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PHD THESIS

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CONDUCTING THE EMERGENCY TEAM

Focus on leadership

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Front-page illustration:

A quickly drawn sketch of the parallel between the conductor and the clinical team leader (by TL)

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PAPERS INCLUDED IN THE THESIS

Paper 1

Ture Larsen, Randi Beier-Holgersen, Jette Meelby, Peter Dieckmann, Doris Østergaard.

Training residents to lead emergency teams [Part One]: A Systematic Review

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Paper 2

Ture Larsen, Randi Beier-Holgersen, Doris Østergaard, Peter Dieckmann.

Training residents to lead emergency teams [Part Two]: Barriers, Challenges and Learning Goals concerning training residents to lead emergencies: a Qualitative Review

Submitted to Annals of Surgery (December 2017)

Paper 3

Ture Larsen, Randi Beier-Holgersen, Peter Dieckmann, Doris Østergaard.

Conducting the emergency team: A novel way to train the team-leader for emergencies

Submitted to Lancet (December 2017)

ABBREVIATIONS AND DEFINITIONS

LBDQ	Leadership Behaviour Description Questionnaire [1]
NOTECHS	Non Technical Skills behavioural marker system. A method for assessing an individual pilot's nontechnical skills (e.g. leadership, decision making, teamworking, situation awareness). [2]
NTL	The National Training Laboratories' average retention rates for different training and teaching methods
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses. PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses [3]
GRADE	Grading of Recommendations Assessment, Development and Evaluation. The GRADE process develops recommendations, the evidence profile, and Summary of Findings table. Grade describes the process for framing questions and identifying outcomes [4]
CASP	Critical Appraisal Skills Programme [4]
Abduction	Theory → Data ←→ Data → Theory → Analysis → Conclusion
Deduction	Theory → Data → Analysis → Conclusion
Induction	Data → Theory → Analysis → Conclusion
QCA	Qualitative Content Analysis
GT	Grounded Theory
Ontology	Knowledge about being (the nature of being) [5]
Epistemology	Knowledge about knowledge (science/knowledge) [5]
Positivist:	
Positivist's ontology	Believes there is one single reality and believes in universal concepts [6]
Positivist's epistemology	Empiricist: collecting – hypothesis – test hypothesis objectively using statistical. No interpretation.
Positivist's methodology	Theory developing: Hypothetic deductive method
Constructivist	
Constructivist's ontology	There's no single reality, reality is *constructed* in the context [7]

Constructivist's epistemology	Interpret reality (puts oneself in the project)
Constructivist's methodology	Inductive (look at single cases studies)
Written communication	Linguistic is based on words and sentences. The value of a word is rarely completely neutral, as there are typically connotations to a word. Furthermore, it is possible to talk about the surface content of the text as well as interpretations of the underlying meaning [8]
Extra linguistics	Non-verbal communication, pictures, videos, all means of multimodal communication [9]
Oral communication	Speaking, lectures, and presentations: Linguistics, including the possibility of adding extra linguistics
Face to face communication	Interpersonal communication: all communicators actively participate and are responsible for its creation. Linguistics, including extra linguistics
Semiotics	The range of different kinds of signs that can be found as compared to language that comprises abstract symbols. [10] Charles Sanders Peirce (1839-1914) described thoughts not as 'ideas' but as 'signs,' external to the self and without meaning unless interpreted by a subsequent thought. His general theory of signs – or semiotic – is especially pertinent to methodologies currently being debated [11]
Multimodality	Describing other meanings than based on language and linguistics. There is visual language, gestural language, and so forth. It is socially produced, cultural resources for making meaning. Situations are given where text only gives a partial account of what is going on[12]

SUMMARY OF THE THESIS

The specific approach to this thesis is to explore a different approach to train the emergency team leader with help from another profession. Furthermore investigate existing aspects of training of the team leader in emergencies in healthcare.

This thesis is based on an abductive approach. The main idea is conceived in collaboration between a surgeon and an orchestral conductor who realised a parallel between leading a medical team and leading an orchestra in terms of the non-verbal communication that demonstrates that the leader has assumed leadership.

It has been described in the literature for the last 30 years that there is an urgent need to train residents and medical students in leadership in acute medical situations. The literature describes the need for the team leader to rise to the occasion when called upon to act as leaders of emergency teams: many residents/rescuers feel unprepared to adopt the leadership role in emergencies. It is important to assume leadership during the teamwork that takes place in the critical situation, as lack of leadership is concluded to be one of the causes of poor outcomes for the critically ill patient.

The conclusion of a systematic review that included all the intervention studies found, focusing on whether or not found adequate training in the team leadership role among residents, is unfortunately that no focused leadership training has taken place.

Instead, literature revealed a large number of taxonomies aiming at measuring the ability of residents to implement various professional algorithms without specific focus on the leadership role. The literature has devoted time to developing measuring instruments in the form of taxonomies and has not focused on the development of leadership. It is possible to conclude that focus has substituted from how to *train* leadership to *measure* leadership.

In a qualitative content analysis of the found literature, it was concluded that leadership training is a necessity which is needed to be addressed, but efforts has so far been focused elsewhere and a useful leadership training in emergencies it is still in demand.

By further review and qualitative content analysis of the literature, including all the opinions and reviews found, it was identified that a crucial factor to address is the anxiety residents can experience when they are to take on leadership in acute critical situations. The literature itself

describes how the residents should be trained in mentally assuming leadership, radiating calmness and credibility and demonstrating authority in the critical and chaotic situation. By reviewing the literature, learning goals that should be the focus of an upcoming training were identified. Those should address the actual needs the resident has in the situation.

The course was developed in a non-medical challenging context, but closely related to the clinic. Musical exercises were used, which made the course harmless to the individual medical participant who was not expected to be able to handle the challenges and 'obstacles' in the exercises.

However, the musical 'obstacles' brought the participant into the mentally challenging state, resulting that all of the participant's personal inappropriate non-verbal expressions were revealed in the situation. This enabled the orchestral conductor to address these, give personal and direct feedback to participant, and thus the participant was enabled to recognise own weaknesses and guided by the conductor was given opportunity to strengthen these expressions. In addition, the musical exercises gave the participant an experience of *flow* when conducting, and the individual participant experienced the intense *feeling* when all communication takes place through the leader.

The courses were evaluated using video recordings, transcriptions of these, evaluations from the course participants, as well as written comments from two students who helped to transcribe the transcriptions. The latter did not attend the courses and were blinded to the idea of the course. Again, a qualitative content analysis was conducted and the conclusion is that the course is able to support the individual participant's ability to gain insight into his / her own leadership challenges and to provide advice and assistance in developing his non-verbal appearance and expression.

In general, this thesis has described how collaboration between two very different professions has managed to exploit the various ontological approaches to the experience of the world in a positive and constructive way. It points out that it is beneficial to allow to see beyond own domain or profession.

SAMMENFATNING PÅ DANSK

Formålet med denne afhandling er at undersøge om det er muligt at bruge en anden profession til at træne teamlederrollen i akutte medicinske teams. Derudover undersøge om der findes andre holdninger eller aspekter vedrørende træning af teamlederrollen i akutte situationer i klinikken.

Denne tese er baseret på en abduktiv tilgang. Ideen er undfanget i et samarbejde mellem en kirurg samt en orkesterdirigent, der så en parallel mellem det at lede et medicinsk team og et orkester mht. bl.a. den non-verbale kommunikation, der viser, at lederen har påtaget sig lederskabet.

Det er gennem de sidste 30 år beskrevet i litteraturen at der er et behov for at træne yngre læger og medicinske studenter i lederskab i akutte medicinske situationer. Litteraturen beskriver et behov for at teamlederen træder i karakter og påtager sig lederskabet under det teamsamarbejde der foregår i den kritiske situation, idet manglende lederskab konkluderes at være en af årsagerne til dårligt outcome for den kritisk syge patient.

Konklusionen på et systematisk review med inklusion af alle fundne interventionsstudier med fokus på om der findes eller har fundet fokuseret oplæring i team-lederrollen blandt yngre læger er desværre, at der ikke har fundet fokuseret ledelsestræning sted. I stedet findes i litteraturen et stort antal taxonomier til måling af yngre lægers evne til gennemførelse af forskellige faglige algoritmer uden specifikt fokus på lederrollen. Litteraturen har fokuseret på at udvikle måleinstrumenter i form af taxonomier og har ikke fokuseret på udvikling af oplæringssituationer i lederrollen. Man kan konkludere at fokus er substitueret fra hvordan træner man lederskab til hvordan man måler lederskab.

Ved en kvalitativ indholdsanalyse af den fundne litteratur er konklusionen at lederskabstræning er et nødvendigt behov, der skal dækkes, men at indsatsen indtil videre har været fokuseret andetsteds og at den fortsat efterspørges.

Ved yderligere en gennemgang / kvalitativ indholdsanalyse af litteraturen, hvor også alle fundne opinions og reviews medtages, findes, at den afgørende faktor, der skal adresseres er den angst som yngre læger oplever, når de skal påtage sig lederskabet i akutte kritiske situationer. Der beskrives, hvordan de yngre læger skal trænes i at mentalt påtage sig lederskabet, udstråle ro og autoritet i den kritiske / kaotiske situation. Ved gennemgangen af litteraturen findes hermed de

læringsmål, som bør være fokus i en kommende træning, hvis træning skal fokusere på de behov den yngre læge har i situationen.

Kurset blev udviklet i en ikke medicinsk faglig kontekst, men med tæt relation til den medicinske verden. Der benyttes musikalske øvelser, hvilket gør kurset ufarligt for den enkelte medicinsk faglige kursist, der ikke forventes at kunne håndtere de "benspænd" der er i øvelserne. De musiske benspænd formåede dog at bringe kursisterne i den mentalt udfordrende tilstand, der medførte at alle de uhensigtsmæssige non-verbale udtryk, som er en udfordring vedrørende lederskab i teamledelsen, kom til udtryk. Dette gav orkesterdirigenten mulighed for at hjælpe den enkelte kursist til at erkende, hvor egne svagheder fandtes samt mulighed for at arbejde med disse. Derudover gav de musiske øvelser en oplevelse af flow i ledelsessituationen, hvor den enkelte kursist oplevede den følelse det er, når al ledelse foregår gennem lederen.

Kurserne blev evaluerede ved hjælp af videooptagelser, transskriptioner af disse, evalueringer fra kursisterne samt kommentarer fra to studenter der hjalp til med at fortage transskriptionerne. Sidstnævnte deltog ikke på kurserne og var blindede for tankerne bag kurset. Igen blev gennemført en kvalitativ indholdsanalyse, og konklusionen på denne er, at kurset formår at understøtte den enkelte kursists mulighed for at få indsigt i egne udfordringer i lederrollen samt at give råd og hjælp til at udvikle sit non-verbale udtryk.

Overordnet har denne tese beskrevet hvordan samarbejde mellem to meget forskellige professioner har formået at udnytte de forskellige ontologiske tilgange til oplevelsen af verden på en positiv og konstruktiv måde. Den påpeger det frugtbare i at tillade sig at se udover egen faggruppe/profession.

STRUCTURE OF THE THESIS

The first chapter presents the background. The second chapter presents the conceptual framework; the ontology and the methodology of the thesis. Furthermore this chapter presents theories considered relevant to the thesis; learning theories, discussion on anxiety and learning, the intuitive and the rational way of thinking, and an assessment model of the impact of learning. Finally, the chapter presents several approaches to non-linguistic or extra linguistic language. The third chapter presents the methods used and data acquisition and analysis. The fourth chapter provides a brief description of the three studies. Chapter five presents a discussion of the implication of the findings in the thesis. Chapter six discusses the limitations in the three studies, and finally concludes on the three studies, highlights implications for practice and suggests future research.

Study one examines the medical, pedagogical and psychological databases if there is a well-functioning training of the clinical team leader in emergencies, 27 articles were relevant. In addition, it examines by a qualitative content analysis whether there is consensus on the importance of leadership.

Study two examines the 27 articles found plus additional 13 articles if it is possible to identify challenges and learning goals concerning leadership training in emergencies.

Study three presents the intervention of the thesis, a course conducted and designed by a conductor and a consultant for residents, medical students and senior nurses at the emergency room.

At the back of the dissertation an online appendix that presents the comprehensive results of the qualitative content analyses is situated. In addition, a log from the course containing field notes, transcribed dialogues, and evaluations. Finally, links to two documents presenting videos from the course is present.

BACKGROUND

Team leadership in emergencies is reported as being important for the quality of the performance of teams [13-24], for patient outcome, patient safety and patient care [22,23,25-35]. The quality of team leadership may even influence patient mortality and survival rates [19,23,27,32].

However, many studies identify that leadership training has been inadequate [1,16,17,23,27,29,36-39], and a recurrent call for *a workable* leadership training programme has been expressed explicitly [1,14,16,17,21-23,26,27,29,34,36-43]. This need has prevailed throughout the 30-year period addressed in our investigation.

The literature affirmed that targeted leadership training is very important. It is necessary for residents to address and handle anxiety [16,23,27,32,44] and panic [32] in stressful [20,22,25,27,31,32,34,41,45] and complex [19-22,35,39,41] situations. Therefore, in order to provide good and convincing leadership, residents must learn to be confident [1,16,23,27,32,36,37,39,41,42,44,46,47] and calm [16,30,32,44] when assuming the leadership in emergencies.

However, 'something' is apparently still missing, and the reason why 'residents feel unprepared and unsupervised as leaders' [27] should be explored.

The parallel between the conductor and the team leader in emergencies in this context is the highly intense situations they work in: both situations require clear and convincing leadership and there is no time or room for discussions. Neither the concert nor the cardiac arrest can be interrupted. The leader's guidance and instructions must be carried out immediately.

One year prior to the start of the PhD study, a pilot project was conducted. A consultant who also was an amateur trombone player realized the parallel between the teamleader and the conductor when her concert band received a new skilled conductor. The consultant and the conductor designed a course for medical students who participated in a program introducing non-verbal communication and team leadership. The results from the course is described in the article "Team Management - Can music contribute to better understanding?" [48]. (Abstract is presented in the appendix section).

Many initiatives have sought to address leadership training in emergencies: in particular leadership is part of the Scottish initiative Anaesthetists' Nontechnical Skills (ANTS) [49], adapted to 'Non-Technical Skills for Surgeons' (NOTSS) [38], and to 'Scrub Practitioners' List of Intra-operative Non-

Technical Skills' (SPLINTS)[50]. The latter replaced NOTECHS for nurses [51] – which was also modified to: Oxford NOTECHS [52] and among other things: T-NOTECHS [53], as well as the Swiss leadership training programme based on the Leadership Behaviour Description Questionnaire (LBDQ)[1]. These programmes focus on developing formative assessment tools[54], behavioural markers [55] and taxonomies in order to measure [15,22,33,38] leadership skills. Since 2015 the literature has begun to question the number of tools – and methods used – in the taxonomies [34].

Handling negative feelings is not a part of existing programmes. Leadership during an emergency situation involves knowledge and skills, but also implies dealing with the pressure [16,25,28,34,38,56] of being the decision-maker and taking the ultimate responsibility for what happens (or does not).

