop communication initierade av teammedlemmar minskade sannolikheten att ta beslutet att gå till operation.

Nyckelord diskurspsykologi, icke-verbal kommunikation, ideologiskt dilemma, kommunikation, ledarskap, makt, position, teamarbete, tid, traumateam, traumateamsövning, tolkningsrepertoarer, tystnad.

Abbreviations

ATLS	Advanced Trauma Life Support
CB	Check-back
CI	Confidence Interval
CLC	Closed-loop communication
CO	Call-out
CRM	Crisis Resource Management
ENPC	Emergency Nursing Pediatric Course
HR	Hazard Ratio
ISS	Injury severity score,
NSS	Nordic Safety and Security
PHTLS	Pre-Hospital Trauma Life Support
RR	Risk Ratio
SBAR	Situational, Background, Assessment, Recommendation
TCU	Turn-Constructional Unit
TNCC	Trauma Nursing Core Course
WHO	World Health Organization

Original papers

This thesis is based on the following publications and manuscript, which are referred to in the text by their Roman numerals:

- I Jacobsson M, Härgestam M, Hultin M, Brulin C.
Flexible knowledge repertoires: communication by leaders in trauma teams.
Scand J Trauma Resusc Emerg Med. 2012 Jul 2;20:44

- II Härgestam M, Lindkvist M, Brulin C, Jacobsson M, Hultin M.
Communication in interdisciplinary teams: exploring closed-loop communication during in situ trauma team training.
BMJ Open. 2013 Oct 21;3:10

- III Maria Härgestam, Magnus Hultin, Christine Brulin, Maritha Jacobsson.
Trauma team leaders' non-verbal communication: video registration during trauma team training.
Submitted for publication

- IV Maria Härgestam, Marie Lindkvist, Maritha Jacobsson,
Christine Brulin, Magnus Hultin.
Trauma teams and time to early management during in-situ trauma team training.
Submitted for publication

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Original papers

Introduction

This thesis highlights two of the core competences in nursing: collaboration in team work, and ensuring patients' safety (1, 2). Communication is one of the most important factors contributing to errors in health care (3, 4), and efforts have been made to minimize the risk of injury as a result of miscommunication. Teamwork is an essential part of preventing critical incidents and errors (5-7), and nurses are an important part of the team through their involvement in clinical care including the effective communication, leadership, and teamwork that ultimately enables quality patient care (8, 9). Studies have shown that miscommunication within the interdisciplinary team leads to errors and mishaps that cause patient injury and extended suffering (10-14). It is therefore important for the trauma team to train in an authentic setting without causing patient injury.

In this thesis, 18 trauma teams were studied and analysed during trauma team training in emergency settings. During this training, efforts were made to construct scenarios that were as authentic as possible in order to improve the team members' skills with respect to realistic trauma situations. When a severely injured trauma patient arrives at the emergency room, the trauma team is called in to take care of them. Generally, the team members work in different departments; they are reached by a call, and then congregate at the emergency room. The close collaboration between the team members in the emergency room can be described as a "dance" (15, 16). The leader chooses the music and the tempo, and may also choose their partner: the registered nurse, the registered nurse anaesthetist or the anaesthesiologist. As in a dance, it is important to take the right position, to know who the leader is, and coordinate the timing to take the right steps. The leader's communication, both verbal and non-verbal, is of importance in making the dance go smoothly. In this complex dance, toes can be stepped on, which may contribute to conflicts. The leader of a trauma team plays an important and decisive role in the team's performance. The hospital's standard operation procedure describes the team members' roles and tasks (Appendix). The team members – physicians, nurses and enrolled nurses – are all expected to participate in the decisions and contribute to the team's collaboration, even though there is one leader who has the

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main responsibility. As well as completing their own tasks, they must also have knowledge of the other members' tasks in order to perform effectively with the best interests of the patient in mind. It is a prerequisite of the hospital's standard operation program that the tasks are communicated efficiently and the common goal is prioritized. An overarching question that I ask in this thesis is: what is effective communication in trauma teams, and how do team leaders communicate in emergency settings?

Background

Trauma is a global health problem. It can be defined as “an injury or wound to a living body caused by the application of external force or violence” (17). Globally, about 10% of the 53 million deaths that occurred in 2010 were related to trauma, and trauma also caused a significant number of temporary or permanent disabilities due to the traumas (18). In the western world, trauma is the leading cause of death among people aged 45 years and under (19). In Sweden, trauma occurs relatively infrequently. About 4000 people die annually due to trauma (20) so health care personnel generally, lack experience in taking care of patients suffering from major trauma (21). The introduction of trauma teams in the United States in the late 1970s was found to reduce the overall trauma mortality at hospitals with trauma centres, and to increase the survival at “regular” hospitals (22-25). In Europe, these teams were introduced a decade later with similar results (26, 27). The objective of trauma team is to reduce the time taken to diagnose of life-threatening injuries by rapidly identifying and assessing the extent of the injuries and developing a plan for definite treatment (28, 29). By coordinating a rapid standardized assessment and initiating early treatment of seriously injured patients, the extent of the damage and the mortality rates are described to be reduced (30, 31). The team in focus in this thesis is the trauma team, which has also been described as action team (32, 33).

Nationally and internationally, failures in communication have been recognized to be the most important factor leading to patient harm (3, 4). Errors in communication have been found to occur in more than 50% of trauma resuscitations (34). My point of departure is that, as earlier researchers have found, effective communication is crucial for the patient’s survival in order to minimize the damage due to the injuries (35-38). Effective communication is primarily described as an exchange of information between sender and receiver (39, 40). Risk factors for unsafe, unsecure and failed communication include external conditions such as ringing telephones and alarm from equipment (37, 41), interruptions, multitasking (36, 37, 42), and stress and long working hours (43-46). My point of view is that communication is more complex than all this, and is

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probably also influenced by gender, ethnicity, and earlier educational experience; these factors therefore have to be taken into consideration when evaluating trauma team training. Furthermore, hierarchies and culture within the organization as well as the structure of the organization are also likely to influence the communication in teams (47, 48). In order to gain a deeper understanding of what effective communication can be, this thesis uses different theoretical and methodological perspectives.

Communication in trauma teams

Efforts have been made to implement communication tools in health care organizations to ensure safe communication. One such tool is Situational, Background, Assessment, Recommendation (SBAR) (49), which underlines the importance of sharing a common mental model in communication, and standardizing the handover. The World Health Organization (WHO) has also developed a checklist to clarify and systematically check that tasks of importance are completed before surgery; the WHO Surgical Safety Checklist First Edition (50). In these models, communication is viewed as transmission of information from a sender to a receiver (cf.(40)). Closed-loop communication (CLC) is another communication model that trauma teams are recommended to use during team training (51, 52). CLC is standardized communication in which feedback is important to ensure safer communication within a team. These communication models does not take into consideration other factors that also may effect communication such as gender, ethnicity, and earlier educational experience. It involves three steps: first, call-out (CO), where the sender initiates a message: second, check-back (CB) or read-back where the receiver interprets the message and acknowledges its receipt: and third, CLC, where the sender ensures that the intended message was received and correctly interpreted (53, 54) (Figure 1).

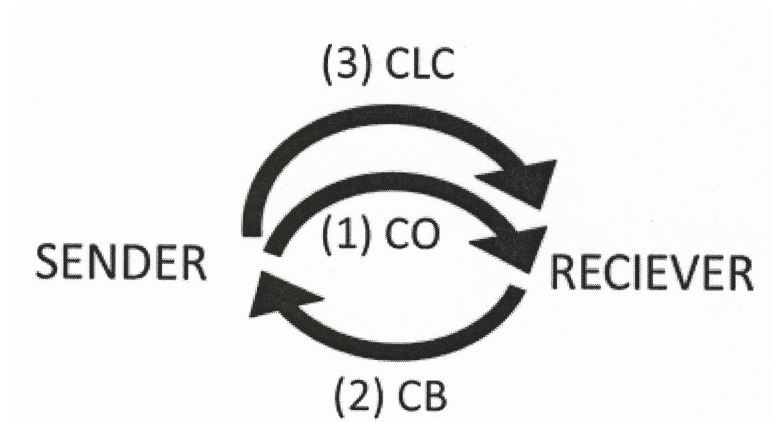


Figure 1. Description of closed-loop communication (CLC). (1) Call-out (CO): the sender transmits the message. (2) Check-back (CB): the receiver acknowledges the message. (3) CLC is achieved as the sender verifies that the message has been interpreted correctly (55).

As earlier researchers have noted, verbal communication cannot be studied in isolation from non-verbal communication, since both play an important role in social interaction (56). Jones and LeBaron (57) highlights that it makes no sense to speak of verbal and non-verbal communication according to Kendon, there is only communication.

Time is a crucial factor that limits the team’s performance, since it affects the outcome for the critically injured patient (30). The efficacy of the team’s performance the first hour following the trauma – “the Golden Hour” – is of importance in order to minimize the extent of the patient’s injuries. The concept is based on experiences from the First World War. The Golden Hour provides a timeframe for the medical team around the severely injured patient to complete their assessment and initiate the treatment; the time spent on this should be as short as possible (58). Space also influences the trauma team’s performance (59). The space in this thesis is the emergency room, a distinct spatial place where the team members are gathered. It is also a space where social relations and identities are created and subsequently influence the way people communicate (60, 61).

Since space and time are central to the trauma team’s performance, I have used time-geography as a frame in this thesis. Time-geography is an approach rather

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than a theory; it originates from regional-geography, and describes ongoing processes taking place in space and time (61). Space and time are limited resources that provide a framework/structure for the team members' performance. To emphasize that space and time are two inseparable dimensions in everyday life, Hägerstrand developed the concept of *space-time* (62). The terms "space-time" and "time-space" are used interchangeably (cf.(60, 63)), and in this thesis I will use "space-time". Analysing the team members' communication allows the researcher to study possibilities as well as constraints in space and time at an individual level (61).

Constraints in communication

Hägerstrand describes three types of constraints: authority, coupling, and capability. These constraints affect individuals' movements in space and time to greater or lesser degrees (63). The constraints influence everyday life (61) and may differ between individuals; they both set limits to and provide opportunities for the individual. They are all intertwined, and so it may be difficult to describe them separately. Constraints have been studied and developed in various contexts including women's health: awareness, possibilities, and power (64), power relations in gendered spaces (65) and marginalized groups such as drug addicts and intellectually disabled peoples' possibilities to seize, or to be given a place (60). However, to my knowledge constraints have never previously been studied in the context of trauma teams.

Within the medical discourse, decisions and recommendations should be grounded on evidence-based knowledge. Patients are often described by professionals as "intellectual problems" (66-68). In order to optimize patient safety, it is necessary to pay attention to recommended communication tools based on the assumption that safe communication is achieved by standardized and structured communication (49-51). The communication tool, CLC, was developed in the context of aviation (53, 69). Implementing communication tools from aviation into medical contexts can provide positive outcomes, but can also constrain communication in trauma teams. Trauma teams' communication can be

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discussed in terms of the three different constraints mentioned above: authority, coupling, and capability constraints.

Authority constraints

The team members' tasks are performed systematically and standardized according to Advanced Trauma Life Support (ATLS) guidelines for early identification of the patient's injuries and resuscitation (58). ATLS offers fundamental knowledge of trauma and skills training, and guides the physicians in their initial assessment and management in trauma care. By coordinating an early identification of life-threatening injuries and treatment of the seriously injured patients, time to early management is important in order to reduce morbidity and/or mortality (30, 70). The program has also been established in the nursing context as the Trauma Nursing Core Course (TNCC) (71), to enhance nurses' ability to assess a patient's response to trauma. ATLS guidelines have also been designed for nurses in prehospital care, where they are known as Prehospital Trauma Life Support (PHTLS) (72), and for children, as the Emergency Nursing Paediatric Course (ENPC) (73).

Aside from ATLS and the hospital's standard operating procedures, the team's work is also based on Crisis Resource Management (CRM), a team-building program. The program was primarily developed and implemented in aviation to address ineffective interpersonal communication, lack of leadership, and poor decision-making (74, 75). The objective of CRM was to improve communication, leadership, and collaboration in order to minimize errors, and increase security, and flatten the hierarchy (74, 76-78). In health care, CRM has become more popular in recent decades.

To summarize, authority constraints relate to power such as control and the ability to have access to different areas of the room. The hospital's standard operating procedures, ATLS and CRM with focus on CLC were developed in order to streamline and improve the trauma teams' performance. These programs and guidelines, control and regulate the team members' ability to have access to different areas of the room. Lack of knowledge and experience of these written documents can constrain the team members, especially the leader.

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Coupling constraints

Working in the emergency room requires coordination in order to implement the care of the patient. To complete their tasks, the team members need to agree how space and time should be allocated. Åquist (61) describes the coordination between individuals, and between individuals and equipment (in this thesis team members and electrocardiogram, ventilators) as coupling constraints. Coupling constraints describe how the teams enable their work, the participants' ambition to share the task, and whether the members of the teams are at the right place at the right time. The focus on the patient's needs and condition requires a more cross-border work where exclusive demands on expert knowledge and authority must be put aside.

Expert knowledge and autonomy are argued to be central for professions to maintain control of the professional field (79). Through knowledge and control of the jurisdiction, the professions will achieve their ultimate aim and monopoly over the area and social status (80). However, Abbott notes that professionals are part of a dynamic system in society and are mutually dependent (81). In fact, practical tasks can be performed by subordinates even if their theoretical knowledge is lacking. Within trauma teams, the workload is often extremely high, and Abbott argues that the jurisdiction between different professions may therefore disappear, meaning that the hierarchies between professionals will decrease temporarily. Abbot also points out that individual characteristics influence whether the task is transferred (81).

To summarize, the team members need to agree how the limited space closest to the patient should be allocated. Coupling constrain show how collaboration and coordination of tasks and external resources such as equipment, in this space is a prerequisite for the team members to complete their tasks.

Capability constraints

Capability constraints describe the individual's social, physical, and psychological abilities as well as material assets (63). Factors such as the individual's knowledge, education and socio-economics have also been included in the concept (60, 64, 82). As stated previously also capability constraints provide limitations

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and possibilities for the team leader as well as for the team members. Previous experience of education and trauma, as well as age, may give advantages in understanding and interpreting the emergency situation. Knowledge is another important factor, which has been discussed as being fundamental for the leader (46, 83). Leadership is a crucial factor in the team's performance, and has a major impact on the team (52, 84-88). The leader should have recognized expertise in trauma, and must be able to act when a team member fails to perform a task (28, 52).

Yun, Faraj, and Sims discuss trauma team leaders' unique pattern of leadership (89). The severity of the patient's injuries and the level of the team members' experience of the situation both influence the leader's performance. Shifting into a more permissive approach, where tasks are delegated and team members engaged to participate actively in decision-making, results in an empowering leadership. On the other hand, the leader could shift into a directive leadership style involving little or no consultation with team members, and thus carry out commands without the involvement of the other team members (89). Similar leadership styles have been described by Klein, Ziegert, Knight and Xiao who, however, reported shifts in leadership from a senior leader to a more inexperienced leader that depended on the urgency of the situation (15). The authors defined this leadership as shared, and demonstrated how delegation encouraged the team members to perform reliably due to their increased self-confidence (15, 90). Shared leadership has been recognized as an efficient way of leading anaesthesia teams with autonomous team members performing complex tasks (91). Kunzle et al. (91) found that residents in high-performance teams were more willing to share leadership with nurses, indicating individual team members' strengths and acceptance of nurses' medical know-how. In another study, Kunzle et al (92) reported that non-hierarchical leadership seemed to adapt to the team members' experience to a greater extent compared to the authoritarian leader.

In CRM, the team members' involvement and responsibility are of importance for the team's objective (76, 93). Although CRM emphasizes the pivotal importance of the leader in determining the team's performance (52), the other team members have a responsibility to speak up when the leader makes the wrong decision or fails

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to make a decision at all (94, 95). Moreover, the team members are encouraged to support the leader which requires and is described as active followership (52, 96).

To summarize, previous educational experience, trauma experience, and individual personality are all factors that provide possibilities for the leader to understand, interpret, and improve the team's performance in the emergency situations. Some teams will contain members whose expertise and experience of trauma exceeds the leader's, and this can become a constraint if it is not taken into consideration.

Theoretical framework

In this thesis, I have been inspired by discourse psychology. My epistemological premise is that we, in interaction with others, create our so-called reality in line with social constructionism (97). Our access to reality is through language in daily interaction and social processes between people, rather than through objective observations of the world (98).

Discourse psychology is both a theory and method. Its focus is to study how people strategically use language to position and construct themselves in certain beneficial ways in social interactions, and the consequences of this (99). Texts and spoken language are considered as a form of social practice that constructs identities, social world, and social relations (100). Empirical studies therefore focus on the use of language (at the micro level) in specific contexts (at the macro level) (101). Discourse psychology is used in this thesis to study how the members of the trauma team construct and position themselves in the interaction as individual team members, as leaders, and as a team and the consequences of this.

On a macro level, the trauma team's performance takes place in a medical context and the members use a medical discourse that can be defined as "interactional activities that accomplish medical problem solving" (67). The trauma team's focus is to identify life-threatening injuries and to efficiently execute life-saving treatment, and it is of great importance that not only the leader has knowledge of the medical treatment, but also the members. In discourse psychology, knowledge is seen as a cultural and historical resource (99, 100). Knowledge is continuously constructed within the discourses, as well as within

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ideas, rules, laws, and power relations in society. Shared versions of knowledge, often called common-sense are constructed between people during their everyday lives (102) and should therefore be considered with a critical approach. The medical discourse is based on knowledge that is produced and legitimized through research and institutional practices (103). The discourse controls what can or cannot be said by whom it can be said, and what is excluded from the conversation; and so these aspects are all important to study.

In trauma teamwork, leaders and team members construct their identities in the team on the basis of their profession. There is an ongoing communication process where identities are negotiated in order to clarify roles, coordinate tasks and exchange information within the trauma team. The leader's role is to keep access and control over the inner circle, and get the work done. The identity work cannot be understood only through the interaction, but must also be explored through talk in the "cultural and ideological context" (104). Identity work is perceived as discursive and relational where the subject is active and can also be contradictory which shows the individual's ambivalent nature (100, 101). In this thesis, the leaders have specific positions as doctors in a medical discourse, and factors as such as clinical and educational experience will reinforce formal status differences (cf.(105)). Wetherell emphasizes the individual's multiple identities, and the possibility to show the variety of available subject positions that are negotiated in talk and interaction (106). Parts of previous identities persist into the current situation, and could be seen as sedimentation of past discursive practices (100).

In speaking and acting from a position people are bringing to the particular situation their history as a subjective being, that is the history of one who has been in multiple positions and engaged in different forms of discourse.