THE CONDUCTOR

The conductor works purposefully with his posture and appearance in order to eliminate anything that could possibly prevent the message from being interpreted as intended. The conductors' main focus to achieve the authority to lead an orchestra, it is important to appear calm, balanced, competent, authentic, and credible. This is the basic starting point for the conductor, when recognised, he is able begin to work and choose his style of leadership [57].

This views expressing the conductor's reflections on his work with the orchestra's musicians are general and do not reflect the opinions of a single conductor. The above description of the conductors focus is read by two symphonic conductors, and discussed thoroughly. Both conductors could endorse the reflections and opinions that were presented.

No literature addresses these competencies equally in health care.

EMERGENCY IN HEALTHCARE

"Emergency medical care teams have […] little time for deliberate planning and elaborate communication while providing care. Second, such teams are generally ad hoc, that is, assigned to work together in ever changing compositions" [40]. 'Ad hoc' teams are also referred to as 'crash' teams [23].

This situation is complex [16,19-22,24,25,29,30,33,35,39,41,44,56,58] and stressful [16,20,22,23,25,27,29-34,41,45,47,59] and has been referred to as a chaotic situation [1,32,34,41,44,46,60] perceived as with anxiety [1,14,16,23,27,32,36,44]. In this framework, the emergency team leader should rise to the occasion when called upon, mark

leadership and identify competencies and resources of the team for the purpose of ensuring the best treatment of the patient.

The problem has been to define these issues and subsequently find a way to train these objectives in healthcare.

AIMS

The overall objective of this thesis was to explore a different approach to train the leader of the emergency team with help from another domain. Furthermore to investigate existing aspects of training of the team leader in emergencies in healthcare using different methods in three studies with the following aims:

Study 1: To describe how literature addresses workable and operational leadership training for the emergency medical team-leader and to enhance understanding of leadership training in the medical environment.

Study 2: An investigation to determine any consensus in opinions and views about challenges or barriers in training leadership in emergencies.

Study 3: The overall aim of the course is to investigate whether, in an emergency, a clinical team leader could apply a conductor's leadership skills. A description of a course held for residents, medical students and emergency room nurses.

CONCEPTUAL FRAMEWORK

DIFFERENT ONTOLOGIES

Ontology: Ontos is Greek for being, logos means study i.e. 'the study of being'. What can be said to really be, or exist? Epistemology: Episteme means knowledge and logos study i.e. 'the study of knowledge'. Even if something really exists, how can I know?

The researcher, who is a conductor, is influenced by a constructivist's ontology, stating that reality is a social construction and must be seen in the context of individuals, and therefore many (interpreted and constructed) realities are present. His epistemology is inductive and interpretative.

Qualitative research methods are "used in the exploration of meanings of social phenomena as experienced by individuals themselves, in their natural context" [7].

A typical surgeon is working in a positivistic research tradition, believing that the world is objective and can be measured, that there are universal concepts, and that these can be objectively verified by statistical manoeuvres. There is only one reality. His epistemology is as an empiricist, that is, he is *testing*. "Medical doctors believe that their field is founded on scientific knowledge; where knowledge is defined as facts that can be empirically verified by the biomedical method", as stated by Malterud [6].

QUALITATIVE METHODOLOGY CONSIDERATIONS

The following research approaches have served as sources of inspiration in this thesis: Grounded theory (GT) [61,62], qualitative content analysis (QCA) [8,63], and hermeneutics [5]. Central to these approaches is that they all rely on a continuous movement between pre-understanding and analysis, 'moving to and from' [64].

The following features are common to GT and QCA: The researcher looks at phenomena with fresh eyes and from new perspectives without restriction within already existing hypotheses – and based on the findings, ideas are developed – and the researchers takes another look at the phenomena [8,63]. In hermeneutics it is stated that to understand a part of a text, one must understand the whole. At the same time, however, one can only understand the whole when understanding the individual parts [5]. All three approaches to interpretation bring the importance of the interpreter into focus. Hans-Georg *Gadamer* argued that knowledge is not something that we acquire and control as a possession. Rather knowledge is to be understood as something in which we are always already situated. The reason we understand anything at all is because we already stand in it [65]. It has been argued in hermeneutics that pure description is impossible because description always involves interpretation [5]. Data can be collected from multiple channels in all three methods, such as interviews, observations, documents, and visual materials [5].

Originally QCA was developed within the field of communication and linguistics as a means to understand the meaning of text and context [8] in order to challenge/supplement a tendency to focus on the quantitative content. GT methodology emerged from the field of sociology [66]. GT is a reaction to positivistic perspectives on science [8]. Hermeneutics is a methodology working with semiotics, presumptions, and pre-understandings [5].

Major Coding Differences Among Three Approaches to Content Analysis

Type of Content Analysis	Study Starts With	Timing of Defining Codes or Keywords	Sources of Codes or Keywords
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of Literature

Table 1. Hsieh: Three Approaches to Qualitative Content Analysis [63].

As presented in Table 1, an *inductive approach* (conventional [63]) is appropriate when prior knowledge regarding the phenomenon under investigation is limited or fragmented [8]. In an inductive approach, codes, categories, or themes are directly drawn from the data [8]. A *deductive approach* (directed [63]) starts with preconceived codes or categories derived from prior relevant theory, research, or literature [8]. A *summative approach* identifies and quantifies certain words in an attempt not to infer meaning but, rather, to explore the extent to which a certain word is being used, thus it is a *quantitative analysis*: the researcher codes the visible and surface content of text (manifest content [8]) and count words. But if the researcher codes the underlying meaning of the text (latent content analysis [8]) it is a summative approach to QCA [63].

In qualitative studies the researcher brings himself in to the investigation, and consequently attention should be drawn to the objectivity and scientific quality of the study. 'Subjectivity' arises when the effect of the researcher is ignored [7].

However, the effect of the researcher is highly implemented in these approaches. In GT and QCA the findings can influence data collection, that is, an interpretation is taking place *before* examining the findings second time. In hermeneutics it is argued that understanding and pre-understanding are fundamental conditions to each other.

The origin of these approaches is related to 'abduction' as defined by Charles Sanders Peirce (1839–1914). An abductive approach to research makes it possible for the researcher to present a qualified presumption *(educated guess or inference)* [67] when commencing his investigation. Based on his findings, he acquires new knowledge, he might alter / adapt this new knowledge to the presumption and the process starts over.

LEARNING THEORY CONSIDERATIONS

THEORIES SUPPORTING CONCEPTUAL CHANGE OR TRANSFORMATION

This section explains how the learning environment can support conceptual change and transformation.

EMBODIED COGNITION

"Cognition is embodied when it is deeply dependent upon features of the physical body of an agent, that is, when aspects of the agent's body beyond the brain play a significant causal or physically constitutive role in cognitive processing" [68] . The theory might be used in the design of effective learning environments, especially those targeting conceptual change [69] . The course described in this thesis assumes that one has to experience the pressure as a conductor by *practice* to understand it as described in *Embodied Cognition*.

TRANSFORMATIVE LEARNING THEORY

In *Transformative Learning Theory* [70] it is stated that one prerequisite for creating a real transformation is being faced with a 'disorienting dilemma' defined as an acute personal or social crisis and through 10 phases (Table 2) of 'perspective transformation' leading to 'a reintegration into one's life on the basis of conditions dictated by one's new perspective' [71] .

1	A disorienting dilemma
2	Self-examination with feelings of guilt or shame
3	A critical assessment of assumptions
4	Recognition that one's discontent and process of transformation are shared and that others have negotiated a similar change
5	Exploration of options for new roles, relationships, and actions
6	Planning of a course of action
7	Acquisition of knowledge and skills for implementing one's plans
8	Provisionally trying out new roles
9	Building of competence and self-confidence in new roles and relationships
10	A reintegration into one's life on the basis of conditions dictated by one's new perspective

Table 2. 10 phases of perspective transformation, Transformative Learning Theory [70]

In the course mentioned, participants were presented for a 'Disorienting Dilemma' at a personal level as in this course: the participants were given assignments almost impossible to solve.

APPRENTICESHIP

Apprenticeship is practice, the student learns from senior master who acts as role model. The master furthermore allows himself to be subjective and bases feedback on his own experiences

from his profession. In short, the learning mechanisms and processes are defined as: Imitation, identification with role models, feedback on specific work solutions, in depth professional focus and peer-to-peer learning [72] (TL's translation from Danish).

In addition, regarding apprenticeship and leadership, it is stated by Mintzberg that leadership "is a *practice*. It is not a profession, not a science. You can't learn it the way you learn surgery or engineering" [73]. This is relevant to the course described in this thesis, because the conductor has acquired his skills mainly through *practicing* leadership.

FLOW THEORY – A PEDAGOGIC IDEAL

This section explains how a learning environment can support the intensity in a student's focus in a learning situation.

"Flow" is defined by the psychologist Csikszentmihályi as: "the creative moment when a person is completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one… " [74]. "The flow state must be a general pedagogical ideal because it is often extremely good learning, as you are optimally challenged, fully focused and emotionally involved so you tend to remember very much of what you are dealing with" [75] (TL's translation from Danish). The conductor knows that when collaboration works optimally with the orchestra, a state can occur where time and place is dissolved as described in *Flow-Psychology* [76], and wants to give the participants an opportunity to experience the *feeling* of flow at the course described.

ANXIETY COUNTERACTS LEARNING

Anxiety causes the body to prepare itself for fight or flight. Chris Williams, professor of psychosocial psychiatry states "If you are in a situation of imminent actual threat, then the increased alertness and body response can be lifesaving, […] but if it occurs when trying to revise, or present a talk, or at such a high level that it paralyses or causes errors, it can interfere with what we want to do." […] Consultant psychiatrist Rajeev Krishnadas states: "Under normal circumstances the amygdala is under tight control from the prefrontal cortex, which evaluates the threat associated with the stimulus. […] If it is threatening, the amygdala fear response is maintained." This is clearly not a state conducive to learning or concentrating in a seminar, says clinical psychologist Dr Angharad Rudkin. "Even if you manage to take in what is being said, the information is likely to bounce around [in your brain], not being processed properly or stored in your long-term memory" [77].

It is important to address fear; a conductor who is afraid in front of an orchestra has been deprived of the opportunity to work. However, anxiety is used as a foundation for creating the disorienting dilemma described above.

THINKING, FAST AND SLOW

Psychologist Daniel Kahneman discusses three topics relevant to this thesis: System 1 and system 2, the intuitive expert, and substitution.

System 1 and system 2

Kahneman describes two ways of thinking. System 1 is fast and intuitive and automatic: associative memory continually constructs a coherent interpretation of what is going on in our world at any instant. System 2 is slower, deliberate and logical: consisting of controlled operations representing an effortful mental activity. The highly diverse operations of System 2 have one feature in common: they require attention and are disrupted when attention is drawn away. Intense focusing on a task in system 2 can make people effectively blind, even to stimuli that normally attract attention. System 1 runs automatically and System 2 is normally in a comfortable low-effort mode, in which only a fraction of its capacity is engaged. System 1 continuously generates suggestions for System 2: impressions, intuitions, intentions, and feelings. If endorsed by System 2, impressions and intuitions turn into beliefs, and impulses turn into voluntary actions [78].

The intuitive expert

The intuitive expert is a term introduced by Kahneman, and he explains: “The chess master who walks past a street game and announces “white mates in three” without stopping, or the physician who makes a complex diagnosis after a single glance at a patient. Expert intuition strikes us as magical, but it is not.” It also occurs in our daily lives: “Most of us are pitch-perfect in detecting anger in the first word of a phone call, recognizing as we enter a room that we were the subject of the conversation, and quickly responded to subtle signs that the driver of the car in the next lane is dangerous. Our everyday intuitive abilities are no less marvellous than the striking insights of an experienced firefighter or physician – only more common” [78].

Substitution

The mechanism of replacing a difficult question with a simpler one is extensively described by Kahneman: “when faced with a difficult question, we often answer an easier one instead, usually without noticing the substitution […] The target question is the assessment you intend to produce.

The heuristic question is the simpler question that you answer instead. The technical definition of *heuristic* is a simple procedure that helps find adequate, though often imperfect, answers to difficult questions" [78] .

Kahnemans objectives have an impact on the existing taxonomy based training as well as the substitution found in the literature, but, furthermore, at the course described in the thesis; the master / apprenticeship relationship and achievement of learning goals for the participants.

LEARNING PYRAMID, NTL

The National Training Laboratories has found the following average retention rates for different training and teaching methods. This is included in the thesis in order to discuss at which level the learning in the described course is, according to NTL.

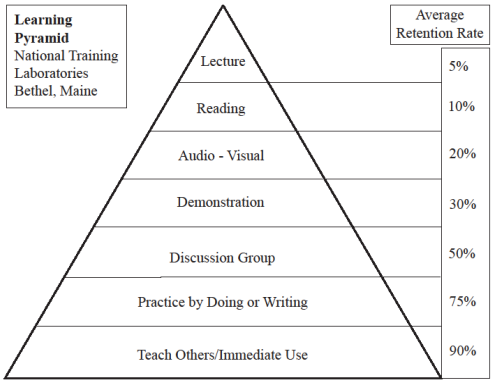

Figure 1. The Learning Pyramid

ANALYSIS CONSIDERATIONS ON EXTRA LINGUISTIC DATA

When two people are present, communication will always take place. It is impossible not to communicate [79] .

This thesis aims at investigating and exploring the conductor's non-verbal skills. Therefore, the following theories and methods of analysis are included to illustrate evidence on non-linguistic communication, including the use of video for research purposes.

INCONGRUENCE BETWEEN ORAL AND EXTRA LINGUISTIC COMMUNICATION

In the 1960s, Mehrabian became aware that there were other factors than linguistics that were important in face to face communication. Mehrabian performed simple interventions where he

demonstrated his findings on inconsistent messages of feelings and attitudes (and the relative importance of words vs. nonverbal cues). When there is incongruence between words, voice and facial expression in communication, our attention will be drawn from the words and their meaning to non-verbal communication. That is, where the words did not match the facial expression specifically in Mehrabian's research people tended to believe the expression they saw, not the words spoken [80,81] .

SEMIOTICS

A pioneer in semiotics was Charles Sanders Peirce (1839-1914) and today his thoughts are among the foundations for Multimodal Analysis. At the centre of his philosophy was a model of the way human beings think, he challenged traditional models by describing thoughts not as 'ideas' but as 'signs,' external to the self and without meaning unless interpreted by a subsequent thought. His general theory of signs – or semiotic – is especially pertinent to methodologies currently being debated [11] . He pioneered approaches to studying visual semiotics, and was interested in the range of different kinds of signs that can be found as compared to language that comprises abstract symbols [10] .

Pierce's work about symbolization and to the conscious control and awareness of signs became known to Susann K Langer (1895-1985). Langer is important for this thesis when she states: "The limits of language are not the last limits of experience, and things inaccessible to language may have their own forms of conception, that is to say, their own symbolic devices" [82] .