Davies & Harre' (107).

In this thesis, the premise is that identities based on for example ethnicity, culture and nationality are constructed categories attributed to different characteristics and theories about the origin of group differences. Social categorization should be seen as a form of social action that occurs discursively.

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The categorization process takes place through negotiation, arguments, and ideological struggles within the discourse (100). According to this approach, categorizations are neither fixed or essential but social positions that may be meaningful in interactions (100).

The doctor's position is central in the medical discourse, as doctors are entitled and regarded as experts when it comes to knowledge, specifically scientific knowledge (103). Extensive experience in the profession gives the doctor legitimacy to interpret the situation and decide what should be done. Potter (108) discusses "category entitlement" to show how individuals in a group can strengthen its credibility and position themselves by referring to their category and title. Doctors have strong subject positions in the trauma teams, both as leaders and due to their title. Anyhow, this position as well as other positions should not be considered as completely locked.

In order to emphasize the structure and flexibility of the discursive resources, which provide both possibilities and constraints for the team members, the concept of interpretative repertoires has been used in this thesis. Interpretative repertoires are arguments comprised of recognizable themes that are familiar both culturally and historically (100, 109). Wetherell and Potter (100) define interpretative repertoires as "broadly discernible clusters of terms, descriptions and figures of speech often assembled around metaphors or vivid images". Compared to the discourses that are more broad, interpretive repertoires exist within the discourse (100).

Interpretative repertoires are pre-eminently a way of understanding
the content of discourse and how that content is organized.

Wetherell and Potter (100).

The individual in their everyday talk has access to a variety of different repertoires which can be successfully used in particular contexts, while in other situations, it may be difficult to achieve the same effect. Each repertoire gives the individual resources to construct their version of reality, and can be both contradictory and conflicting. Wetherell and Potter (100) demonstrated for

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example how white New Zealanders used contradictory, flexible repertoires that were both tolerant and prejudiced when they spoke of the Maori people. In another study, Gilbert and Mulkey (109) showed how scientists used different repertoires in order to talk about research. Their own research was constructed as more scientifically founded while other researchers work was constructed as more speculative.

To summarize, the team members' identities and positions are negotiated on the basis of gender, ethnicity, and culture, as well as knowledge and earlier experiences, in order to clarify their roles within the team. The leader has a strong subject position, although, this position is not completely locked. In this negotiation process, the team members, including the leader, used flexible interpretative repertoires conditioned by authority, coupling and capability constraints.

Rationale for the thesis

In trauma care, time and space are limited resources that will constrain the trauma team's performance. Factors such as organization, rules and regulations, collaboration between team members, equipment, knowledge, and educational experience can all influence the teams' performances which ultimately affect the outcome for the trauma patient. These circumstances may influence both communication and how the leaders are positioned, or position themselves in the team, which can be considered to be important factors for efficient performance in the trauma team. When serious actions have to be performed, information must be communicated to "a receiver". This thesis supports the assumption that failure in communication is an important reason for errors in health care (3, 4). Effective communication in trauma teams is regarded as transmitting a message from the sender to the receiver (38). In order to provide secure communication, the teams are trained to use a communication tool (CLC) developed and successfully implemented in another high-risk industry, aviation. Nevertheless, it is important to understand that different factors in the work environment such as profession, gender, ethnicity and language affect and complicate the communication between team members. In order to understand how verbal and non-verbal communication

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is transmitted in trauma teams, this thesis will clarify the communication process during ongoing high fidelity training.

As far as I know, there is a limited number of empirical nursing or medical studies with an integrated approach where both verbal and non-verbal communication are studied inseparably in trauma teams. All communication is interaction, and to gain knowledge of how safe communication in trauma teams can be achieved, we need to explore how team members communicate, both verbally and non-verbally. More specifically, it is of value to study the individual's communication in order to understand the possibilities and the constraints that verbal and non-verbal communication can provide in a specific situation when time is critical and there is a need to improve and enable patient safety.

Aim

The overall aim of this thesis was to analyse how members in trauma teams communicated verbally and non-verbally during trauma team training in emergency settings, and how the leaders were positioned or positioned themselves in relation to other team members. The aim was also to investigate the use of a communication tool, closed-loop communication, and the time taken to make a decision to go to surgery in relation to specific factors in the team as well as leader's position.

The aims of specific studies were:

Study I. To analyse how formal leaders communicate knowledge, create consensus, and position themselves in relation to others in the team.

Study II. To investigate communication during in situ trauma team training, more specifically (1) the use of call-out and closed-loop communication during a simulated emergency scenario and (2) its relation to profession, age, gender, ethnicity, years in profession, educational experience, work experience, and leadership style.

Study III. To investigate how trauma team members are positioned in the emergency room, and how leaders communicate in terms of gaze direction, vocal nuances, and gestures during trauma team training.

Study IV. To investigate the association between the time taken to make a decision to go to surgery and gender, ethnicity, years in profession, earlier experience of trauma team training, and experience of structured trauma courses and trauma in the trauma team as well as use closed-loop communication, and leadership style during a trauma team training.

Materials and methods

This thesis was initiated as a part of Nordic Safety and Security (NSS) (ref: 41 952), a project funded by the European Union Regional Development Fund. NSS was a collaborative project between Umeå University, Västerbotten County Council, Luleå University of Technology, and the Swedish Defence Research Agency. The overall aim of NSS was to develop collaboration in crisis management research and education connected to educational programs for emergency nurses, firefighters, and police officers.

Both qualitative and quantitative methods were used to achieve the aim of this thesis. An overview of the participants and study designs is presented in Table 1.

Table 1. Overview of Studies I-IV

Study	Data analysis	Participants	Data collection
I	Discourse psychology	Team members (n=96), including team leaders (n=16)	Transcriptions of audio and video recorded material, observation, questionnaire
II	Descriptive and analytic statistics, Poisson regression	Team members (n=96)	Transcriptions of audio and video recorded material, observation, questionnaire
III	Quantitative content analysis, descriptive statistics	Team members (n=108), including team leaders (n=18)	Transcriptions of audio and video recorded material, observation, questionnaire
IV	Descriptive and analytic statistics, Cox proportional hazard regression	Team members (n=96)	Transcriptions of audio and video recorded material, observation, questionnaire

Research setting for the studies

The setting in the four studies was the emergency room in a hospital in northern Sweden. The hospital is a regional hospital responsible for highly specialized care for the approximately 877,000 inhabitants in the northern parts of Sweden (110). A large number of students and trainees with various levels of clinical experience pass through the hospital. Approximately 102 patients arrived

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annually as trauma cases at the hospitals' emergency department (111). The trauma team training followed the standardized operating procedure for trauma care at the hospital. The task for each team was to identify and perform life-saving actions on a severely injured patient, in this case a patient simulator. The training started with an alert from an ambulance to the emergency department. The nurse at the emergency department paged the trauma team, and the members gathered at the emergency room. When all team members had arrived, the registered nurse from the emergency department briefly informed them about the "injured patient". This brief information also included a presentation of the team members' names and roles. The designated leader then conducted an initial prioritization of the work and an inventory of the available resources in the emergency room (i.e. equipment and materials).

Before the trauma team training, the participants were shown a video about collaboration in trauma teams, with the emphasis on leadership and structured communication according to CLC. Next, they were given a short presentation on the structure of the trauma team training, in which aspects such as timeframe, resources in the environment, and the function of the educational staff facilitating the simulation were explained. The functionality of the patient simulator was also shown to the participants before the team training started, to ensure unobstructed measurement.

The surgeon/emergency physician was the designated leader of the team, and responsible for the team's performance in the emergency room. The anaesthesiologist was in charge of assessing and maintaining airway and breathing. The registered nurse from the emergency department was responsible for inserting intravenous lines and fluids. The registered nurse anaesthetist assisted the anaesthesiologist with the airway, and initiated monitoring of vital parameters such as electrocardiogram, blood pressure, and saturation. The enrolled nurse from the emergency department removed the patient's clothes, and assisted the team members with various tasks. The enrolled nurse from the operating theatre had no written instructions or specified function in the standard operating procedures, but initiated the documentation and assisted the anaesthesiologist and registered nurse anaesthetist with airway and equipment. The patient was a patient simulator, in the

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form of a digitally controlled manikin (SimMan 3G, Laerdal, Stavanger, Norway), preprogrammed as a severely injured patient (injury severity score [ISS] of 25) (112) suffering from hypovolemia due to external trauma. Two different cases were used both based on the standardized auto mode hypovolemia scenarios (ISS=25).

The patient simulator was transported from the scene of accident into the emergency room. After the handover from ambulance personnel, the trauma team took over the responsibility for care of the patient simulator, and began the initial assessment. The assessment was based on ATLS (58), and divided into a number of separate tasks. The ATLS program consists of two surveys; first, the patient's vital functions are examined for early identification and immediate treatment, and second, the examination is repeated in more detail, according to the recommended systematic head-to-toe approach. According to the hospital's standard operating procedures (Appendix), the team members had predetermined roles with specific positions and responsibilities in emergency room. In order to make the workflow as realistic as possible, the participants were informed to act as authentically as possible in their regular roles and responsibilities during the team training.

Participants

The participants in all four studies consisted of personnel from three departments involved in regular trauma team training. Personnel were assigned to participate in the team training by the heads of the units of Surgery, Anaesthesiology and Intensive Care, and Prehospital and Emergency Care. The personnel were given the opportunity to decline participation in the team training.

Nineteen trauma teams were audio and video recorded during training but one team was incomplete due to illness and therefore excluded. Study III included all 18 teams. Each team consisted of six participants: one surgeon/emergency physician (n=18 in total), one anaesthesiologist (n=18 in total), one registered nurse from the emergency department (n=18 in total), one registered nurse anaesthetist (n=18 in total), one enrolled nurse from the emergency department (n=18 in total), and one enrolled nurse from the operating theatre (n=18 in total). Hence, a total of 108 participants were included in the trauma team training. Four of the surgeons/emergency physicians (22 %) and three of the anesthesiologists (17

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%) were senior physicians. All registered nurse anaesthetists had a postgraduate diploma in Specialist Nursing in Anaesthesia Care, and three of the registered nurses from the emergency department had a postgraduate diploma in Prehospital Emergency Care. The teams' distribution of age, years in profession and female gender are shown in Table 2 together with educational experience (structured trauma courses and trauma team training) and experience of trauma. The team members' years in profession had a wide variation, from 2 years to 18 years. Team P, had the highest number of women (n=6), and team S had the lowest number of women (n=1). The leaders' age ranged from 30 to 56 years (median 40) and their experience ranged from 2 to 26 years (median 4). Five of the team leaders were women, and three team leaders were of non-Scandinavian origin.

In Studies I, II, and IV, two of the teams were excluded due to technical complications with the audio-recorded material, and so the results were based on 16 teams. Each team consisted of six participants: one surgeon/emergency physician (n=16 in total), one anaesthesiologist (n=16 in total), one registered nurse from the emergency department (n=16 in total), one registered nurse anaesthetist (n=16 in total), one enrolled nurse from the emergency department (n=16 in total), and one enrolled nurse from the operating theatre (n=16 in total). Descriptions of the participants see Table 2.

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Table 2. Age, years in profession, gender, and experience of team training, structured trauma course, and trauma for each team. Each team had 6 participants

Team n=18	Age median (Q1, Q3)	Years in profession median (Q1, Q3)	Female gender n	Experience of team training n	Experience of structured trauma course n	Experience of trauma n
Team A	42 (31, 55)	12 (5, 26)	4	6	4	6
Team B	39 (32, 54)	8 (4, 24)	2	6	6	6
Team C	39 (32, 44)	10 (8, 24)	3	5*	4*	5*
Team D	44 (32, 51)	14 (4, 22)	5	5*	3	6
Team E	47 (32, 53)	11 (5, 18)	5	6	4	6
Team F	31 (30, 43)	8 (3, 19)	4	3	3	5
Team G**	40 (35, 52)	16 (8, 28)	3	5	4	6
Team H	40 (30, 53)	2 (1, 22)	4	4*	3*	4*
Team I**	39 (31, 52)	12 (2, 26)	2	4	0	6
Team J	37 (32, 48)	6 (4, 18)	3	4	4	6
Team K	41 (30, 57)	16 (5, 30)	2	3	5	6
Team L	34 (32, 43)	6 (4, 12)	5	4	4	6
Team M	38 (27, 44)	4 (1, 13)	2	5	4	5
Team N	39 (32, 49)	8 (1, 26)	3	4	3	6
Team O	45 (30, 55)	18 (2, 32)	4	4	4	5
Team P	38 (32, 52)	6 (2, 30)	6	4	1	5
Team R	34 (29, 39)	6 (1, 13)	3	3	3	6
Team S	40 (38, 48)	14 (8, 20)	1	5	6	6

*Missing data for this variable (n=5); **Only in Study III

Data collection

Data collection was carried out in 2009/2010 via audio and video recorded trauma team training, a questionnaire, and observations.

Audio and video recorded data collection

The trauma team training were audio and video recorded during high fidelity training in the emergency department. The video recording was performed using standard video surveillance cameras. Three video cameras were situated in the emergency room and one in an office at the emergency department where the registered nurse received the alarm. The four cameras were positioned in the setting in order to encompass all active participants in the scene. Video can be used to capture aspects of social activities in real time: talk, visible conduct, and the use of technologies and artefacts (113). To capture the communication between the team members, individual external wireless microphones were used. All the audio and video data were collected in F-Rex, (114) a software program developed by the

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Swedish Defence Research Agency, Linköping, Sweden, to reconstruct the event and investigate the incident. The program allows for simultaneous viewing and playback of multiple data sources of different origins.

Questionnaire

A pre-training questionnaire was used to collect background information about the participants such as age, sex, years in profession, previous experience of trauma, and educational experience in structured trauma courses, and experience of trauma team training was collected.

Observations

In addition to the audio and video recording, I performed observations during all team training. The focus of the observations was *how* the leader and the team members communicated during the trauma team training and *how* the interaction was expressed. In non-participating observations the researcher remains as an outsider without interfering with the participants and does not participate during the data collection (115). Before the trauma team training started, the purpose of the observation and my role as a researcher were explained to the team members. In order to avoid influencing the team training, my position in the emergency room was discreet. Field notes were written down continuously as additional notes to capture the communication and interaction between the team members. The field notes supplemented the recorded material and could support the interpretation of the communication, especially the non-verbal communication.

Data analysis

The audio and video recordings were transcribed verbatim and covered both verbal and non-verbal aspects of the communication between the team members, including pauses and interruptions were considered (113). Material from five teams was analysed in depth, selected due to quality of the audio. An assistant and I carried out the transcriptions, and I made the final correction of the transcriptions.

In *Study I* the analysis interpretative repertoires in the leaders' communication has been sought. The text was read through repeatedly to get an overall view of the material. The focus of the analysis was *how* the leaders were talking in terms of

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interpretative repertoires (106, 109), which allowed to capture how the leaders strategically chose repertoires in order to achieve consensus. The team leaders' communication was categorized into "turn-constructive units" according to conversation analysis (116, 117). The analysis was a process of moving between the empirical material and theory, while developing theoretical arguments. The turn-constructive units were categorized and quantified.

In *Study II* the transcribed text of the team members' communication was according to previously described definitions categorized and quantified into CO, step one and CLC, all three steps included (53, 54). Thus, the dependent variables were CO and CLC and the independent variables were: profession, age, gender, ethnicity, years in profession, educational experience, work experience, and leader's position. Since the number of discrete events was rare, a Poisson distribution was assumed. To assess the impact of the independent explanatory variables (Table 3) on the dependent variables, the number of CLC was calculated and number of CO initiated by individual members in each team, and analysed these using Poisson regression analyses. An exchangeable correlation structure was presupposed by the fact that participants were correlated in each team. The parameters were estimated by generalized estimating equations. A backward elimination procedure was undertaken, starting with the six independent variables. The non-significant variables were deleted one at a time, and the final model consisted of the remaining significant variables. The results are presented as risk ratios (RR) with 95% confidence intervals (CI) and p-values, with $p < 0.05$ considered to be statistically significant. All statistical analysis was performed using SPSS for Windows, version 20.0.

Table 3. Overview of measurements and analysis in Studies II and IV

Study	Measurements	Analysis
II	<i>Dependent variables (outcome):</i> CO, CLC <i>Independent variables:</i> years in profession profession, gender, ethnicity educational experience experience of trauma leadership style	Descriptive statistics Poisson regression
IV	<i>Dependent variables (outcome):</i> Time taken to decision to go to surgery <i>Independent variables:</i> Specific for the team members gender, ethnicity educational experience experience of trauma years in profession CO, CLC, Specific for the team leaders; educational experience, experience of trauma, CO, CLC, leadership style	Descriptive statistics Cox's regression

In *Study III*, quantitative content analysis was used to categorize and organize the video observations of the team members' positions and the team leaders' communication (118). The team members' positions and movements around the patient in the emergency room were compared to the predetermined positions specified in the hospital's standard operating procedures for trauma care, and any deviations from the predetermined positions during the team training were registered (cf.(119, 120)). The team leaders' gaze direction, speech time, and gestures were identified to the level of seconds and are presented as proportions (%) of the total training time (15 minutes). The team leaders' vocal nuances were identified, coded, and categorized.

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In *Study IV*, the dependent variable for the regression analysis was the time taken for the team to make a decision to go to surgery. If no decision was taken within 15 minutes, the team was censored. Cox proportional hazards regression was performed to assess the impact of the independent variables on the dependent variable (Table 3). The proportional hazards assumption for the independent variables was tested with scaled Schoenfeld's residuals. Variables with p-values below 0.2 in crude analyses were included in an adjusted regression model. From this primary adjusted model, a stepwise elimination procedure was performed until only independent variables with p-values below 0.05 were left in the final model. The results are presented as hazards ratios (HR) with 95% confidence intervals (CI) and p-values, with $p < 0.05$ considered to be statistically significant. Most of the statistical analyses were performed using version 21.0 of SPSS for Windows, though the test of the proportional hazards assumption for independent variables was performed using R 3.0.2.

Ethical considerations

The studies conform to the principles in the Declaration of Helsinki (121) and were approved by the Regional Ethical Review Board in Umeå, June 9, 2009 (ref: 09-106M).

The participants' integrity was taken into consideration, and informed consent was obtained after providing written information to all participants before the team training and assuring them that participation was voluntary. The participants were informed that the recorded material would be handled with confidentiality and that they could leave the study at any time without giving any reasons for the withdrawal. Teams were included in the study only when all participants had agreed to participate and their written consent were provided. No participants declined.