MULTIMODALITY (EXTRA LINGUISTIC COMMUNICATION)

Gunther Kress (Professor of Semiotics) emphasises that in linguistics there is always something that is *paralinguistic* or *extra linguistic* existing together [9] . Multimodality is describing other meanings than based on language and linguistics. There is visual language, gestural language, and so forth. It is socially produced, cultural resources for making meaning. Situations are given where text only gives a partial account of what is going on [12] . Though it is important we should not throw knowledge overboard: linguistics has shown us how language works and sociolinguistics shows how it is used [9] . Multimodal discourse analysis opens the possibility of moving against the "reductiveness of twentieth-century generalizations and abstractions […] and toward a full account […] of the impact of the fact that, as humans, we are physical, material bodies and that meaning cannot be understood outside the recognition of this materiality" [83] . "Gaze, gesture and posture,

for instance, tend to be considered a *support* to speech; reinforcing or otherwise modifying speech but not providing communication in its own right, and image is often thought to be in a *supportive* relation to writing. Multimodal research across a range of social settings cast doubts on this assumption" [84] .

VIDEO ANALYSIS

It was stated in 2000 that when transcribing 'visual phenomena' we are only at the beginning of this process [85] . And it was considered a challenge associated with enormous methodological and theoretical problems [85] . Furthermore, video as data collection was extensively discussed by researchers [86] .

Xiao et al. stated in 2004 that video recordings are a rich source of data for such research because, in comparison to observational notes and audio recording, video recordings capture much of the richness of human interactions and of the context in which activities are studied [66] . However, Xiao does not take the consequence when he decides to limit the use of videos to *verbal* analysis of what's going on in his study. One possible explanation could be that Xiao did not have methods or toolkits to describe / analyse this *"richness of human interaction"* which he emphasizes. In 2010 Raudaskoski stated that visual data material has no established transcription standards [87] .

The availability and use of video has evolved exponentially over the last decade, and production of High Definition video is now available to everybody at their daily life especially via mobile phones camcorder. It is today a natural mean of communication and videos are shared on all social media. It might be argued that video has evolved into being an independent form of communication on its own. According to Statistic Brain Research Institute it is interesting to ascertain that in 2016 300 hours of video was uploaded to YouTube every minute, total number of people who use Youtube 1.325.000.000, and the number of videos viewed everyday was 4.950.000.000.

CONDUCTORS AND VIDEO

In recent years, the use of video recordings has been a natural and integral part of conductor teaching at the conservatories around the world. For example, at the Sibelius Academy in Helsinki, Finland, a camera is mounted in the rehearsal room for the purpose of recording the conductor in close-up as he conducts the orchestra. A video room has been built where students receive and provide feedback on the performance together with the lecturer after the rehearsal with the orchestra.

VIDEO AND SIMULATION IN HEALTHCARE

Video is widely used in simulation training in healthcare, hence the students are highly accustomed to the presence of a camera during the training. Video recordings in the emergency department are used in USA and are regarded as an effective tool for improving trauma team performance by educating clinical staff regarding roles and responsibilities [88] . The use of a surgical black box [integrating video recordings] has been researched [89] . Delivery situations, that represent complications, are video recorded at Aarhus University Hospital in Denmark in a PhD research project in 2017 managed by Lise Brogaard, PhD-student.

PRE-UNDERSTANDING

In accordance with qualitative research traditions, the PhD student's preconceptions are accounted for. Being an orchestral conductor, I find the social mechanisms that take place in the interaction between conductor and musicians extremely interesting, both to observe as well as to influence in my position as conductor. Furthermore, I have been a professional musician and have thus the other perspective on this cooperation seen from the team's point of view, and have thus experienced the huge distance between those highly different viewpoints. In addition I am a composer and as such I have created and have detailed orchestrated complex actions and events at a long time distance, as all composers do. Those are the pre-understandings I bring into this project.

METHOD

SYSTEMATIC REVIEW

In the first study, we systematically reviewed the literature. Quantitative studies were classed according to PRISMA [3], Cochrane [90], and GRADE [91]. PRISMA focuses on the reporting of reviews evaluating randomized trials, but can also be used as a basis for reporting systematic reviews of other types of research, particularly evaluations of interventions. GRADE's approach to rating the quality of evidence is used in this study. With GRADE, the quality of evidence was assessed, as well study design / method as risk of bias, inconsistency, indirectness, imprecision and publication bias. In addition Cochrane's recommendations for the risk of specific bias have been assessed: selection, performance, attrition, detection and reporting bias. There has been attention to internal validity and external validity in the assessments. Qualitative studies were classed according to CASP (Critical Appraisal Skills Programme) [4].

A number of presumptions were included in the search in the systematic review for the purpose of narrowing the number of articles in this search. One presumption was that operational leadership training is related to non-verbal communication. Another presumption was that NTS or NOTSS might turn out to address the topic. A third presumption was that specific words about leadership were necessary (authority, respect, management, leader, lead, etc.). The literature was searched for the words describing the conductor's competencies (conductor, orchestra, symphon*). Education was added in the search (teach, educa *, train *, learn *). Various emergencies (CPR, intensive, acute etc.) were added. 'Mesh terms' was searched in the Pubmed database: 'leadership' and 'education, medical'. Combinations of the above were tested to find the connection with the clinical team leader. Supplementary search was inspired by articles found in Pubmed's 'similar articles'. Inspired by the new articles new keywords emerged (training leaders, team learning, urgency, situation, task performance, resuscitation, cardiac arrest, human factors, performance, advanced life support, etc.) combinations of these were added to the search.

QUALITATIVE CONTENT ANALYSIS AS A METHOD

After conducting the conventional systematic review it was decided to examine the articles in another perspective abductive - inductive QCA.

Strategy for qualitative content analysis

In the systematic review, all articles included were grouped together in a single PDF document and searched several times for keywords, their synonyms and, if available, their meaningful similar positive and negative analogies, phrases and sentences. The quotes were grouped into themes in an iterative process, and sorted chronologically. The most important/significant quotes chosen on basis of the authors' interpretation are presented in this thesis.

At the beginning of the QCA the method was 'conventional', abductive – inductive. When codes became established, the search and analysis became directed by those findings. By using a directed, summative approach on 'quantitative manifest content analysis' [63] in order to explore usage of the visible and surface content of the text it was possible to identify consensus on selected words from a quantitative approach. By using 'qualitative latent content analysis' [8] it is possible to interpret the underlying meaning of the words and thus, rather, interpret a qualitative approach.

The preconceived categories in the search conducted in the second paper were guided by the content of an article [44] . Directed (deductive) qualitative content analysis starts with preconceived codes or categories derived from prior relevant theory, research, or literature [63] . Introducing a different perspective on the articles found in the systematic review, the inclusion criteria were expanded to cover experience, perceptions and emotions relating to leadership training in emergency situations, and therefore primary as well as secondary articles became relevant.

QCA was finally used to analyse a course for residents, 3rd semester medical students and nurses, as presented in the third paper as well: All text-based data were gathered into one single PDF document and searched for keywords and sentences describing the content of the course, and the words were interpreted in a meaningful context. The method was Qualitative Content Analysis, conventional, and inductive: Themes emerged in and abductive – inductive process, abductive because the conductor had his presumptions for the course – inductive because the findings adjusted the presumptions. When themes based on keywords were established, the process became directed by the themes, thus the process became deductive. Three keywords were present at the course though rarely verbalized, but showed up on the video footage. The words were grouped into three themes according to the presumptions as well as the findings in the data set.

VIDEO

Video footage was reviewed several times, and edited with the aim of exemplifying the themes described above. Integrated video and audio recordings representing 22:12 hours of observation of all the courses for the residents and students were made. One camera focused on the 'leader' and another on the 'team'. The first four course days were recorded on the GoPro Silver edition, and these cameras were replaced by the GoPro HERO 4 Black edition, which has high definition resolution (4K), allowing zooming in on the details of the footage in the editing process. The HD footage was edited on a MacBook Pro with two external two TB hard drives (one for backup). Recordings from a single course day took up between 40 and 60 GB of disk space: all 22:12 hours of recordings filled approximately one TB of hard drive space. The videos were edited in Adobe Premiere Pro CC, release 2017.1.2.

TRANSCRIPTIONS

Written field notes were compiled for all the courses. Complete dialogues were transcribed from six courses (the final course design). Transcription made partly by TL and partly by two medical students who were not attending or informed about the course ('blinded' as to the background, method and assumptions for the course). Throughout the project, TL kept a research diary, where observations and thoughts deemed to be relevant for the project were recorded (Online log available in Appendix).

EVALUATIONS

All the participants (students, residents and nurses) evaluated the course immediately after. They gave written quantitative evaluations and responded to a short survey of four quantitative questions plus an option for a free assessment comment (Appendix). The students and residents were encouraged to reflect on the course in written evaluations after the course. After receiving edited video clips showing their personal performance during the two course days, the students and residents were sent a survey with 14 questions. The 'blinded' students wrote a qualitative non-guided reflection from the videos transcribed.

ETHICAL CONSIDERATIONS

The Committees on Health Research Ethics for the Capital Region of Denmark was asked to give ethical approval but a formal review was waived for this study (H-4-2015-FSP). All participants gave written consent for their videos to be displayed / published here.

PRESENTATION OF THE INCLUDED PAPERS

STUDY 1

Training residents to lead emergency teams: A Systematic Review

Aim: To describe how literature addresses workable and operational leadership training for the emergency medical team-leader and to enhance understanding of leadership training in the medical environment

Results

Twenty-seven articles were identified. One single study addressing workable and targeted leadership training was identified [41] . Most of the articles discussed several different types of behavioural markers and taxonomies. Leadership training was for the most part combined with the training of algorithms including medical competencies. Nine studies were based on interviews or questionnaires.

A total of 20 taxonomies addressing leadership, teamwork, and communication were mentioned in the articles. Twenty five of the twenty seven articles were influenced by one or both of two frequently mentioned taxonomies: 1) *The Leadership Behavior Description Questionnaire*, LBDQ (adapted from military) (nine articles). 2) *The Non-technical skills taxonomy, NOTECHS* (adapted from aviation) (seven articles). The above mentioned studies did not refer to each other. Nine other articles, however, referred to both taxonomies.

Result of content analysis

Three key themes were evolved: 1) Leadership 2) Taxonomies 3) Training leadership *and* medical competence.

Leadership

Eight different definitions of leadership were identified. Four articles stated in the background to their study that leadership is lacking, and five articles discussed or concluded explicitly that leadership was lacking. Three articles mentioned that leadership training was important and appeared to improve behaviour. Nine concluded that leadership training would have a positive impact. That leadership training has been ignored was stated in the background for three studies. Nine articles discussed or concluded that leadership training has been ignored. 18 of the 25 authors (20/27 articles) identified a recurring need for explicit targeted team leadership training in

healthcare, 7 articles mentioned this in the background / introduction and 13 articles as a finding or a conclusion. Nine articles proposed different approaches or focus areas to improve leadership in emergencies. (Aviation, NTS, Gender, Ethnicity, Non-Verbal communication etc.)

Taxonomies

Four articles agreed that the idea of using behavioural marker systems was to identify explicitly the needed skills with the purpose of teaching, observing and measuring. Two articles find a comprehensive taxonomy advantageous; two stated that taxonomies should be simple. Five articles stated that measurement tools were lacking. Seven articles announced the development of a new or adapted tool. Three articles stated in the background that it could be difficult to keep track of the actual content of the variety of tools and methods. One stated explicitly (in 2015) that the time had come to stop developing new tools and begin focussing on workable interventions in this area.

Training leadership and medical competence simultaneously

One article stated that reducing the cognitive workload beforehand by separating role instructions would have a positive impact on the CPR performance and on the trainees. Six articles explicitly stated that leadership training differed from medical knowledge training. One article stated that it was important to focus on leadership separated from medical knowledge.

Conclusion

No targeted training programmes were found. The literature has focused on developing leadership measurement tools. A prevailing need for explicit targeted team leadership training in healthcare was identified in most articles found.

STUDY 2

Training residents to lead emergency teams: Barriers, Challenges and Learning Goals concerning training residents to lead emergencies: a Qualitative Review

Aim: An investigation to determine any consensus in opinions and views about challenges, barriers or learning goals in training leadership in emergencies

Results

Forty articles were included. Nine themes emerged 1) Residents feel unsupervised and unprepared 2) A complex, stressful, unpredictable and chaotic experience 3) An unpleasant, disturbing, frightening and panicked perception 4) Lowered stress 5) Confidence 6) How a leader is perceived 7) A shortcut to perception of authority 8) Assuming Leadership 9) Born to lead – or learn to lead

Residents feel unsupervised and unprepared
Ten articles concluded that residents felt unprepared as leaders of cardiac arrest teams.

A complex, stressful, unpredictable and chaotic experience

A broad consensus were identified that leadership in emergencies is experienced as a complex issue, as well in terms of stressful situations demanding important decisions for the benefit of the patient, as of managing the team itself. Nine articles, in the background for the studies, mentioned complexity, seven stated complexity in the discussion/conclusion section. The term: *coping with pressure* was mentioned by six articles, and three used a similar term *coping with stress*. The stressful working conditions were emphasized in the background section of eight articles and ten articles highlighted these conditions in the discussion / conclusion section. Three articles described the performance in emergencies as unpredictable or unanticipated. The word *chaos* was used by seven articles, as they described the situation.

An unpleasant, disturbing, frightening and panicked perception

The emergency situations were characterized by various forms of discomfort: the concerned trainees were mentioned by seven articles, eight articles mentioned anxiety. One article mentioned panic.

Lowered stress

Four articles claimed that a good leader was able to create “lowered stress” or to “calm other people down”. Two articles mentioned noise and crowd control. [32]

Confidence

Three articles stated that confidence was important in the background section. 13 articles concluded that a degree of self-confidence is crucial for the quality of the leadership.

How a leader is perceived

Eight articles discussed the team's perception of the leader. To establish a comfortable and safe environment for the team, team members must be able to perceive their leader as trustworthy[16,47] . Jacobsson et al. emphasizes that it was importance that the leader "had a strong ethos and expressed competence" [30] .

A shortcut to perception of authority

Three articles state that the leader should take care of his/her appearance "especially for first meetings" and in this context that: "The clinician will work on ways to develop his/her own charisma" [46] . It is important to adopt "a powerful posture" [32] , and "Team members who are aware of how they use their bodies to communicate will be able to facilitate and improve their performance" [35] . Another issue emphasized as important by eight articles is how the leader uses his/her voice.

Assuming Leadership

To become a good leader it is important to assume the leadership with all its implications including risks and failure. Five articles state this view in the introduction/background sections. Six articles elaborate this view in their discussion/conclusion sections. When assuming leadership one can benefit from 'introspection' [46] , 'psychological self-care' [60] , or 'self-management' [47] .

Born to lead – or learn to lead

Seven articles mention that some are born to lead while others have to learn.

Conclusion

Barriers for acquiring leadership competencies required when managing emergency teams were identified. Learning goals were identified. Strong negative emotions such as stress, anxiety and panic were found when working in emergencies.

STUDY 3

Conducting the emergency team: A novel way to train the team-leader for emergencies

Aim: The overall aim of the course is to investigate whether, in an emergency, a clinical team leader could apply a conductor's leadership skills. A description of a course held for residents, medical students and nurses.