Results

The presentation of results is based on the aims and findings from each study. First, I describe how the leaders communicated knowledge and created consensus, including descriptions of how they positioned themselves as leaders in the team depending on chosen knowledge repertoires (Study I). I next describe the use of call-out and closed-loop communication during trauma team training in relation to the teams' characteristics (Study II). This is followed by a description of how the team leaders communicated verbally and non-verbally in terms of position, gaze direction, vocal nuances, and gestures (Study III). Finally, I describe the association between the time taken to make a decision to go to surgery and the characteristics of the trauma team (Study IV).

Study I

The leaders used coercive, educational, discussing, and negotiating repertoires in order to convey knowledge and create a common goal regarding the priorities of the work (Table 4). Changes in repertoires were dependent on the situation and the interaction between the team members. The repertoires were flexible, and the leaders positioned themselves in different ways; either as authoritarian or egalitarian leaders.

When using coercive repertoires the leaders gave orders, asked closed or leading questions, and did not invite the members into the decision-making process. Within this repertoire, the leaders gave the impression that they possessed expert knowledge. In educational repertoires the leaders also gave the impression of having expert knowledge, but were willing to share this knowledge and to explain why it was important to prioritize in a certain way. In comparison with coercive repertoires, leaders using educational repertoires seemed to be more willing to listen to their team members. Using both these repertoires, the leaders positioned themselves on a superior level, in an authoritarian position.

Leaders who involved team members in the decision-making and were more interactive used discussing repertoires in which they discussed possible explanations of the patients' symptoms and gave the impression that the team had

Results

found a common understanding of the situation. When the leaders encountered more resistance from team members and had to argue more for the prioritizing, they used negotiating repertoires. In both discussing and negotiating repertoires, the team leaders positioned themselves in an egalitarian position. There were also occasions when the leaders did not succeed in communicating a common goal, called working failure. In these cases, the leader did not give directions and another team member took over the prioritization of tasks and the leadership role. This working failure did not necessary lead to a break down in the work, but led to prolonging the assessment of the patient.

Table 4. The frequencies of the different strategies coded into turn-constructural units

Strategy	Authoritarian leadership style		Egalitarian leadership style		
	Coercive repertoire	Educational repertoire	Discussing repertoire	Negotiating repertoire	Working failure
Team A	10	10	12	0	0
Team B	1	1	2	4	6
Team C	7	0	5	3	1
Team D	0	0	0	2	6
Team E	4	2	5	11	2
Team F	0	0	9	0	0
Team H	4	1	13	0	0
Team J	5	4	7	4	1
Team K	1	2	7	0	1
Team L	2	0	2	0	1
Team M	0	0	2	1	1
Team N	2	2	2	1	1
Team O	1	0	3	2	2
Team P	5	0	3	1	0
Team R	3	0	4	1	0
Team S	3	2	5	1	3
Total	48	24	81	31	25

Study II

There was only limited use of closed-loop communication in the trauma team during the trauma team training, with about 20 CO and 3 CLC per team. All professions in the teams initiated CO, and all except the enrolled nurse from the operating theatre initiated CLC. The frequency of initiation of CO and CLC varied between the professions, with the leaders initiating the most and the enrolled nurses from the operating theatre the fewest. The leaders made more CO and CLC compared to the anaesthesiologists. There were also a variation between the nurses: the use of CO and CLC was more common among the registered nurse anaesthetists than among the registered nurses from the emergency department. In comparison to the other professions in the team (including the leaders), the registered nurse anaesthetists initiated most of CO that led to CLC about one of four CO (23%); (Table 5).

Table 5. The number and proportion of call-outs (CO) and closed-loop communication (CLC) initiated by each profession

Profession	Number of participants	CLC n (%)	CO n (%)	CLC/CO (%)
Surgeon	16	21 (47)	151 (47)	14
Anesthesiologist	16	12 (27)	93 (29)	13
Registered nurse from ED	16	1 (2)	22 (7)	4
Registered nurse anaesthetist	16	10 (22)	43 (14)	23
Enrolled nurse from ED	16	1 (2)	6 (2)	17
Enrolled nurse from OT	16	-	4 (1)	-
Total	96	45 (100)	319 (100)	

ED= emergency department; OT=operating theatre

Results

Having eleven or more years in the profession, and experience of trauma within the past year were associated with more frequently use of CO by compared to team members with no such experience (Table 6).

Table 6. Poisson regression with call-out (CO), as dependent variable, final model

	Full model		Final model		
	RR	p	RR	95 % CI	p
Profession					
Surgeon	40.48	0.000	32.63	(18.04- 59.00)	0.000
Anesthesiologist	21.76	0.000	17.47	(8.99- 33.94)	0.000
Registered nurse	5.88	0.000	5.36	(2.84- 10.14)	0.000
Registered nurse anesthetist	9.04	0.000	8.17	(4.08- 16,34)	0.000
Enrolled nurse	1		1		
Years in profession					
≥11 years	1.28	0.394	1.51	(1.10- 2.06)	0.011
≤10 years	1		1		
Most recent experience of trauma					
≥1 year	0.86	0.656	0.93	(0.60- 1.45)	0.761
≤1 year	1.33	0.298	1.43	(1.03- 1.99)	0.034
None	1		1		

RR = risk ratio; CI = confidence interval

Scandinavian origin, an egalitarian leader, and previous experience of two or more structured trauma courses were associated with more frequent use of CLC. It is of interest to note that team members with previous experience of participating in trauma team training used CLC just as frequently as team members with no such experience. On the other hand, team members with previous experience of participating in two or more structured trauma courses used CLC more frequently than team members with no such experience (Table 7).

Results

Table 7. Poisson regression with closed-loop communication (CLC) as dependent variable, final model

	Full model		Final model		
	RR	p	RR	95 % CI	p
Profession					
Surgeon	36.59	0.001	34.87	(4.24- 286.94)	0.001
Anesthesiologist	19.36	0.008	17.92	(2.36- 136.22)	0.005
Registered nurse	1.87	0.649	1.42	(0.09- 23.36)	0.805
Registered nurse anesthetist	17.29	0.012	13.39	(1.62-110.54)	0.016
Enrolled nurse	1		1		
Ethnicity					
Scandinavian	5.33	0.010	4.46	(1.87- 10.65)	0.001
Non-scandinavian	1		1		
Leadership style					
Authoritarian	0.84	0.002	0.85	(0.77- 0.93)	0.000
Egalitarian	1.61	0.012	1.14	(1.04- 1.26)	0.007
Trauma course					
>2	2.31	0.171	3.17	(1.22- 8.24)	0.018
1	1.01	0.991	1.67	(0.38- 3.60)	0.789
None	1		1		

RR = risk ratio; CI = confidence interval

Study III

The team leaders who gained control over the “inner circle” positioned themselves as heads of the team, using gaze direction, vocal nuances, verbal commands, and gestures to solidify their verbal messages. There was an invisible but clear division of the area around the patient simulator where the action took place, the “inner circle” (Figure 2). Changes in position required both attention and collaboration, since the movements occurred without verbal requests. In most teams, the members seemed to know about and be aware of each other’s tasks both in time (when) and space (where).

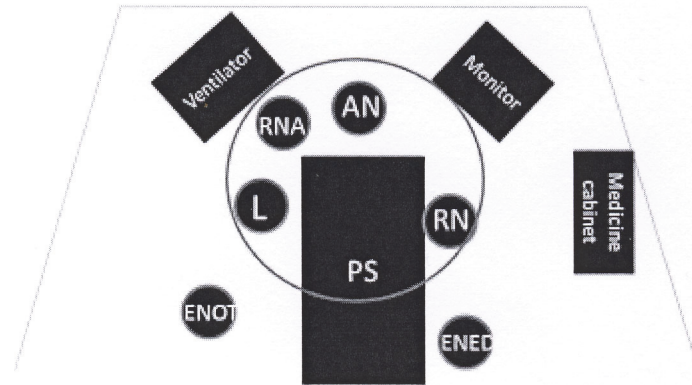


Figure 2. The “inner circle” around the patient simulator.

AN = anaesthesiologist, ENED = enrolled nurse from the emergency department, ENOT = enrolled nurse from the operating theatre, L = leader, PS = patient simulator, RN = registered nurse from the emergency department, RNA = registered nurse anaesthetist.

The team members rarely made eye contact during the training. The leaders directed their gaze towards the patient simulator and/or the monitor for more than 50% of the time while assessing and examining the patient simulator. Mutual gaze was established when the leader was discussing the priority of actions or treatment with the anaesthesiologist, and when specific tasks were requested of team members (Table 8).

The proportion of speech time during the training session varied remarkably between the team leaders. In team A, the leader spoke 63% of the time during the team training, while the leader in Team I spoke only 6% of the time (Table 8). The leaders used vocal nuances and gestures to underline and emphasize the importance of their commands. Leaders who seemed to have less control over the inner circle were characterized by speaking in a hesitant voice and giving hesitant answers. They used a soft-spoken or whispering voice that may not have been perceived by the team members in this stressful and noisy environment. Leaders who were silent, used few gestures, and gazed around at the team members during the team training had less access to and control over the inner circle.

Results

Table 8. Team leader’s gaze direction, speech-time, and gestures during silence or during speech presented in proportion (%) of total team training time

	Gaze directed towards patient or monitor (%)	Gaze directed around the ER or at the team members (%)	Silence (%)	Speech (%)	Gestures during silence (%)	Gestures during speech (%)
Team A	92	8	37	63	74	85
Team B	63	37	75	26	44	41
Team C	58	42	60	40	45	28
Team D	78	22	83	17	51	36
Team E	58	42	50	44	43	82
Team F	85	15	61	35	28	79
Team G	81	19	76	24	68	31
Team H	73	27	73	27	56	62
Team I	68	32	94	6	42	57
Team J	72	28	46	53	60	30
Team K	69	31	66	34	67	18
Team L	86	14	78	22	63	34
Team M	86	14	73	27	30	24
Team N	73	27	84	16	36	33
Team O	89	11	75	25	77	3
Team P	67	33	67	33	63	27
Team R	70	30	84	23	12	15
Team S	56	44	72	33	58	43

ER=emergency room

Study IV

Only 8 of the 16 teams, managed to make a decision to go to surgery within the 15- minutes duration of the trauma team training (Table 9). The team leader’s closed-loop communication was most important for make a decision to go to surgery. More frequent use of CLC initiated by the leader was significantly associated with decision to go to surgery (hazard ratio [HR]: 3.88, p=0.046). Conversely, the more CO (HR: 0.82, p=0.012) and CLC initiated by (HR: 0.23, p=0.010) the trauma team members, the less likely it was that the team leader would make a decision to go to surgery (Table 10).

Educational experience varied between the teams. All members in teams A, B, and E had experience of trauma team training, while in teams F, K, and R only three of six members had previous experience of team training. In team P, only one team member had completed a structured trauma course, while in teams, R, N, H, F, and D three of six members had completed a structured trauma course (Table 2).

Results

Table 9. Total numbers of closed-loop communication (CLC) and call-outs (CO) initiated in each team. Time in seconds to decision to go to surgery

Team	CLC	CO	CLC/CO	Time to decision	Decision
n=16	n	n	(%)	(in seconds)	within 15 min yes
Team A	1	19	11	394	Yes
Team B	3	15	20	770	Yes
Team C	2	30	7		
Team D	2	22	9		
Team E	2	26	8	475	Yes
Team F	7	22	32		
Team H	7	21	33		
Team J	1	9	11	239	Yes
Team K	5	25	20	524	Yes
Team L	1	14	7	361	Yes
Team M	1	15	7	405	Yes
Team N	1	15	7	383	Yes
Team O	3	14	21		
Team P	1	35	3		
Team R	3	16	19		
Team S	5	26	19		

Table 10. Cox regression with time to make a decision to go to surgery as a dependent variable, final model

	Adjusted model		Final model		
	HR	p-value	HR	95 % CI	p-value
Leader's CLC	3.30	0.099	3.88	(1.024 - 14.690)	0.046
Team's CLC	0.24	0.024	0.23	(0.076 - 0.706)	0.010
Team's CO	0.84	0.070	0.82	(0.706 - 0.958)	0.012

HR = hazards ratio; CI = confidence interval

Discussion

Time is a crucial factor that limits the trauma team's performance. Trauma team training has become an important factor in the pursuit of improved performance in the trauma team. The objective of trauma team training is to reduce the time taken to diagnose life-threatening injuries by helping the team to rapidly identify and assess the extent of the injuries and develop a plan for definite treatment. In order to reduce time taken to decision to diagnosis the leader must obtain essential knowledge.

Earlier studies have shown that the leader plays a critical role in the trauma team (84, 122, 123). The picture of a successful leader is a person with a high level of professional knowledge who communicates clearly and distinctly with confidence and calmness, creating security within the team (46, 83). According to standards, a good leader needs to create a common goal for the team and help the teamwork move forward. The leader has responsibility for the decisions that are to be made, and must intervene if the situation changes. In this thesis, the leaders changed positions and used different repertoires to convey and gain knowledge in order to create common goals in the team. These repertoires were flexible, and varied depending on the situation (Study I). Knowledge was negotiated from different positions: authoritarian, egalitarian and from a position when the leader remained silent.

First, the team leaders who gained control over the inner circle were positioned or positioned themselves as authorities over the team. They solidified their verbal messages using gaze direction, vocal nuances, verbal commands, and gestures (Study III). According to the hospital's standard operating procedure, the surgeon/emergency physician is the designated leader of the team (Appendix). The findings in this thesis showed that the surgeons/emergency physicians often were positioned or positioned themselves as authoritarian leaders, which can be important in order to efficiently help the teamwork to move forward. Authoritarian leaders used both coercive and educational repertoires (Study I).

CLC can be regarded as a part of the coercive repertoire, since the leaders called out commands with direct requests to specific team members, and asked

Discussion

closed or leading questions that only required short answers from the team members. The results showed that the more CLC the leaders initiated, the greater likelihood of the team making a decision to go to surgery within the timeframe of the training (Study IV). An early statement of the emergency situation, using feedback communication (CLC), has been shown to be associated with an increased likelihood of executing life-saving treatment (124). An earlier study showed that when surgical teams used CLC, the number of miscommunications decreased (13). In this thesis, Study III showed that the verbal communication was strengthened with non-verbal communication. In order to underline important messages the team leaders used clear gestures, vocal nuances, and gaze direction (Study III). By using coercive repertoires, the leaders expressed competence and knowledge, and the team members did not question the leaders' priorities. The common goals could be achieved quickly (Study I).

The authoritarian leaders also used an educational repertoire. When using this repertoire the team leaders expressed expert knowledge, gave the impression of creating a common understanding for the prioritization of the treatment and were willing to explain and share their knowledge (Study I). This repertoire seemed to instil confidence and trustworthiness within the teams. Confidence and trustworthiness have been described as important qualities of leaders in trauma teams (46, 83). The leaders also used non-verbal communication to reinforce their message, using vocal intonation to emphasize phrases such as "very important" and "very quickly", and directing their gaze towards the team members to make them aware of important actions to focus on (Study III).

To summarize, when the leaders were positioned or positioned themselves as an authority in the team, they gave the impression of having expert knowledge and competence. The team members were silent, mainly listening, and did not question the leaders' knowledge and priorities, meaning that there was an unequal relationship between the leader and the members of the team. When the patient's condition deteriorates rapidly, the leader needs to make a rapid response and initiate the necessary treatment. The findings in this thesis also showed that the leaders' CLC increased the probability for the team to make a decision to go to surgery. This authoritarian position is relevant, given that it is the leader who has

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the expert knowledge, though there is a risk that important knowledge may not be utilized since no one in the team is invited to speak up.

Second, the studies also showed that some of the leaders were flexible. They were positioned or positioned themselves as an egalitarian leader by using, for example, a discussing repertoire. Using this repertoire, they involved team members in the search for possible explanations for symptoms and ideas and for appropriate treatment as well as actions (Study I). The members had the opportunity to comment on what the leader said, and were encouraged to speak up; their knowledge and previous experience were acknowledged. Communication between physicians has been described as “presenting evidence” (14, 66, 68, 105). Knowledge is essential in this process, and the colleagues have to reach an agreement on the interpretation of the reports and descriptions of patient-oriented information (66, 68). When the leaders encountered more conflict from the team members concerning priorities or treatment they used a negotiating repertoire (Study I). Knowledge was negotiated, which can be of importance for the treatment of the patient. However, if the leaders used vague expressions, this repertoire gave the impression of uncertainty, which could have a negative effect on the teamwork in terms of prolonging the time to decision on treatment. The leaders seemed to exhibit a greater degree of non-verbal uncertainty in this repertoire; gazed around at the team members, using less gestures and sometimes whispered or spoke in a hesitant voice (Study III). Since time is limited due to the patient’s condition, there is little or no time for discussion in emergency care situations. One problem with discussing or negotiating repertoires is that they prolonged the time to necessary treatment, which can influence the quality of the care. The negotiation can also develop into a power struggle between the members of the team.

The findings in this thesis showed that all professionals in the teams initiated CO, and all except the enrolled nurses from the operating theatre initiated CLC (Study II). This is in line with the CRM guidelines, showing that the team members were encouraged to speak up when there was a need to pay attention to important changes in patient status. However the results also showed that CO and CLC were used only to a limited extent. In addition, the more CO and CLC initiated by the team members, the less likely that there would be a decision to go to surgery (Study

Discussion

IV). Another disadvantage of the negotiating repertoire is that a power struggle can arise between the members in the team, which can influence the quality of the work, likely leading to delays and – in the worst case – to failure. There are limitations to this process in emergency care situations, since there is time pressure due to the patient's condition and little or no time for discussion.

To summarize, when leaders were positioned or positioned themselves in a more egalitarian position, they used discussing and/or negotiating repertoires. The egalitarian leader invited team members to join the discussion, and the team members' knowledge and experience were important for the decision for final treatment. It was notable that the use of discussions and the initiation of CO and CLC by all team members could lead to extended discussions that prolonged the assessments, as well as communication overload.

Finally, in the studies reported here, some of the leaders took a position outside the inner circle from the start of the trauma team training, and used no gestures, remained quiet, and directed their gaze around in the emergency room. Some of them remained quiet and/or spoke in a whispering voice as the trauma team training progressed (Study III). Team leaders who speak quietly, hesitantly, and barely audibly have earlier been described as a cause of miscommunication (128). When the leader showed uncertainty or ambiguity and had weaker arguments, members with more experience of trauma took over the prioritization (usually the anaesthesiologist), or other team members guided the leader with leading questions. The position of leader was changed temporarily or permanently (Study I). The leader's personality and physical resources are also important factors to take in account. The quietness of the leaders in this study may be due to lack of knowledge or personality traits such as shyness, but it can create uncertainty and doubts concerning the leader's ability to maintain their position as the leader of the team.

To summarize the leaders that were positioned or positioned themselves outside the inner circle and remain silent, gave the impression of not having knowledge and experience to create common goal. Other members in the team took over the position as leader and initiated the prior but it prolonged the assessment of the patient.