Methods

We developed a course for residents and 3rd semester medical students. In order to simulate an emergency situation and to optimize leadership training the course creates a framework with stress, anxiety, and discomfort in a harmless, non-clinical, and safe setting. The participants were challenged to act as conductors in musical exercises. A consultant and an orchestral conductor were the faculty for the course. One additional course day was held for emergency room nurses.

Data acquisition and analysis

All the participants made evaluations immediately after the courses, n = 61. They gave written quantitative evaluations and responded to a short survey of four quantitative questions plus an option for a free assessment comment. The students and residents, n = 38, were encouraged to reflect on the course in written evaluations after the course, those qualitative evaluations were received from 20 participants (53%). The courses were recorded on two video cameras. After receiving edited video clips showing their personal performance during the two course days, the students and residents were sent a survey with 14 question, those were received from 10 participants (26%). Written comments received 24 months after the course from 4 participants (10%). Selected courses were transcribed verbatim by TL and by two 'blinded' students respectively. The 'blinded' students wrote a qualitative non-guided reflection from the videos transcribed. Participants evaluated and commented on each other's development at the course.

Analysis

Qualitative Content analysis

All text-based data was gathered into one single pdf-document and searched for keywords and sentences describing the content of the course, and the words were interpreted in a meaningful context. The method was Qualitative Content Analysis. Themes emerged in an abductive – inductive process. When themes were established the process became directed by the themes, thus the process became deductive. Three keywords were present at the course though rarely

verbalized, but showed up on the video footage. Video footage was reviewed several times, and edited with the aim of exemplifying the themes described above.

Results

20 three-hour course days were completed.

Three key themes emerged: 1) Learning environment. 2) Pedagogics. 3) Learning goals – the conductor's focus.

Learning environment

Safe, enjoyable laughter had a significant impact on the course indicating that the participants felt safe and enjoyed participating. 15/38 participants stated that they felt that the faculty fully understood the challenges they faced ('got under their skin'). 17/38 participants stated that they greatly appreciated this personal and 'straight on' feedback. 15/38 participants during the course and 21/38 participants after the course stated that this feedback has caused a significant development in the individual participant's behaviour. The participants observed, noted and commented frequently on each other's performance and development in the dialogues recorded at the course.

Pedagogics

It was important to give the participants a feeling of the intense communication when leading an orchestra non-verbally. It was observed that a trance-like state frequently occurred between the leader and the team during the exercises.

Part of the learning process through apprenticeship is the very direct personal feed-back. As presented on the videos, the participants were changing their behaviour during the course.

Learning goals – the conductor's focus

A total of 47/61 (students, residents and nurses) expressed that they had become aware of the importance of body language. 17/38 (students and residents) specifically stated that they had achieved interaction between body language, appearance and authority – and understood why this leads to calmness and confidence. Eighteen participants stated that they had learned that eye-contact is a powerful tool for ensuring that decisions are communicated, received and understood. The participants learned that in this course context it was valid to talk about and express subjective perceptions. 15 participants stated that they were pushed out of their comfort zone, however 19

participants acknowledged that the environment was nevertheless safe. Participants were surprised and impressed to see how much they could communicate and how explicit and nuanced they could make their demands without speaking.

Additional findings

One blinded student and four participants stated that they forgot the newly learned lessons when challenged on clinical knowledge. Three of those plus additional another four students and residents stated that it was advantageous to train leadership separately from medical competence. The experienced nurses responded most positively to the course. The average age in this group was over 50 years, which indicates that after years of experience this group was aware of how fatal it could be when the team leader failed. 35 of the participants agreed that the course was highly relevant for their clinical practice. Two years after the course, four participants stated that it had changed their professional behaviour. 11 participants stated that the content of the course had an important objective, which was lacking in teaching at the university. 13 participants stated that the subject was relevant to educational contexts, to the clinic, when collaborating in general, day to day work, doctors' work, instructing cross-fit, swimming lessons, public speaking and attending oral exams.

Conclusion

The participants noted and commented on each other's development on the course. According to their self-reporting after the course the transfer of a conductor's skills changed the participating students', nurses' and residents' behaviour, and introduced a method to handle anxiety and show calmness and authority. This course clearly seems to accommodate the need for an operational and targeted training of the team leader in emergencies, addressing a way to achieve confidence in a stressful, but safe learning environment.

DISCUSSION

The overall objective of this thesis was to explore a different approach to train the emergency team leader with help from another profession. Furthermore, to investigate existing aspects of training of the team leader in emergencies in healthcare. This chapter will summarize the main findings and discuss the strength and weaknesses of the studies.

No defined and workable leadership training was identified in the systematic review and no clear definition of leadership has been found. In addition the literature on this subject are dominated by 'significant variability in terminology, training modalities and evaluation' in this field [15,41,43] . Nevertheless, scientists agree that leadership training has an impact, improves behaviour and changes clinical outcome. Despite this, the literature demonstrated that formal leadership training has been inadequate or that education is insufficient. This thesis demonstrated a gap – or at least lack of consequence – in between what medical educators knows and what action they do take.

An explanation could be that research in healthcare has a tradition for applying the positivistic clinical research tradition, the need to *measure*. In accordance with this explanation: most of the articles found in the systematic review in this thesis (23 of 27) revealed a positivistic ontology aiming to make qualitative findings quantitative and measurable – and used statistics to prove the result [1,13-15,17,21-23,26,27,29,33-37,39-43,56,59] . The enthusiasm of the researchers is noticeable when they consider solving the problem as stated by Prof. Yule in 2006 "this study has taken the additional step of identifying explicitly the particular non-technical skills which might be both taught and observed – and therefore measured" [38] . Here it seems to become a goal in itself to be able to measure.

But when no definition of leadership is found, as stated above, it will subsequently not be possible to try to measure anything concerning leadership. An explanation to this dilemma could be that the social and communicative qualities the team leader needs is *not* measurable, but nevertheless represents very real interpretations and constructions of reality in between humans. This is in accordance with the ontology of a constructivist approach and not the ontology of a positivistic approach.

Another explanation to this change of focus could also be explained by 'substitution'. The mechanism of replacing a difficult question with a simpler one is extensively described by psychologist Daniel Kahneman: "when faced with a difficult question, we often answer an easier

one instead, usually without noticing the substitution […] The target question is the assessment you intend to produce. The heuristic question is the simpler question that you answer instead" [78] .

The predominant training found involves taxonomies and algorithm training as demonstrated in the Systematic Review. This is dominated by two schools of medical educational research, one inspired by the military, the LBDQ, and the other one inspired by aviation, NOTECHS. It is not within the scope of this thesis to discuss why there is very sparse communication between the two research groups, but it is a surprising finding that may be important. The weakness of using military and aviation models is that they are aimed at people who have leadership as a full-time employment, while doctors also have to cope with several other roles in their profession, in accordance with CanMEDS definition of the seven roles of the doctor [92] .

As described above, literature revealed a large number of taxonomies aiming at measuring the ability of residents to implement various professional algorithms without specific focus on the leadership role. It can be argued that this relationship expresses more about an actual clinical skill and basically nothing about the quality of leadership. Again, in accordance with Kahneman [78] , it is possible to argue that training in clinical skills and memorizing algorithms addresses the effortful, slow and rational operations of system 2 while interaction between people (leadership) takes place in the automatic, fast and intuitive system 1. It is difficult to operate in both systems simultaneously and errors can occur if the two systems conflict with each other.

This thesis describes that it is appropriate to train clinical knowledge and leadership separately. Evidence from evaluations and videos in this study demonstrates that the participants are very excited to have the opportunity to focus explicitly on their personal leadership skills as well as stated in the literature [14,17,23,27,33,36,41] .

In study 2, it has been described that there is a need to address the young physician's strong negative feelings associated with the leadership role. Anxiety can block learning (amygdala hijack) and anxiety can block performance, 'paralyses or causes errors, it can interfere with what we want to do' as stated by Prof. Williams [77] . It is not found in the existing training that the researchers have considered – or even managed – to address the fear that young doctors can experience in a stressful situation.

Development and conduction of a course addressing leadership

This project developed an unconventional course focusing on training leadership for the clinical teamleader in emergencies in an effective way that seems to address what the literature has sought for 30 years.

In this regard, it is important not to threaten the young doctors professionally. On this course they are not assessed on clinical competencies, participants do not compete with their professional knowledge. The focus is solely on the leadership aspect in the musical exercises that address the intuitive system 1, in accordance with Kahneman, addresses creativity also and, in fact, are fun challenges as evidenced by the data. Common to all participants, however, is the total lack of knowledge and prerequisites for solving the exercises. All participants, in this regard starts on a shared baseline close to zero. This is an important point that is in line with the phases of transformational learning theory [70,71] . Participants are given an impossible task to be performed in a stressful situation where they are highly vulnerable in front of everyone. This is described as 'a disorienting dilemma', which provides an excellent starting point for later transformation in accordance with transformational learning theory. As described in the data, as well as clearly visible on the videos, cohesion is created when the participants discover that this recognition of inadequacy is shared by all. This phase is also expressed as an important part of the transformative learning process, which describes a phase four, where it is pronounced as follows: 'Recognition that one's discontent and process of transformation are shared and that others have negotiated a similar change' [70,71] . Many participants expressed that they discovered new characteristics of themselves from the course.

Previously it has been claimed that anxiety can block learning. Nevertheless, as demonstrated, it is possible to process the anxiety created on this course because the challenge is almost impossible and therefore ridiculously unfair, creating cohesion among the participants and lots of laughter. Furthermore, the exercises are fun itself when dealing with music and creativity, not algorithms and clinical knowledge.

It was an important objective to give the participants a feeling of the intense communication when leading an orchestra non-verbally. This was as much 'learning by feeling' as 'learning by doing'. With the intention of giving the participants this deep understanding and experience of being in control, creating confidence in the leadership, focus on the work at hand and creating calmness in the team, it was considered desirable that the participants in their own body experienced that it

was possible in *practice*. The feedback was dependent upon features of the physical body of the participant, that is, aspects of the body beyond the brain and therefore the cognition of the participant is embodied, as described in *embodied cognition* [68] . This phenomena is described as important for effective learning especially promoting learning targeting conceptual change, in accordance with *embodied cognition* [69] .

It is described in the literature that there is a need to address the strong negative feelings of young doctors associated with the role. Therefore, conscious work is to integrate the fear into the design of the course. It may seem paradoxical that it should be possible to create a safe learning environment while introducing anxiety-inducing exercises, but it is nevertheless what happens and this paradox is emphasized by the participants' evaluations. Everybody laughs very often and everyone is speaking freely, as is evident from transcriptions of the course and of the videos. Discussions among the students promote a high level of learning, with a retention rate of 50%, according to NTL's average retention rates for different training and teaching methods.

For a short while, the participant gets the opportunity to work as a conductor and actually influence others to act and respond to their intuition – no questions are asked – and especially when conducting the Ghetto Blaster session a state can occur where time and place is dissolved, the participants are optimally challenged, fully focused and emotionally involved – described as learning by feeling – as can be observed at the videos (youtu.be/KcyZf3_QfMk). This condition is described in *Flow-Psychology* as a general pedagogic ideal [74-76] . Furthermore, this is also 'learning by doing' (by practice), which promotes a higher level of learning, with a retention rate at 75%, according to NTL.

The teaching method at the course is apprenticeship. The conductor acts as a role model and provides feedback. The participants imitate the conductor and receive feedback on their own performance, which guarantees in depth professional focus according to the qualities of apprenticeship [72] . Participants chose to call this feedback 'straight on', and this gave them the opportunity to gain direct insight into their own weaknesses as experienced by the conductor.

One factor that is unusual in relation to medical education is that the conductor allows himself to have an opinion and be subjective when giving feedback. In accordance with the principles of hermeneutics, it is possible to recognize and observe reality when present in it and being able to interpret on the basis of presumptions [5,65] . The conductor is capable because he is an 'intuitive expert', according to Kahneman [78] .

A benefit of this method is that the participants realise that it is acceptable to trust an intuition and be subjective in their interpretation as the conductor does. This is emphasized on the joint discussions and reflections where participants discover that this ability is not a talent or a competence reserved to the conductor. These personal subjective interpretations are shared by everyone and thus *generally* applicable. It should be emphasised that the participants do not learn to interpret at this course, they already know; we believe it is deep within us to seek to understand and find explanations, that is, to interpret. The course teaches the participants to trust their own intuitive, subjective interpretation and consequently; that it is possible to be interpreted or 'read' as desired. Therefore, reality is a non-measurable construction, but nevertheless real construction of what takes place in people's minds when they are together. Reality becomes a social construction of (intuitive) interpretations and must be seen in the context of individuals interacting, as also described in constructivism.

The study is to be seen in a context of allowing experiences and perceptions to exist beyond the limits of language, according to semiotics and multimodality [9-12,83,84,86,93] . The course deals with non-verbal communication on multiple levels. 1) One level deals with bodily expression and gesture. 2) Another more intangible, but still shared, recognised level dealing with 'presence to the moment', 'credibility', 'responsiveness' and 'authority'. 3) Finally there's music, which, according to Langer, deals with experiences inaccessible to language [82] . Especially in the Ghetto-Blaster exercises, the participant gets acquainted with an exercise in which they are playing creatively with a music-aesthetic they have not experienced before. The (spoken) focus at the above mentioned level 1 and 2, but the language in the exercises is the music – level 3. The music and the interpretation of the music is a topic that is rarely mentioned in the text material representing data from the course, but it may be important for a non-verbal course to work with this creative and wordless communicative media where the outcome only exists in the moment it is created – and only in the cognition and interpretation in the minds of the participants.

Feedback

As documented in the evaluations and in the video footage, the participants are most excited about the personal and clear feedback. This is considered – by the participants – as a very useful and completely unique strength of the course as described in the evaluations after the courses. Obviously, this is not a surprising reaction, it's highly unusual for adults to comment on each other's appearance and non-verbal communication, but this is highly appreciated in this context.

It is a delicate balance for the faculty when feedback is given to the participant; it is important to 'get under the skin' of the participant, but crucial that the feedback is safe; this is the decisive challenge for the course. Participants stated that they felt that the faculty fully understood the challenges they faced.

An important factor is that feedback is given immediately the moment a problem arises. Common practice in simulation training is to provide feedback after the simulation is completed; i.e. with a certain distance of time. As demonstrated on the videos, the conductor immediately pinpoints an inappropriate behaviour, is able to imitate it and thereby demonstrate the disadvantage of this behaviour and he is able to demonstrate what a more appropriate behaviour would look like in the situation, in accordance with apprenticeship [72] .

Initially, it is the conductor who gives feedback, then it is the clinical teacher for clinical relevance but soon during the course the feedback is handed to the course participants. There are on-going discussions and reflections on the lessons learned and about the interpretation of the non-verbal expressions that are the subjects of the course, and equipped with this new awareness and vocabulary, the participants gradually give each other feedback on each other's behaviour and appearance as leaders. When the participants comment on each other's development, it is considered as the most optimal learning setting, with a retention rate at 90%, according to NTL.