Discussion

In the trauma team, the surgeon/emergency physicians are clearly pointed out as the team leader. It is presumed that the leader takes a position as an authority in the trauma team, in order to make rapid responses to changes in the patient's vital signs. Mishler (125) refers to "the voice of medicine", and Måseide (66) talks of "the voice of doctors". Communication in the trauma team is dominated by this "voice", which refers to the physician's knowledge, practice, and judgment (66). The language is based on expert knowledge consisting of technical terms (126). The "voice" dominates and controls what can and cannot be said, and by whom it can be said. There may appear to be a contradiction or dilemma here. Recommendations state that the leader should be authoritative, but at the same time CRM supports the assumption that members of the team must speak up and question the leader's priorities if these are perceived as incorrect (52, 127). On one hand, the leader should remain an authority, while on the other hand CRM advocates the importance of "flattening the hierarchy" within teams. Billig (126) argues that a dominant culture exists within each community, consisting of authorities and experts that have been approved by society; and in a medical context, the doctors' voices dominate. Members of the team are expected, both by themselves and by others, to unconditionally listen to the doctor's voice. However, according to CRM they should at the same time be reviewing this dominating voice. When two conflicting themes of ideology arise, the result might be problematic: an ideological dilemma occurs (126).

The studies in this thesis illustrate the complexity of the trauma team leader's communication. There can be problems if the leader is positioned either as an authoritative or an egalitarian leader. In order to managing the dilemma that they should be authoritative and at the same time search for relevant knowledge in the team, the leader can be flexible and use different positions and repertoires.

Certain circumstances in this thesis, point to the idea that authority, coupling, and capability constraints will provide both possibilities and limitations for the team members' communication that may influence how effective communication is achieved during trauma team training. It can for instance be problematic if the leaders become quiet. The hospitals standard operating procedures and ATLS are designed to facilitate the teamwork, but they can also constrain the team members'

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performance if the voice is silenced. These rules and regulations will then be reconsidered. Inexperienced leaders might not speak up about factors such as risk, since their senior colleagues are involved and control the conversation (128). When studying silence, the interplay between speech and silence must be taken into consideration; in other words, it is important to also study what is not said in the team. Inexperienced leaders have been reported as expressing a need to be supported and guided by more experienced team members, as well as having concerns over making the wrong decisions (83, 129, 130). Other researchers have demonstrated that senior physicians intervened and temporarily took over the leadership role on occasions when the patient's condition deteriorated rapidly (15, 47). These situations were particularly problematic when they involved physicians from different disciplines with different levels of experience, since this led to conflicts that negatively affected the teamwork (47). The studies in this thesis show that the leaders sometimes took other team members' knowledge into account when they changed their position from an authoritarian leader into a more egalitarian one.

Leaders in business organizations have been found to achieve durable consensus in teams when shifting between egalitarian and authoritative leadership style, with an emphasis on the authoritative style (131). Earlier studies have recognized shared leadership as an efficient way of leading teams (15, 91), meaning that the leaders delegated tasks and empowered the team members to participate in the decision process (15, 91). The senior team leader stepped back and shifted between an empowering and a directive approach depending on the team members' experience and the patient's condition (89). This shifting between the positions may also encourage less experienced leaders to develop their skills and knowledge.

In order to streamline the collaboration in the emergency room, it was important for the team members to understand the importance of knowing their predetermined positions and tasks. Collaboration between individuals requires timing and being at the right place at the right time, described in this thesis as coupling constraints (61). The quality of collaboration quickly become visible in the inner circle because working in this area requires close teamwork (in both physical

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and mental terms). In imparting both theoretical and practical knowledge for critical situations, CRM training for team leaders in resuscitation teams improved the distribution and coordination of tasks (132). Hence, clear role allocation and coordination of tasks may streamline the team's performance.

In this thesis, CLC initiated by the team leader was the most important factor for a decision to go to surgery. CLC needs to be practiced purposefully in the teams, including non-verbal communication. Team training has proved to be an ideal way to improve the dynamics of communication in multidisciplinary teams, because the subject of information can be held constant in each scenario along with other factors that normally vary in clinical work (133, 134). Factors such as time pressure and workload, but also hierarchical and inter-professional factors, could be reasons why CLC may not come naturally to many health professionals. Establishing routines that help to normalise the practice of CLC under acute circumstances is important, but so is achieving role modelling from clinical leaders. Convincing health professionals to adopt this more formal mode of communication during critical moments will depend on good evidence followed by deliberate practice (33). CLC was developed in a context where annually recurring exercises are obligatory and this has to be kept in mind when transferring the tool to the health care context.

It is not only team leaders who need to improve their communication skills. The overall use of closed-loop communication in the trauma teams was limited during the trauma team training even though all professions in the team initiated CO and CLC (except for the enrolled nurses from the operating theatre) (Study II). Differences between the professions' communication styles have been described as contributing to communication failure and tensions within interdisciplinary teams (135). Nurses' communication style is described to be holistic – “storytelling” – while physicians are trained to communicate succinctly using “headlines” (11). By identifying profession-specific aspects of communication, interdisciplinary team training can improve and strengthens the communication within the teams during trauma team training (136). The findings in this thesis highlight that communication strategies need to be changed depending on the situation, without hampering the patient's safety. CLC and SBAR are examples of communication

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tools that have been implemented to improve this communication (137). When introducing the communication tools, it is important to conduct repeated trauma team training to allow the team members to learn and improve their communication skills. In order to avoid communication overload, the team members need to be attentive to other team members' communication especially the leader's (Study III).

To summarize, this thesis illustrates the complexity of the trauma team leaders' communication. The rules and regulations clearly point out the surgeon/emergency physician as an authority in the team. These studies show that it can be problematic if the leader takes either an authoritative or egalitarian position; instead, it seems to be better if the leaders are flexible and use different repertoires in order to convey knowledge. The communication may be constrained, but these constraints can also provide possibilities for achieving effective communication.

Methodological discussion

This thesis used both qualitative and quantitative methods to achieve the objectives of the studies. The data collected from audio and video-recorded material as well as observations and field notes during the trauma team training were used in a strategy of methodological triangulation (138). Another strength in the analysis of the data was the multidisciplinary research team, with experience in areas such as nursing, social work, and medicine; and this was an important aspect throughout the analytical process. In the process of analysing the material, the interpretation of the texts and video observations of the material was repeatedly discussed within the research team, and different interpretations emerged.

In the qualitative research tradition, the trustworthiness of the findings is discussed in relation to concepts such as credibility and transferability (138). Credibility relates to how well the data are collected and how well the research methodology corresponds to the objectives. It also addresses the motivation to include participants with varied background characteristics that correspond to the focus of interest (139). The participants in this thesis consisted of personnel taking part of regular trauma team training. Each team was included in the study only if

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all of its participants agreed to participate; however, none of them declined participation. To increase the credibility of the analysis, excerpts were inserted into the text to verify the findings (138).

The findings in this thesis should be transferable to similar contexts (i.e. traditionally hierarchical organizations), since similar structural problems may affect the communication in other trauma teams (138). The trauma team training in this thesis took place in a Scandinavian context; the composition of trauma teams can vary nationally and internationally. The hospital's resources, team composition, and recommendations for summoning the teams may also differ. Each team in this study included one surgeon/emergency physician; the leader's communication within the team may have differed in a real scenario and also if a more senior physician would have been present as a backup for leaders still in training.

The presence of me as observer and instructors in the emergency room may also have affected the teams' performance. Hammersley and Atkinson (140) state that the researcher must consider the impression they wish to give. I chose to be discreet during the trauma team training. However, my presence was an unavoidable fact due to the need to observe the trauma teams' interaction with the patient simulator. There may be concerns that the presence of microphones and cameras can alter standard working procedures and this could increase the risk of poor performance due to lack of enthusiasm for the trauma team training. However, other researchers have shown that audio and video recording affect the team's performance only to a limited extent (141).

My own position as a registered nurse anaesthetist who has previously worked in trauma teams may have influenced the interpretative process, as working in trauma teams is familiar to me. With this background, it has been necessary to reflect upon my position as researcher. Knowledge cannot be regarded as a passive reflection of reality and should therefore be considered in a reflective approach. Moreover, I consider knowledge as produced within the discourse and thus not only provides one version out of reality (97). Koster (115) states that studies in one's environment should be avoided. As an "insider" in certain environments with their own "language" and rules, I know the language and the rules. However, my

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pre-understanding made it easier to follow the team members' roles, positions, and task performance during the observations of the trauma team training. Understanding the medical terminology was also an advantage when transcribing the communication and during the process of analysing the text and the observations. As Wetherell & Potter (100) argue "At its most basic, an analyst has to have a basic comprehension of what the words in a language mean to make sense of a text or transcript". Furthermore Kostera also points out the difference between theoretical knowledge of the field of study and knowledge of the underlying rules that govern this knowledge (115).

Simulation training is an educational method that gives health care personnel the opportunity to train for low-frequency events in high-fidelity settings. In the trauma team training described here, efforts were made in order to make the context as realistic as possible. The training took place in an emergency room at the emergency department, and the participants acted in their ordinary professional roles within the trauma team according to the hospital's standard operating procedures. The "patient" in the simulation training was a patient simulator which allowed the research team to standardize the trauma case scenario and hence give every team the same conditions. However, the authenticity of the patient simulator was one of the limitations of the studies, as it differed from a real patient.