Another important learning takes place when participants *observe* how and why personal feedback is given, and experience how this feedback immediately influences, transforms and strengthens the 'leader's' credibility in front of the team.

Faculty

The participants learn from the conductor, who is a master in non-verbal communication and leadership of the orchestra. He himself has acquired his leadership competencies through apprenticeship, and these skills have evolved not through theoretical learning, but, in accordance with Mintzberg through many years of *practise* [73] . This gives him a high level of credibility among the participants.

As demonstrated in the data, the course works explicitly and is highly targeted with intangible topics such as non-verbal communication, appearance, presence and authority. It is possible to work with these subjects because the course draws on the experience of a conductor who works

consciously (deliberately) with these subjects in his profession when he stands in front of the orchestra.

One can say that the entire argument for this thesis about the conductor's communication is that the conductor can work to be interpreted unambiguously – without using words, and this skill is valuable knowledge for the clinical team leader.

Participants acknowledge his expertise and experience how much he can 'speak' without words and acquire a clear understanding of this possibility of communication, which, according to Mehrabian's research, is a very strong element in 'face to face' communication; people tends to believe the expression they see [80,81] .

This conductor seems to claim that there is only one way of conducting an orchestra: keep calm, raised sternum, in control of arms and body. But there are evidently many, different and often extremely passionate and expressive conductors, and furthermore their leadership style is very different as well. Riccardo Muti = commanding style centred around 'I, the conductor'. Richard Strauss = only execution of the written music – no interpretation. Herbert von Karajan = closed eyes and no clear instructions, all about interpretation and listening. Carlos Kleiber = creates conditions, motivation and partnership – but authoritative leadership. Leonard Bernstein = demonstrating the *feelings* of the music [57] . What is the same for all conductors is that the *basic* knowledge and ability are shared. Only when this is acquired it is possible to add personality to the leadership style.

However, it was important that the other teacher on the course is clinical lecturer and consultant and set the framework for the course. By consultants presence, the clinical relevance is visualized and guaranteed in the dialogues and discussions on the course. The lecturer draws parallels from the learned to the clinic and the clinical team leader.

It is interesting to ascertain that the skills and competences addressed in the course are situated on a meta-level and are a prerequisite for the teaching: the faculty has to be able to assume the leadership role as educators who are able to *improvise* when teaching, which is a skill requiring a high level of experience and knowledge according to Koivunen and Barrett [94,95] . It is very important for the faculty to be able to demonstrate 'presence at the moment' and 'responsiveness' in order to appear credible as teachers and role models. If the teaching in leadership was based on theories and the teacher was unable to demonstrate leadership, the teaching would not have the impact it had. It would not be experienced as authentic but rather as an assertion or an abstraction.

Assessment of the impact of the course

According to the results of the course, participants reported to gain self-confidence, calmness and overview when called upon to act as conductors. Video recordings from the course have shown that the course strengthened the participant's credibility, and the participants received tools for dealing with personal anxiety as demonstrated in the qualitative content analysis of the transcriptions from the course, the evaluations as well as shown in the video footage.

The Kirkpatrick Model is a highly recognized way of assessing learning [96] . On a questionnaire designed according to this model, the participants themselves assessed how the learning will change their behavior and how they will implement the learned in their professional work. The quality of this assessment may be challenged. It would have been better if a third part had evaluated the change in behaviour. This is not an option in this thesis. However, many evaluations, after the course, described that the course had an impact on their professional activities as well as in their daily lives.

One video sequence summarizes in a very convincing way one of the core objectives of the course and documents the transformation of a participant. This video demonstrates how the trainers 'gets under the skin' of the participants, shows the reflection on the learning and the support from the other participants. The participant in focus goes from saying "My palms are totally sweaty" and "I think it's horrible" to say: "I wish everyone could try this" and "It is most impressive". youtu.be/GW7XPdnf-EU.

We allow ourselves to *interpret* that we change the participants' behavior as team leaders, measured by their own experience on their own body as well as by observing the other participants in the situation. However, we think it is necessary to *interpret* because we are discussing things that have no definite definition. There is no fixed definition of the quality of leadership and it is not possible to assess 'charisma' or assess the quality of non-verbal communication and leadership, only qualitative and interpretative approaches exist.

STRENGTHS AND LIMITATIONS

The search in the systematic review has been systematic, objective and reproducible. But the search string produced can be criticized for involving non-verbal communication in the search. It is the researchers' conviction that it is necessary to address this topic in the training. The search can

be criticized for not incorporating the theoretical aspect of leadership, but it has not been the purpose of the study, which has explicitly focused on finding an operational and workable training.

It could be a limitation that the search string used focused on leadership training in a variety of emergencies. It could be argued that other leader development programmes might have been ignored, by doing so.

It can be discussed whether it is reasonable to examine texts in articles written in positivist ontology with an interpretative epistemology. It could be argued that it is irrelevant to emphasize and interpret what the article states based on experience in a scientific study. The scientific premise for their study must be discussed on the basis of their scientific approach, design, method, and analysis. It can be considered inappropriate to make the articles accountable for statements as it is expressed in the articles. However, this interpretative method tells where the focus has been. The method reveals whether leadership is needed and that leadership is important. The interpretative method makes us look through the literature, in terms of consensus on opinions as well as behind the aims of the articles.

A strength of this thesis is the latent content analysis by which it is possible to include the underlying meaning of a text, and the study as well searched synonyms and, if available, meaningful similar positive and negative analogies, phrases and sentences. This analysis is broader than Isersons words, which was used as the objectives in the QCA.

It can be discussed if the population who attended the course was representative, if there was any selection bias. The residents and the medical students were offered a course in leadership training, and maybe those who enrolled in the course were participants who had difficulty taking the authority in this role. If there had been more attendees who already had high self-confidence as leaders, there would not be so much improvement of the participants, and eventually, the evaluations would have been more moderate. Nurses participated in other terms, they were not offered a course but were told to attend. They found the course most valuable.

It has been in accordance with this general practice in conductor teaching to integrate video at the course. One basic idea for the project is to place a participant in a stressful and vulnerable situation in front of the other participants, giving him difficult tasks to solve in the situation for the purpose of provoking discomfort and anxiety. If the camera is experienced as an additional stress factor, it will only add beneficial challenges to the idea of the intervention itself.

It has been repeatedly shown that there are communicative terms which are not verbal in accordance with Mehrabian, Peirce, Multimodal Analysis and Langer [11,67,80,82,83,97] . It has been demonstrated that video has evolved to an independent communication tool suitable for showing the diversity of social interaction in accordance with Xiao [66] . It has been demonstrated several times in this study that interpretation and intuition can be shared, and thus general. In some situations, we recognise that there is only one reality, the measurable reality. In other situations, and especially in the context of human interaction, we must acknowledge that there are several realities, and these are constructed and interpreted among people who interact. In accordance with this, we allow ourselves to present the edited videos that are not interpreted with words as evidence. It should be mentioned that all the videos presented in the appendix are in fact more *explanatory* when documenting the diversity and nuances in the content of the course.

In order to underline which objectives were addressed during the course, this is demonstrated primarily by words in the form of quotes. It is stated that the more participants who say the same independently of each other, the greater the possibility that the statement is generally applicable. This can be criticized for using positivist statistics in a study based on an interpretative approach. The challenge inherent in this thesis is to document the conductor's highly qualitative approach when introducing non-verbal communication in a clinical research tradition. Moreover, it is not considered that one ontology exclude the other.

What can be documented can be seen from the available data: It is estimated that 1) the participants' reflections at the course reflect their immediate experience. 2) Their evaluations after the course reflect what they took home from the course. These answers are available one week after, ten months after and up to two years after the course was conducted. 3) The two 'blinded' students commented the course impact on course participants independently, based on their own interpretation of the videos. 4) Videos are edited and categorized according to the encoded themes. The content of this data presents a triangulation of the course's impact.

A strength for the course was the diverse ontologies represented by the researchers in the study. The PhD student, the conductor, and the main supervisor, the consultant, constituted a unique research team in the constellation between two very different ontologies acquired through their very different professions. This represented a different approach in relation to the conventional approach in medical-pedagogical research in this field. They looked at the phenomena with fresh eyes and from new perspectives without restriction within already existing hypotheses, but had an

idea based on intuition. From the findings, new knowledge was acquired, this new knowledge was adapted to the original idea and the process was restarted, according to the abductive-inductive methodology introduced by Pierce [67], and found in the hermeneutics [5], GT [62,63], and QCA [8,63]. Through those various ontologies and thus the following discussions on epistemology, the subject has been studied and elucidated from several angles. Consequently this led to new findings on leadership in the clinic through understanding of what a conductor does in front of the orchestra.

CONCLUSION

No consistent and targeted leadership training for the emergency medical team leader was identified. For many years multiple taxonomies and assessment tools have been developed but failed to come to address leadership training. A need for explicit targeted team leadership training in healthcare was identified. The authors recommend training of leadership take another turn to investigate if it is possible to find other and more efficient ways to train the team leader in emergencies.

Barriers for acquiring leadership competencies required when managing emergency teams were identified. Learning goals were identified. Strong negative emotions such as stress, anxiety and panic were found when working in emergencies. We developed a course that addressed those barriers.

The participants noted and commented on each other's development on the course. According to their self-reporting after the course the transfer of a conductor's skills changed the participating students', nurses' and residents' behaviour, and introduced a method to handle anxiety and show calmness and authority. This course clearly seems to accommodate the need for an operational and targeted training of the team leader in emergencies, addressing a way to achieve confidence in a stressful, but safe learning environment. In addition the outcome turned out to be a profound transformation of participants' self-understanding.

The thesis illustrated that it was beneficial to involve another profession to healthcare. This thesis demonstrated a gap – or at least lack of consequence – in between what is known and what action is taken.

PERSPECTIVES

Implications for future practice

The thesis describes how it is possible to achieve leadership skills by using musical exercises. It is therefore recommended to continue the development of courses in medical unchallenging, harmless environments that allow each resident / student to gain insight into their own personal challenges and guidance in how to work with these. This thesis has shown a context where this is possible.

Educational implications

We recommend: If this course is to be introduced as a compulsory part of the educating of doctors, the ideal time would be after clinical skills have been acquired, experience gained and routines understood in the clinic. The course will be an important supplement to existing educational programs for residents.

Further research

It is recommended to evaluate whether the learning can be transferred to clinical practice and whether they have a positive impact on the treatment of patients.

Research is needed to examine if it is possible to train these skills in mixed clinical teams.

Research is needed to develop and validate a score to assess the quality of non-verbal communication and leadership. This could be measured at conductor students at a conservatory.

In this connection, another study could be conducted to investigate the emotional response of conductor students when conducting. Measured on pulse, or hormonal changes in norepinephrine or cortisol level if possible.

It is recommended to develop a 'train the trainer' programme aiming to educate more trainers and involve them in the further development of the course. In this context, it is recommended to develop a certification method for a 'train the trainer' education programme.

TRAINING RESIDENTS TO LEAD EMERGENCY TEAMS [PART ONE]: A SYSTEMATIC REVIEW

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Abstract

Objective: To describe how literature addresses workable and operational leadership training for the emergency medical team-leader and to enhance understanding of leadership training in the medical environment

Summary Background Data: Worldwide, medical supervisors find it difficult to get students to rise to the occasion as leaders of emergency teams: many residents/rescuers feel unprepared to adopt the leadership role in emergencies. It appears that many residents/rescuers feel unprepared to adopt the role as leader in emergencies. In spite of the knowledge acquired in 30 years of research, scientists are still seeking a solution as to how to teach workable leadership in healthcare.

Method: A systematic review was conducted (May-December 2016 in accordance with the PRISMA 2009 Checklist). A qualitative content analysis was added.

Results: 27 articles, by 25 single corresponding authors, were considered primary and covered the period 1986-2016. No targeted leadership training for doctors was found. The majority of the research projects described different types of behavioural markers, taxonomies and checklists. A need for explicit targeted team leadership training in healthcare was identified in 20/27 articles.

Conclusions: No consistent and targeted leadership training for the emergency medical teamleader was identified. Over the years, multiple taxonomies and assessment tools have been developed but failed to address leadership training. The authors recommend training of leadership take another turn to investigate if it is possible to find other and more efficient ways to train the team leader in emergencies.

Introduction

Worldwide medical supervisors find it difficult to get students to rise to the occasion when called upon to act as leaders of emergency teams: many residents/rescuers feel unprepared to adopt the leadership role in emergencies. [16,17,23,26,27,32,37,39]

The aim of this systematic review is to investigate how literature describes workable and operational leadership training for the emergency medical team-leader. The scholarly field of leadership and general healthcare-leadership is rich, but this study is not aimed at discussing differentiated leadership behaviour at a theoretical level.

The corresponding author in this systematic review represents another profession. But, nevertheless, has a clear sense of practical and operational leadership acquired from a profession of being an orchestral conductor. The study could be considered as a fresh look at how the literature and teachers approach leadership training in emergencies.

This study will describe issues related to the education and training of the clinical team leader in emergencies.

Background

In 1986 Iserson stated: "Most people are not born leaders; they must be taught leadership techniques" [44] . In 2016 Robinson and colleagues asserted: "In the field of cardiac arrest leadership, an increasing weight of evidence supports the notion that individuals can be trained to lead" [23] .

For the last three decades, leadership has been described as an important issue in healthcare. But in spite of the knowledge acquired in 30 years of research, scientists are still looking for a solution as to how to teach workable leadership in healthcare [1,16,17,21-23,25-29,34,36-39,41,42,44,46,47,58-60] . This study indicates that it is seems necessary to acknowledge that 'practical guidance needed for the deliberate practice of leadership skills' [22] instead of focusing on developing new or adapting existing leadership measuring instruments.

There appears to be a lack of clarity on the perception of "good team leadership" in the literature. In 2010 Yukl [98] cited: "there are almost as many definitions of leadership as there are persons who have attempted to define the concept" (Stogdill (1974, p. 259). And Yukl continues: "The stream of new definitions has continued unabated since Stogdill made his observation, Leadership has been defined in terms of traits, behaviors, influence, interaction patterns, role relationships, and occupation of an administrative position".

Method

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic review and Meta-Analysis 2009 (PRISMA) Checklist. A search of the databases of Pubmed, Psycinfo (via Ovid), and ERIC was carried out in June-December 2016 with the aid of a research librarian. Appendix I shows the search terms and strategy, to which no time limit or language restrictions were applied. The search strategy was not limited by design or methodology. All types of papers concerning leadership training and education in emergency medical scenarios were included. Technical skills training, organizational leadership and teamwork training without

explicit focus on leadership were excluded. During the early stages of the search, systematic reviews identifying relevant original articles were used as sources.

The Committees on Health Research Ethics for the Capital Region of Denmark was asked to give ethical approval but a formal review was waived for this study (H-4-2015-FSP).