Conclusions

In this thesis, I have illustrated that communication in trauma teams is complex, and consists of more than just transferring messages quickly and involve verbal as well as non-verbal communication. We already know that failures in interdisciplinary teamwork and communication can directly lead to compromising the patient's care, and are contributory factors in a majority of errors. This thesis widened knowledge of how communication in trauma teams can be understood, and how communication in trauma team training can be improved by focusing on the team leaders' communication.

So what constitutes effective communication in trauma teams and how do the leaders communicate in order to convey the common goal?

The studies showed that the leaders used different repertoires to convey and gain knowledge and create common goals. Depending on chosen repertoires different positions was enabled; authoritarian and/or egalitarian. Studies in this thesis indicate that, the leaders used coercive repertoire (closed-loop communication), and called out commands and directed requests to specific team members in urgent situations that required rapid response on key tasks. Closed-loop communication was used only to a limited extent, important to note was that the more closed-loop communication initiated by the leader the more likely that the team would make a decision to go to surgery. Furthermore, the results showed that the numbers of call-outs and closed-loop communication initiated by the team members decreased the probability of making decision to go to surgery. Effective communication in trauma teams is about what leaders express, and how they speak to and involve other members of the team.

Overall, an important aspect is that extensive experience of trauma, will require many years to achieve but the findings in this thesis show that it is more important for the leaders, through training, to understand how they can use communication, including non-verbal communication, to gain access to inner circle. If they are left to gain this knowledge through experience many patients will receive worse care during the years that this takes. The results in this thesis thus provide an achievable way to substantially improve the care of trauma patients.

Conclusions

This thesis widened knowledge of how communication in trauma teams can be understood, and how communication in trauma team training can be improved by focusing on the team leaders' communication. The leaders have an important role in the trauma team and need to communicate effectively. The studies showed that in order to convey common goals the leaders used different communication strategies that varied depending on the situation and the interaction. Depending on chosen communication strategy different positions were enabled; authoritarian and/or egalitarian.

Clinical implications

The results in this thesis contribute important knowledge regarding how members in trauma teams communicate during trauma team training. This can have practical implications for improving trauma team training programs, since there are benefits to be gained by actively practicing how to communicate.

One example is the importance of practicing CLC during trauma team training, with a specific focus on the team leader. The results show that the more CLC initiated by the leader, the greater the likelihood of the team making a decision on final treatment. Although efforts have been made to bring the recommended communication tool, CLC, into focus, one of the studies in this thesis showed that it was used only to a limited extent.

The results also shed light on an ideological dilemma relating to written regulations. These regulations state that, on the one hand, the leader should be authoritative, and on the other, that the hierarchies should be "flattening". It is important to discuss this dilemma that: how can the leader gain the best knowledge in order to give the patient the best treatment? Important information from the team members concerning changes in the patient's condition may not be taken into account if the leader retains their position as an authority. The importance of "speaking up" must be emphasized, since it can be decisive for the patient's treatment. Even if it is important to take every team member's knowledge into account, "flattening" hierarchies can delay effective treatment of the patient. One study in this thesis showed, for instance, that CO and CLC initiated by the team members decreased the likelihood to make a decision to go to surgery. CO and CLC initiated by the team members are necessary when the leader is inexperienced and/or needs guidance, but in critical situations the team members must be aware of the risk of communication overload. Another way for the leader to convey knowledge and create common goals can be to use different knowledge repertoires. In clinical practice it is important to remember that, depending on the situation and interaction, different repertoires can be used flexibly in order to gain relevant knowledge.

Clinical implications

Another clinical benefit that can be drawn from this thesis is that the leaders who gained control over the “inner circle” positioned themselves in an authoritarian position and emphasized their verbal messages using gaze direction, vocal nuances, verbal commands, and gestures. In this stressful and noisy environment it is important to underline the message in this way. We can assume that there are benefits to be gained by using clear non-verbal communication. In the same study, leaders who seemed to have less control over the inner circle were characterized by speaking in a hesitant voice and giving hesitant answers which were not audible to the team members. Leaders with less experience and who are more soft-spoken can improve their communication strategies by using clearer verbal communication complemented with strong non-verbal communication.

Future research

Future studies should investigate the effects of the leader’s gender, ethnicity, and years in profession, as these factors may be significant for how the communication in the trauma team works. The results in this thesis indicated differences in verbal and non-verbal communication between leaders, and pointed to that working failures occurred more often in teams led by women than in teams led by men (Study I). In addition, having a Scandinavian origin was associated with more frequent use of closed-loop communication (Study II). These factors have only been studied in a limited extent in this thesis, and no conclusions can be drawn based on this results. Therefore, future studies should focus of how factors such as gender, ethnicity, age, and class influence hierarchical positions and unequal power relations in the trauma teams.

This thesis points at a need to further investigate communication in trauma teams, during real emergency situations in the emergency room. These studies were performed with a patient simulator during trauma team training, it may be possible that the team members will communicate differently in a real situation. Future studies will deepen our knowledge of the communication process in trauma teams.

Clinical implications

These studies were conducted in 18 trauma teams taking part in regular trauma team training. Involving more trauma teams in future studies should also strengthen the findings from these studies.

To further widen the knowledge of communication in the trauma team, studies could focus on how nurses communicate in the trauma team. Although in this thesis I have studied how the leader communicates knowledge in the trauma team, nurses also play an integral and important role, and so it is important to learn how they communicate their knowledge. Differences between the professions' communication styles have been described as contributing to communication failure and tensions within interdisciplinary teams (135). By identifying profession-specific aspects of communication, interdisciplinary team training can improve and strengthen the communication within the teams.

In these studies the second step of closed-loop communication (check-back/read-back) were not included into the analyses, future research may take this part of closed-loop communication in order to deepen the understanding of communication in trauma teams.

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Appendix

Organisation på akutrum vid omhändertagande av multi-trauma patient

Patienten lyfts - efter kort ambulansrapport - från vacuummatrass över till akutrumsbåren där rygglåtar för pulm och bäcken redan ligger.

	Sjuksköterska 1 (akut)	Läkare 1 (kirurg)	Läkare 2 (narkosläkare)	Sjuksköterska 2 (narkos)	Undersköterska (akut)
Funktion	Patientens vård	ÖVERGRIPANDE VÅRDANSVAR	Patientens huvudvårdning	Patientens huvudvårdning, därefter på hö sida	
FÖRPLANERING	Lifts trauma larm Beräkna ankomst AKM Förbered akutrum Förvarna CT	Beslut om lämnivå Kalla andra specialister Kontroll akutrum Prioritera vid fler skadade	0-Rh-neg blod snabbt tillgängligt på Blodcentrals akutlab. tel. 52076. Möta patient på akuten	Ordna anestesimedel Ordna anestesiutrustning	Frivåg till akutrum Möta i ambulansinläg
OMBEHÖR ÅTGÄRDER	Ass HLR Grovt iv-infart vä arm Blodprover 1000ml varm Ringeracetat Exponera torso Stoppa synlig blödning	Primär Bedömning BCD Vitalinsatser ABC (kirurgisk, koniolomi, mlthoracoscentes) HLR Sakra fri luftväg (samråd före Blodtransfusionsbehov (samråd läk 2))	Primär bedömning ABCD Vitalinsatser ABCD (näskontomi, jet insufflation) HLR Sakra halsrygg Sakra fri luftväg (samråd före intubation för bedömning av D) Blodtransfusion?(samråd läk 2) Forsatt bedömning vitalstatus	Ass säkrande av luftväg Ass HLR Exponera nedre kroppshälva Ev. Kontomi set	Ass HLR Exponera nedre kroppshälva Ev. Kontomi set
FORTSATT BEDÖMNING	Skydd mot hypotermi (Bairhugger, varma filtar)	Akut åtgärd BC Thoraxdrän DPL Friläggning perifer ven	Akut åtgärd C Fortsatt iv vätskebehov Behov av smärtstillning	Arteriella blodgasser Ass akut åtgärd A Ringeracetat/v olven/Blod Admistrera analgetika	Bairhugger Ev. Thoraxdrän Ev. Pericardioscentes Ev. Friläggnings set
FORTSATT ÅTGÄRDER	KAD om ej kontraderad ID-märkning (kontroll) Läkemedel (retanusvaccin, antibiotika, cortison etc.)	Sekundär bedömning Vårplan Stabilisera inför transport Analysera rtsvar	Iv-sond Kontrollera ntri vid överflyttning Artnål (vanligen inte) CVK (vanligen inte)	Ass likt 2 Materiel vid överflyttning	Ass KAD Ev. DPL set Ev. SP kateter set
ÖVER- FLYTTNING	Ring CTÖP - vi kommer! Komplettera traumajournal	Informera anhöriga Traumajournal Press-kommuniké	Övervaka ABCD Medfölja överflyttning	Övervaka ABCD Medfölja överflyttning	Ryggrädd + gedyña
EFTER ÖVER- FLYTTNING	Kontakt med anhöriga Iordningställa akutrum	Ansluta på op/rtg/iva Beslut om vård efter CT Kontroll rapportering "Bedside" överläggning Komplettera traumajournal	Samråd om vård efter CT Rapportera	Följa till slutdestinationen Rapportera	Iordningställa akutrum

Debriefing (eftersnack) vid lämpligt tillfälle inom 24-72 timmar (se kapitel 4). Glöm ej närvarande studenter

From the Trauma manual, Umeå University hospital, 3rd ed, May 5, 2005

Dissertations

Dissertations from the Department of Nursing the Faculty of Medicine, Umeå University, Sweden

Doctoral theses

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