Screening articles

One author (TL) searched PubMed and screened titles including 820 eligible articles. Pubmed´s feature 'similar articles' was used and a further 226 articles were identified. A further search was conducted inspired by the new keywords found in the articles, and another 131 articles were found. The search strategy was applied to a search in the databases of Psycinfo (via OVID) and Eric resulting in 1.177 articles from Pubmed, 82 from Psycinfo, and 242 from ERIC. After removing duplicates, two authors (TL and RBH) screened 1.405 titles and abstracts applying the above mentioned inclusion and exclusion criteria. One article was added on the basis of the references (Yule, 2006) [38] . The two authors then read the full text of the 53 potential articles applying inclusion and exclusion criteria. 39 articles were selected. There was a high degree of overall agreement between the two raters (94.45%). Interrater reliability was very good (Cohen's κ coefficient = 0,852). Differences of opinion about inclusion or exclusion were resolved by discussion between TL and RBH. 13 articles were excluded because their content did not meet the inclusion criteria and one article was incomplete because of missing references. Towards the end of the review process one further article, found in an additional manual search in Google (Ford 2016) was added [24] . 40 articles and reports were identified. Of these 27 were considered primary as they were original articles with interventions and new findings/evidence. 13 articles were considered secondary: 10 reviews and 3 opinions. Fig. 1 (Flowchart)

Quality of body of evidence

A review of qualitative as well as quantitative research papers was conducted. Quantitative articles were classed according to PRISMA, Cochrane and GRADE. Qualitative articles were classed according to CASP (Critical Appraisal Skills Programme). They were considered primary if they reported empirical data about leadership training or behaviour (i.e., specific reports about leadership taxonomies and findings in questionnaires). Only primary studies are included in this Systematic Review. (Table 1)

Abduction as a method

An abductive approach to research makes it possible for the researcher to present a qualified presumption *(educated guess or inference)* [67] when commencing his investigation. Based on his findings, he acquires new knowledge, he might alter / adapt this new knowledge to the presumption and the process starts over. This principle is the foundation of more contemporary methods e.g. Grounded Theory or Qualitative Content Analysis.

Qualitative Content Analysis

An *inductive approach* (conventional, inductive [63]) to Qualitative Content Analysis (QCA) is appropriate when prior knowledge regarding the phenomenon under investigation is limited or fragmented. [8] In an inductive approach, codes, categories, or themes are directly drawn from the data [8] without imposing preconceived categories or theoretical perspectives. [63] By adding 'latent content analysis' [8] it is possible to interpret the underlying meaning of the words.

Qualitative Content Analysis in this study

After conducting the conventional systematic review no focused training of team leadership was revealed and instead many leadership measurement tools were found. It was decided to examine the 27 primary articles in an abductive - inductive QCA. This investigation was conducted with the purpose to identify opinions about leadership in emergencies and views on the identified leadership measurement tools.

Strategy for qualitative content analysis

All articles were grouped together in a single PDF document and searched several times for keywords, their synonyms and, if available, their meaningful similar positive and negative analogies, phrases and sentences. The quotes were grouped into themes in an iterative process, and sorted chronologically in appendix II. When thought to possibly influence the interpretation, they were sorted according to where they appeared in the articles: before or after the methodology section, i.e. expressing either a pre-condition in the background for the study or a finding or a conclusion as a result of the study. A pre-condition for an intervention may change when the investigation is completed and a conclusion may contradict the pre-condition. Therefore, it is assumed that a conclusion can be stronger than a pre-condition. The most important/significant quotes chosen on basis of the authors' interpretation are presented in this article. All quotes are available in Appendix II.

Results

27 original articles, covering the period from 1986 to 2016 were included in the review. Two authors were responsible for more than one article: Yule [34,38] and Cooper [1,42]. Of the 27 articles five were Randomized Controlled Trials, six Case Controls, ten Case Studies, and six Qualitative Studies.

One sole study addressing workable and targeted leadership training was found [41]. This study focuses on leadership training separate from medical competence. One article covering non-verbal communication and positioning around the patient simulator was identified [35]. One article investigated whether external distractors influenced performance during a CPR scenario [59]. Eleven studies on resuscitation, eight on trauma, four on surgeons, two on ALS were found (acute dyspnea [43] and burns [56]) and finally one on leadership style in health care teams "as perceived by nurses" [36]. The majority of the articles described and discussed different types of behavioural markers and taxonomies. Leadership training was mostly combined with the training of medical competencies including algorithms. Four studies used a questionnaire after training. One study conducted a focus group interview after training. Nine studies were based on questionnaires or interviews. A summary of the articles is displayed in Table 1.

LBDQ or NOTECHS measurement tools: 25 of the 27 articles were to some extent influenced by one or both of the most frequently mentioned taxonomies, one developed originally for the military and the other for the aviation industry. 1) *The Leadership Behavior Description Questionnaire*, LBDQ (military, 1945) (Fig. 2) (nine articles, eight authors [1,14,17,23,27,32,33,42,59] mainly situated in Switzerland). 2) *The Non-technical skills taxonomy, NOTECHS* (aviation, the nineties) Adapted to healthcare in 2003: Anaesthetist's nontechnical Skills (ANTS) and adapted to surgeons in 2006: Non-Technical Skills for Surgeons (NOTSS) (Fig. 3) (seven articles, six authors [15,21,34,38,39,43,56] mainly situated in Scotland). The above mentioned researchers (LBDQ or NOTECHS) did not refer to each other. However, nine authors [13,16,22,26,29,30,35,40,41] referred to both taxonomies. Research into leadership is strongly dominated by the two different concepts and their prerequisites which have influenced 93% of the articles in this study. Two articles found in this review do not refer to NOTECHS or LBDQ but have unique references. [36,37]

14 articles covered training to some extent (training algorithms and debriefing). 13 articles focused on other aspects (surveys, questionnaires etc.). (Table 2)

Result of content analysis

Three key themes emerged: Leadership, taxonomies, and training leadership and medical competence simultaneously. The quotes are collected in the themes and their subgroups, and are representative for subgroups (pre-condition or conclusion).

Leadership

Definitions: Leadership is implicitly defined in the Leadership Behavior Description Questionnaire (LBDQ) taxonomy (Fig. 2) as well as in the Non-Technical Skills for Surgeons (NOTSS) taxonomy (Fig. 3). In addition, six other definitions were found [1,16,36,37,41,56]. Mantha and colleagues refers to Heifetz (2009) in 2016:

> "… leadership involves analyzing complex situations, identifying available resources and required expertise, formulating a strategy in real-time, and coordinating multiple stakeholders" [41].

Leadership is lacking: Four articles [16,23,38,40] stated in the background to their study that leadership is lacking.

Five articles [14,16,17,21,23] discussed or concluded explicitly that leadership was lacking.

> "Our study suggests that participants did not have a general lack of leadership skills, but they may not have linked the necessity of leading and structuring a team to the resuscitation situation" [17].
>
> Hunziker and colleagues, 2010

Leadership training is important – leadership changes behaviour

Gilfoyle and colleagues stated in the background to their article in 2007:

> "Team leadership has been recognized as very important for many years, in areas such as business, the military, and aviation" [26].

Three [1,26,39] articles *discussed* that leadership training was important and appeared to improve behaviour. Nine [13,15,17,23,27,33-35,42] studies *concluded* that leadership training would have a positive impact.

> "Our aim was to focus on the leadership aspect of CPR, as it has been widely recognized as being linked to the adherence to establish protocols, fewer errors, and more favorable patient outcome" [33].
>
> Castelao and colleagues, 2015

Leadership training has been ignored: Despite recognition that leadership training appears to change and improve behaviour, it seems that leadership training has been ignored, as stated in the background for three studies [37-39].

> "Traditionally, development of physician leadership has occurred at random in surgical training. One possible reason is that surgical educators have focused on detailed instruction on critical patient situations, resuscitation, and technical skills, but they have provided little formal training in the essential leadership skills" [37].
>
> Itani and colleagues, 2004

Nine articles [1,16,17,22,23,27,29,36,39] discussed or concluded that leadership training has been ignored.

> "Traditionally, surgical education has not formally taught leadership skills …" [39].
>
> Nicksa and colleagues, 2015

Leadership training is required: 18 of the 25 authors (20/27 articles) identified a recurring need for explicit targeted team leadership training in healthcare, 7 articles [17,22,34,36,38,39,43] mentioned this in the background / introduction and 13 articles [1,14-16,23,26,27,29,34,37,39,41,42] as a finding or a conclusion. Among the latter, Marsch and colleagues, 2004:

> "Absence of leadership behavior […] were associated with poor team performance … this finding could have important implications for the teaching of medical emergencies" [14].

> "We recommend that training in and assessment of leadership skills in emergency scenarios should be an integral component of postgraduate medical training" [23].
>
> Robinson and colleagues, 2016

Nine articles [13,21,30,32,33,35,40,56,59] proposed different approaches or focus areas to improve leadership in emergencies. (Aviation, NTS, Gender, Ethnicity, Non-Verbal communication etc.)

Taxonomies

A total of 20 taxonomies addressing leadership, teamwork, and communication were mentioned in the articles. (Table 3)

The purpose of taxonomies: The idea of using behavioural marker systems was explained by Yule and colleagues in 2006:

> "The prototype NOTSS behavioural marker system was designed to allow structured observation and feedback to trainee and consultant surgeons on observable non-technical skills […] this study has taken the additional

> step of identifying explicitly the particular non-technical skills which might be both taught and observed – and therefore measured" [38].

This view is shared by three articles [15,22,33].

Comprehensive or simple: Some articles [22,36] find a comprehensive taxonomy advantageous: Leenstra and colleagues, 2016:

> "The TTLS details 5 skill categories […] and 37 skill elements. The skill elements are captured by 67 behavioral markers" [22].

Some prefer a simple tool [43,59]: Carlson and colleagues, 2009:

> "One barrier may be that many reported instruments may be too complex" [43].

Measurement tools lacking: Four articles [15,21,29,43] pointed out in the introduction/background that measurement tools were lacking.

> "Although the importance of team NTSs continues to be a topic of investigation, the role of the team leader has not been evaluated in previous studies" [21].
>
> Briggs and colleagues, 2015

And Krage and colleagues concluded in 2014:

> "However, to our knowledge no standard scoring protocols are available to assess overall individual human performance of the resuscitation team leader during CPR" [59].

New tool developed: Two articles [22,38] stated in the aim/background that new tools had been developed: Leenstra and colleagues, 2016:

> "To address the need for a taxonomy of leadership skills that specifies the skill components to be learned and the behaviors by which they can be assessed across the five phases of trauma care, the authors developed the Taxonomy of Trauma Leadership Skills" [22].

Five articles [26,33,36,39,43] announced the development of a new or adapted tool in the discussion/conclusion section of their articles: Nicksa and colleagues used a previously adapted NOTECHS taxonomy, 2015:

> "A modified Oxford Non-Technical Skills (NOTECHS) scale […] was used to assess surgical resident nontechnical performance" [39].

Three articles [15,41,43] stated in the background to their study that it could be difficult to keep track of the actual content of the variety of tools and methods developed.

> "While NTS have been shown to correlate with technical proficiency, there is significant variability in terminology, training modalities, and evaluation of NTS" [41].
>
> Mantha and colleagues, 2016

Yule and colleagues indicated in 2015 that the focus might advantageously be changed away from the development of new measuring tools:

> "The rate of developing assessment tools in this area has outpaced development of workable interventions to improve non-technical skills in surgical training and beyond" [34].

Training leadership and medical competence simultaneously

It may be advantageous to separate leadership training from training in medical competencies, Castelao and colleagues states in the background:

> "… the complexity of such a multifactorial structure increases, creating the potential for an incomplete understanding of the whole process. […] Thus, reducing the cognitive workload beforehand by separating role instructions can have a positive impact on the CPR performance and on the trainees' individual learning process" [33].

Six articles [14,17,23,27,36,41] concluded that leadership training differed from medical knowledge training.

> "… the training provided through the ALS qualification is not sufficient to develop the necessary level of leadership skills for a cardiac arrest team leader" [23].
>
> Robinson and colleagues, 2016

And Mantha and colleagues concluded in 2016 in the study focusing explicitly on leadership training separate from medical knowledge:

> "Short-term outcomes of this leadership curriculum demonstrate a significant increase in paramedic trainees' self-perceived confidence, communication, and leadership skills" [41].

Discussion

One of the objectives of this systematic review was to search for a workable method to train physicians for leadership in emergencies. For the last three decades, leadership has been described as an important issue in healthcare. We found six definitions of leadership, which centred mostly on achieving common aims through collaboration between leader and team. Some articles

described leadership as a more complex process in which the leader had to analyse the situation and handle multiple stakeholders. We did not find a clear definition and must conclude, like Stogdill in 1974, that “there are almost as many definitions of leadership as there are persons who have attempted to define the concept”.

Despite there being no clear definition, the literature describes lack of leadership as highly prejudicial to performance during a critical, clinical situation and performance as very variable. The literature sought help outside the medical world from the military (LBDQ) and from aviation (NOTECHS), adapted taxonomies to the behaviour of the leader and team and customized them to medical emergencies. The LBDQ and NOTECHS taxonomies were originally developed to assess officers and pilots in command of aircrafts – leaders in their professions. People selected and educated to be leaders in professional emergencies. It could be said that this starting point is essentially different for that of newly qualified young doctors who have not yet been introduced to leadership. In medicine the taxonomies (i.e. LBDQ form XII, NOTSS) seem to have been developed and adapted to assess medical algorithms (i.e. ALS) or procedures (i.e. surgery) in order to optimize patient outcome by changing/improving the behaviour of the team-leader and his team. But many articles concluded that leadership is still lacking.

Over the years the research has tried to define an appropriate taxonomy to measure and improve doctors’ ability to act as leaders. It is very interesting that 2/3 of the research into taxonomies has been conducted by two completely separate research groups inspired by either the military or the aviation industry almost without referring to each other. The other 1/3 of researchers was inspired by both taxonomies. The taxonomies mostly assessed how well the algorithm had been completed, not the actual quality of leadership. One could assert that they therefore measured how well the doctors knew how to treat the patient. One could conclude that leadership training actually takes place in a clinical context which is complex itself – focusing simultaneously on ‘task distribution’, ‘human factors’ or ‘initiating structure’ (LBDQ) or ‘task management’, ‘non-technical skills’ or ‘situation awareness’ (NOTECHS) as well as on medical knowledge and creating structures while implementing algorithms and maintaining standards. But this setting could diminish the actual focus on targeted leadership training.

The use of taxonomies and assessment tools in medicine could be explained by the wish to produce evidence for the actions and changes in treatment/behaviour. We discovered several taxonomies and assessment tools in the literature; some comprehensive, some very simple. However the

literature still affirms that standard performance measurement tools are lacking and therefore a constantly increasing number of new tools have been developed. In addition, it should be mentioned that significant diversity was revealed in terms of terminology, training methods, evaluations and conclusions in the interventions found. It could be concluded that the definition of leadership is unclear and therefore consensus is impossible. The literature begins to question the number of tools – and methods used – in the taxonomies.

As demonstrated in the results section, scientists agree that leadership training has an impact, improves behaviour and changes clinical outcome. Despite this, the literature demonstrated that formal leadership training has been neglected or that education is insufficient. It still appears to be a skill that is traditionally acquired by 'learning by doing'. Nevertheless the literature affirmed that targeted leadership training is very important. More than half of the 27 articles examined concluded that there was an urgent need to develop a workable method to provide residents with specific and targeted leadership training.

Several articles stated it may be an advantage to separate leadership training from medical competencies training. Medical and behavioural training are very different topics, and training simultaneously could even work be counter-productive because of the huge cognitive workload. To our knowledge nobody has addressed workable targeted team leader training for doctors in emergencies. Taxonomies might detail 'what to do', but apparently do not address the actual needs of the team-leader in emergencies in order to assume leadership in a satisfactory manner.

It is possible to argue that this – as this study also reveals – obviously is not new knowledge, the importance of this has been emphasized and sought after for 30 years. The result of this systematic review is thus negative and consequently, it is possible to argue that the study is unsuccessful. One can also, as the authors of the study, argue that the result is alarming and reveals the deficiency of research in this area in the last 30 years. This can be considered as a substantial contribution adding constructive and important knowledge.

Conclusion: No consistent and targeted leadership training for the emergency medical teamleader was identified. For many years multiple taxonomies and assessment tools have been developed but failed to come to terms with leadership training. Yule and colleagues backtracked in 2015:

> "The rate of developing assessment tools in this area has outpaced development of workable interventions to improve non-technical skills in surgical training and beyond" [34].

A need for explicit targeted team leadership training in healthcare was identified in 20/27 articles. The authors recommend training of leadership take another turn to investigate if it is possible to find other and more efficient ways to train the team leader in emergencies.

Further research recommendations

Does the literature identify areas to be addressed in the training of leadership for residents when acting as team leaders in emergencies?

Contributors

T Larsen had full access to all the data in the study and had final responsibility for the decision to submit for publication. TL undertook the search for material, extracted and collected data, developed the analysis strategy, and wrote up the results. TL & R Beier-Holgersen, conceived and designed the project, reviewed the scientific reports, made quality assessments and interpretation of the results. J Meelby assisted in the literature search and provided advice. P Dieckmann and D Østergaard provided advice and critically revised the manuscript.

Appendix I, A search for Leadership Training in Healthcare–Search strategy

Search in Pubmed

#1((((gesture OR mimic OR eye-contact OR eye contact OR eyebrow OR smile)) OR (((NTS Skills OR "non-technical skills" OR notss)) OR ((communicat*) AND ("non verbal" OR "nonverbal" OR "non-verbal" OR visual))))) = 99.119 entries

#1b ((gesture OR "body language" OR mimic OR "eye-contact" OR "eye contact" OR eyebrow OR smile)) OR (((NTS Skills OR "non-technical skills" OR "nontechnical skills" OR notss)) OR ((communicat*) AND ("non verbal" OR "nonverbal" OR "non-verbal" OR visual))) NOT (autism OR pregnancy OR pain OR Alzheimer* OR vertebral OR drawing* OR children) = 69.150 entries

#2 (task management OR authority OR discipline OR respect) OR (leads OR leading OR lead OR teamleader OR "team leader" OR teamleader) = 1.465.692 entries

#2c ((task management OR authority OR discipline OR respect)) OR (leads OR leading OR lead OR teamleader OR "team leader" OR teamleader) NOT (“lead to” or “leads to” or “leading to”) = 824.514 entries

#1 AND #2 limited to Systematic rev. = 138 entries

#3: (conductor* OR orchestra* OR symphon*) = 22.335

#1 AND #2 AND #3 = 29 entries

#4: (teach* OR educat* OR train* OR learn*) = 1.684.125

#1b AND #2c AND #4 = 432 entries

#5 ((((“advanced life support") OR ("cardiopulmonary resuscitation"[MeSH Terms] OR ("cardiopulmonary"[All Fields] AND "resuscitation"[All Fields]) OR "cardiopulmonary resuscitation"[All Fields])) OR ((Acute* OR intensive OR emergency OR trauma OR traumatic OR resuscitat* OR "cardiac arrest simulation")))) = 2.501.517

#8 (("leadership"[Mesh]) AND "Education, Medical"[Mesh]) = 1.262

#5 AND #8 = 114 entries

9 “body language” = 354

#10 communicat* OR leadership OR leading or leads or lead OR teamleader OR "team leader" OR team-leader = 1.476.894 entries

#9 AND #10 (NOT (autism OR pregnancy OR pain OR Alzheimer* OR vertebral OR drawing* OR children or consultation or hypno*)) = 107 entries

Total = 820

Supplementary search inspired by articles found in Pubmed's 'similar articles' = 226 entries

Total=1046

New keywords emerged inspired by the new articles:

"training leaders" OR ("team learning" AND "interprofessional teams") OR (urgency AND situation and leaders and goal) OR (leadership and "resuscitation teams" and task and performance) OR (Leadership and management and education and train* and healthcare and doctors) OR (leadership and "cardiac arrest" and task) OR (Leadership and cardiopulmonary resuscitation and skills) OR (leadership and ("cardiac arrest" OR cardiopulmonary) and resuscitation and human factors) OR (("cardiac arrest" OR cardiopulmonary) and "resuscitation performance" and training) OR (leadership and team and ("cardiac arrest" OR cardiopulmonary) and performance and communication) OR (lead and "advanced life support" and performance and training) OR (leads and "advanced life support" and performance and training) OR (leading and "advanced life support" and performance and training) OR (leadership and "advanced life support" and performance and training)

134 entries

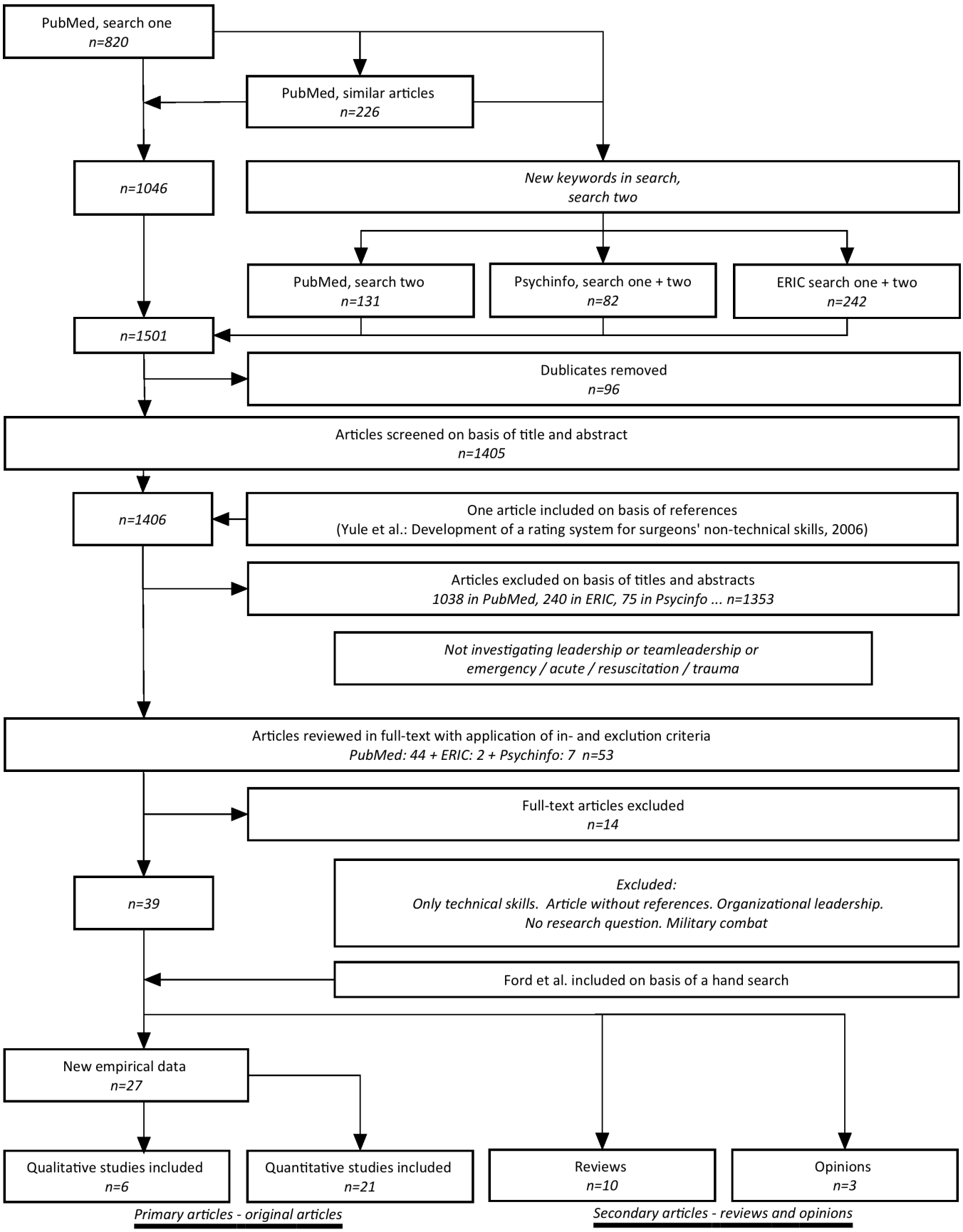
PubMed, search one
n=820
PubMed, similar articles
n=226
n=1046
New keywords in search,
search two
PubMed, search two
n=131
Psychinfo, search one + two
n=82
ERIC search one + two
n=242
n=1501
Dublicates removed
n=96
Articles screened on basis of title and abstract
n=1405
n=1406
One article included on basis of references
(Yule et al.: Development of a rating system for surgeons' non-technical skills, 2006)
Articles excluded on basis of titles and abstracts
1038 in PubMed, 240 in ERIC, 75 in Psycinfo ... n=1353
Not investigating leadership or teamleadership or
emergency / acute / resuscitation / trauma
Articles reviewed in full-text with application of in- and exclution criteria
PubMed: 44 + ERIC: 2 + Psychinfo: 7 n=53
Full-text articles excluded
n=14
n=39
Excluded:
Only technical skills. Article without references. Organizational leadership.
No research question. Military combat
Ford et al. included on basis of a hand search
New empirical data
n=27
Qualitative studies included
n=6
Quantitative studies included
n=21
Reviews
n=10
Opinions
n=3
Primary articles - original articles
Secondary articles - reviews and opinions

Fig. 1

Study type	Objective	Content of intervention	Outcome/Conclusions	Risk of bias	Validity of evidence
RCT					
YULE, S. et al. 2015	Demonstrate the effect of non-technical skills coaching on intraoperative behaviors and clinically significant decisions during simulated operations.	16 surgeons, two groups. Five operations each surgeon. Case group received coaching on NTS after each operation - control not. Operation one and five was videorecorded. Blinded assesors	Coaching improved residents' non-technical skills in the simulated OR compared with those in the control group	Performance bias: participants not blinded. Small sample size. No baseline for participants were recorded. Extern validity unclear.	Low body of evidence according to GRADE. + +
FERNANDEZ CASTELAO et al. 2015	This study assessed the impact of the CRM team leader training on CPR performance and team leader verbalization	Forty-five teams of four members received ALS training. One in each team assigned to teamleader in a CPR simulation. Team leaders in group one attended 90 min. CRM training. All others 90 min. ALS training. Video recorded. Check-list based tool developed by experts. Authors assesors blinded to the experimental allocation	Training only the designated team leaders in CRM improves performance of the entire team, in particular guideline adherence and team leader behavior. (Emphasis on training of team leader behavior appears to be beneficial in resuscitation and emergency medical course performance.)	Selection bias: Randomization 1 alphabetically. Randomization 2 unclear. Randomization 3 unclear. Performance bias: participants not blinded. Statistical method questionable (study called for median not mean). No baseline for participants were recorded.	Low body of evidence according to GRADE. + +
KRAGE, R. et al. 2014	To invest whether external distractors influence performance during a standardized simulated CPR scenario in general and whether level of experience has an impact	30 physisicians, two simulated CPR. Cross-over study: 1: distractors (radio noise 70 dB, scripted family member, talking at crucial moments) 2: not. Videorecorded. Scoring protocol developed. Two assesors rated independently	No interaction was observed between additional distractors and experience level. External distractors markedly reduce the quality of cardiopulmonary resuscitation.	Performance bias: participants not blinded. Small sample size (N=10 in each group).	Moderate body of evidence according to GRADE. + + +
HUNZIKER, S. et al.2010	The aim of this study was to compare leadership instruction with a general technical instruction in simulated CPR scenario	237 (280) medical stud. in teams of three. CPR simulation, pre-video. Basic instruction 20 min. Two groups. Case: Leadership training. Control: Technical training. CPR simulation, 2 post-video, n=96 and n=93. Follow up after 4 Mo. Videotapes coded by two independent blinded researchers	Causal relationship between leadership and performance was proven: Leadership instructions were superior to technical instructions, with more leadership utterances and better overall cardiopulmonary resuscitation performance.	Performance bias: participants not blinded.	High body of evidence according to GRADE. + + + +
COOPER, S. et al. 2001	Develop a course training leaders with the aim of changing behavior and performance	Three day ALS course. N=68. Three courses. Day one ALS training. Day two and three all acted as team leader in a CPR simulation. After day two case group attended a leadership seminar. Control not. Five independent assesors, blinded	The leadership training programme significantly improved candidates leadership performance in the training situation	Performance bias: participants not blinded. Unclear assessment procedure.	Moderate body of evidence according to GRADE. + + +
Case-Control					
MANTHA, A. et al. 2016	NTS curriculum for Indian paramedic trainees focused on strengthening on-scene leadership, teamwork, and public speaking skills	40 paramedic trainees. Six-day course. Trainees completed self-assessments and delivered two brief video-recorded presentations before and after completion of the curriculum. Independent blinded observers scored 10 randomly selected trainees.	Outcomes of this leadership curriculum demonstrate a significant increase in paramedic trainees' self-perceived confidence, communication, and leadership skills	Performance bias.	Low body of evidence according to GRADE
NICKSA, G.A. et al.2015	To educate surgical residents in leadership, teamwork, effective communication, and infrequently performed emergency surgical procedures with the use of interprofessional simulations.	43 surgical residents PGYs 1 and 2. Interdisciplinary high-risk clinical scenarios. Pre (control) and 6 Mo after Post (case) 37 responded to a survey. Author assesor	The PGY 2 residents improved their skills, but the PGY 1 residents did not. A total of 89% of the residents felt the sessions were of great benefit.	Educational level could be a confounder	Very low body of evidence according to GRADE
ROBERTS,	To investigate if brief	57 medical staff members. Pretest	Participants changed teamwork		Moderate

N.K. et al. 2014	training would have a sustained effect on individual acquisition and retention of knowledge and team practice behaviors and on team behaviors of health care professionals in medical emergency situations…	simulated CPR sessions. Then training concluding with a post simulation. Debriefing. Three weeks later third simulation. Videorecordings. Two blinded raters. Questionnaire	and communication behavior on the posttest, and changes were sustained after a 3-week interval, though there was some loss of retention. Brief training exercises can change teamwork and communication behaviors on ad hoc trauma teams.		body of evidence according to GRADE
MAKINEN, M. et al. 2007	The purpose of this study was to assess the resuscitation skills of nurses to facilitate construction of an educational programme	From Finland: 110, Sweden: 40 nurses. Case, leadership training (S), control not (F). Subjects tested in pairs. A checklist used to grade. 5 assesors independently, not blinded	Defining and teaching leadership seems to improve resuscitation performance.	Not blinded assesors	Very low body of evidence according to GRADE
GILFOYLE, E. et al. 2007	Educational intervention. evaluate immediate and long term learning outcomes in order to determine whether residents could acquire and retain team leadership skills in pediatric advanced resuscitation.	Case 15 paediatric residents 2 leader skills training, simulated resuscitation scenarios. Evaluated again 6 months later. Control N=7 no training. Rating by checklist and self-reported questionnaire	Residents acquired resuscitation team leadership skills following an educational intervention. Six-month follow-up demonstrated skill retention beyond the initial intervention. Control group suggested that this was because participants had attended the first workshop.	Very small sample size. Inkonsistency in groups. Doubtful use of students T-test	Very low body of evidence according to GRADE
MCCUE, J.D. et al.1986	To assess the residents' leadership style and the nurses' perceptions of the effectiveness of those styles.	17 residents. A self-administered, self-rating leadership style indicator, LSI. Self Reports and Nurses Reports. Questionnaire. Computerized scale. Not blinded assesors	The present study suggests that female residents may be more likely to use high relationship leadership styles in their interaction with nurses … analysis of leadership style is a potentially useful way of helping residents assume leadership more effectively.	Only women nurses. Sex bias. Only residents known to nurses was allowed = not blinded assessors	Very low body of evidence according to GRADE
Case Study					
ROBINSON, P.S. et al. 2016	To assess the perceptions of leadership and team working among members of a cardiac arrest team and to evaluate future training needs	102 members of a cardiac arrest team. Survey. Responses sought from doctors, nurses and healthcare assistants	We recommend that training in and assessment of leadership skills in emergency scenarios should be an integral component of postgraduate medical training		Not relevant
HARGESTAM, M. et al. 2016	Investigate how trauma team members are positioned in the emergency room. How leaders communicate in terms of gaze direction, vocal nuances, and gestures during trauma team training.	108 participants. Eighteen trauma teams were audio and video recorded during trauma team training. Focus is on team leaders' communication, analysis is performed in relation to both verbal and non-verbal communication.	Non-verbal communication reinforced the team-leaders' communication. Team-members who are aware of their non-verbal communication can improve their performance. Vague non-verbal communication reinforces ambiguity and can lead to errors		Not relevant
BRIGGS, A. et al. 2015	Does team's and team leader's NTSs correlate with technical performance of clinical tasks?	20 teams. Two separate, high-fidelity, simulated trauma scenarios. Video, divided into 4 consecutive sections. Team leader assessment using NOTSS. Entire team 2 additional raters used T-NOTECHS	The NTSs of trauma teams and team leaders deteriorate as clinical scenarios progress, and the performance of team leaders and teams is highly correlated. Cognitive NTS scores correlate with critical task performance.		Not relevant
RINGEN, A.H. et al. 2011	To assess the experience and education of Norwegian trauma team leaders, and allow them to describe their perceived educational needs	Written questionnaires. All 45 hospitals in Norway receiving severely injured trauma victims were contacted, randomly selected weeknight. Team leaders asked to specify what trauma related training programs they had participated in, how much experience they had, and what further training they wished, if any.	Level of experience among team leaders was highly variable and their educational background insufficient according to international and proposed national standards. Team leaders stated that more experience and better training are important to them in order to become better leaders		Not relevant

CARLSON, J. et al. 2009	To develop a measurement tool reliable at capturing team behavior during a high-fidelity simulation when used by multiple raters. Use the tool to explore the relationship between the team behaviors measured and the standard of technical medical care delivered specific to the needs of the case.	Study participants (n = 113), 44 teams (2 or 3 team members) During the workshop, every team participated in the same scripted case scenario facilitated by the same training instructor. Raters using the team behavior measurement tool were unaware of the teams' global assessment of technical standard of medical care delivered	The methods used provide a possible method for training and assessing team performance during simulation. The instrument presented in this study offers a possible template for future work		Not relevant
HAYES, C.W. et al. 2007	Determine internal medicine residents' perceptions of the adequacy of their training to serve as inhospital cardiac arrest team leaders	654 residents were sent a survey, 289 residents (44.2%) responded. Subjects: adequacy of training, perception of preparedness, adequacy of supervision and feedback, and effectiveness of additional training tools	A significant number of internal medicine residents feel inadequately trained, unprepared, and unsupervised to lead cardiac arrest teams in teaching hospitals.		Not relevant
ITANI, K.M. et al. 2004	Assess the perception of surgical residents in leadership skills.	Questionnaire was administered to 43 residents. 1) the residents ranked 18 leadership skills on a scale of 1 to 4 in importance for career development. 2) a similar scale with regard to their personal confidence and competence in these same areas. 3) to evaluate themselves with regard to five leadership traits.	Traditionally, development of physician leadership has occurred at random in surgical training. It is our job as surgical educators to provide this opportunity to our residents. Ethics was the only area in which 75% of the residents believed themselves to be more than minimally competent		Not relevant
MARSCH, S.C. et al. 2004	How human factors affect the team performance during a simulated cardiac arrest. And show correlation between leadership behaviour and outcome	16 teams, each three health-care workers. Simulator. Video. Data analysis was performed independently by two of the authors using a checklist.	Two thirds of teams composed of qualified health-care workers failed to provide basic life support and/or defibrillation within an appropriate time window.		Not relevant
WISBORG, T. et al. 2003	Does the training of multiprofessional trauma teams and resusciation teams for newborns vary?	A telephone survey of training practices. The head nurse at each emergency department (n=50) and neonatal ward (n=16) was interviewed in a structured fashion. They were asked if their emergency team personnel had participated in practical multiprofessional training during the previous 6 or 12months.	Regular team training represents an underused potential to improve handling of low-frequency emergencies.		Not relevant
COOPER, S. et al. 1999	Determine the relationship between leadership behaviour, team dynamics and task performance	20 resuscitation attempts were observed (19 on video). All teams more than five members. A total of 18 leaders. LBDQ: measure level of structure. Interpersonal behaviour and tasks of resuscitation with a team dynamics and a task performance scale. Observers: an ALS instructor and a video rater	Leaders who initiated a structure, distributed tasks, and remained "hands off" improved team performance. An emergency leadership training programme is essential to enhance the performance of leaders and their teams.		Not relevant
Qualitative Studies					
SADIDEEN, H. et al. 2016	Video analysis of leadership behaviors within The Burns Suite (a simulation tool to deliver inter professional and team work training). Explore whether Simulation-based team training within TBS can elaborate on key leadership theories. Which leadership models appeared predominant within TBS.	N=12, 3 simulations, each team 4 members. Video. Focus group interviews after debriefing. Objective to identify leadership skills mapping them on to leadership theory. 2 authors and 2 other authors independently assesors	Effective leadership is essential for successful functioning of work teams and accomplishment of task goals. Leadership in a team-based resuscitation scenario can be considered as distributed, rather than continuously being associated with a specific leader.	"There was a difficulty in blinding authors during coding of participant leadership behaviors, which may have introduced an element of detection bias, although care was exercised to avoid this"	According to CASP there is a clear statements of findings and the research is valuable

LEENSTRA, N.F. et al. 2016	To address the need for a taxonomy of leadership skills that specifies the skill components to be learned and the behaviors by which they can be assessed across the five phases of trauma care, the authors developed the Taxonomy of Trauma Leadership Skills, TTLS	28 interviews w. trauma leaders and 14 raters. Skill elements captured by 67 behavioral markers. Categorized using multiple raters	The TTLS provides a framework for teaching, learning, and assessing team leadership skills in trauma care and other complex, acute care situations	According to CASP there is a clear statements of findings and the research is valuable
KOLEH-MAINEN, C. et al. 2014	Investigating code leadership as perceived by residents in four areas: (1) learning to be a code leader (2) leadership defines code success (3) ideal code leadership behaviors (4) leadership and gender	25 residents, semi-structured telephone or in-person interviews. Recorded and transscribed. Three authors analyzed three interviews focusing on content areas. Four authors read all transcripst in full	Leadership defines code success. Poor leadership was cited as the major factor to a chaotic code. Participants reported that it was important to be "authoritative"; to have a "strong presence" by being both seen and heard. Female participants described feeling stress from having to violate gender behavioral norms in the role of code leader.	According to CASP there is a clear statements of findings and the research is valuable
JACOBSSON, M. et al. 2012	Analyze how formal leaders communicate knowledge, create consensus, and position themselves in relation to others in the team	Sixteen trauma teams, six members on each team. High fidelity training in an emergency department. Video.	This study indicates that communication in trauma teams is complex and consists of more than just transferring messages quickly. It also concerns what the leaders express, and even more importantly, how they speak to and involve other team members	According to CASP there is a clear statements of findings and the research is valuable
HJORTDAHL, M. et al.2009	To obtain a deeper understanding of which non-technical skills are important to members of the trauma team during initial examination and treatment of trauma patients.	Twelve semi-structured interviews. 2 authors participated in all 12.	Leadership was perceived as an essential component in trauma management. The ideal leader should be an experienced surgeon, have extensive knowledge of trauma care, communicate clearly and radiate confidence. Lack of leadership was often given as a reason for dysfunctional teamwork.	According to CASP there is a clear statements of findings and the research is valuable
Yule S et al. 2006a Developing	Describe the method used to identify surgeons' non-technical skills, and the development of a skills taxonomy and behavioural rating system to structure observation and feedback in surgical training	27 consultant surgeons. Interview. Identify key non-technical skills and interpersonal skills. Multidisciplinary group developed the interview scedule (psycologists, surgeons and an anaesthetist). Interviews recorded, transscribed and analysed by thee pairs of psycologists independently.	The NOTSS skills taxonomy and marker system presented here has been grounded empirically in surgery, and was developed with domain experts (consultant surgeons) at every stage to ensure that the system is explicit, transparent and has an acceptable degree of construct validity.	According to CASP there is a clear statements of findings and the research is valuable

Table 1: Primary studies

Study type	Leadership is important for the outcome	Educational needs/recommendations	Measure/Aim	Teaching?	
RCT					
YULE, S. et al. 2015	"… Non-technical skills matter at critical stages of surgical care"	"Important next steps are to implement non-technical skills coaching in the real OR"	Measure, NOTSS	Non-technical skills coaching	+
FERNANDEZ CASTELAO et al. 2015	"In CPR, effective leadership is positively associated with patient outcome"	"… leaders trained in a separate explicit step appears to be an efficient way to foster team processes and outcomes as a whole"	Measure (LBDQ inspired)	CRM team leader training and additional ALS-training. Team leaders of the CRM-TL groups attended a 90-min CRM-TL training	+
KRAGE, R. et al. 2014	"... stress can interfere with the performance of technical skills in critical situations"	"… more effort into training the non-technical skills of individuals and teams who are working in a highstress environment"	Measure, protocol ERC guidelines	Not teaching	-
HUNZIKER, S. et al.2010 Brief leadership instructions	"… strong leadership may positively influence team performance"	"However, because inexperienced rescuers are often involved early in situations of cardiac arrest, their training is of outmost importance"	Measure, prespecified checklist (LBDQ inspired)	Leadership instruction with prespecified checklists - LBDQ inspired	+
COOPER, 2001	" … a leadership development programme significantly changes behaviour and increases performance"	It is recommended that a "formal leadership development programme should be introduced into advanced life support courses".	Measure (LBDQ inspired)	The experimental group then attended a 75-min leadership development seminar	+
Case-Control					
MANTHA, A. et al. 2016	"... we designed an NTS curriculum for Indian paramedic trainees focused on strengthening on-scene leadership, teamwork, and public speaking skills"	"focused NTS development curriculum into Indian paramedic education and further evaluation of the long term impacts of this adaptive leadership training".	Personal training AND measuring posture, gesture, eye-contact emotions, confidence - etc.	6 - day seminar. Presentation of a non professional topic to classmates.	+
NICKSA, G.A. et al.2015	"Simulation-based education has been shown to directly impact physicians' clinical behavior and change outcomes"	"Traditionally, surgical education has not formally taught leadership skills, effective communication, professionalism, or team management"	Measure, NOTECHS	Teaching: "feedback, facilitated discussion, instructed on areas of knowledge as needed, provided insight, and encouraged participant self-reflection"	+
ROBERTS, N.K. et al. 2014	"... the majority of participants strongly agreed that the training had the potential to improve patient safety"	"… there is a great deal of talk about the desirability of multiprofessional team training, but the number of examples of such training in hospital settings is limited".	Measure (LBDQ-inspired, TeamSTEPPS inspired, Kilpatrick)	Simulation - video analysis - simulation - debriefing. 3 weeks later: simulation and questionnaire	*
MAKINEN, M. et al. 2007	"Defining and teaching leadership seems to improve resuscitation performance"	"In previous analyses made the majority of physicians and nurses felt that training in CPR was insufficient at various levels of care"	Measure - compare Sweden and Finland	Not teaching	-
GILFOYLE, E. et al. 2007	"Teams who function with an effective team leader […] have a more favourable outcome for their patients, both simulated and real"	"... it is our hope that learning leadership skills specific to resuscitation will carry over to other areas of professional practice of paediatric medicine"	Measure, checklist and questionnaire. CRM	Half-day workshop: Based on the needs assessment learning objectives were developed. 2 simulations - debfiefing	*

MCCUE, J.D. et al.1986	"… increased emphasis on the importance of doctors' noncognitive skills in medical practice…"	"Although physicians are required to act as leaders in a variety of situations, leadership ability and leadership training have been largely ignored by medical educators … "	Nurses' perceptions. Measuring. Tool: LSI	Two-hour discussion about leadership.	*
Case Study					
ROBINSON, P.S. et al. 2016	"Leadership skills directly correlate with the quality of technical performance of CPR and clinical outcomes"	"… training in and assessment of leadership skills in emergency scenarios should be an integral component of postgraduate medical training"	Measure. Survey, 12 rated statements and 4 dichotomous questions - Likert Scale	Not teaching	-
HARGESTAM, M. et al. 2016	" ... understanding … non-verbal communication could not only improve teamwork but also increase patient safety ... "	"Communication cannot be taken for granted; it needs to be practiced regularly just as technical skills need to be trained".	Measure. Non-verbal focus.	Team training, CRM	+
BRIGGS, A. et al. 2015	… the performance of team leaders and teams is highly correlated ... teamwork and NTS performance do correlate with clinica loutcomes in trauma resuscitation	"Increased attention to NTSs during trauma team training may lead to sustained performance throughout trauma scenarios"	Measure. NOTSS, T-NOTECHS	Simulations - brief CRM training. Focus on Measuring	*
RINGEN, A.H. et al. 2011	"This might lead to negative consequences not only for the team leader and members, but may also affect patient outcomes"	"Proposed national standards should be urgently implemented to ensure equal access to high quality trauma care"	Measure. Questionnaire. NTS	Not teaching	-
CARLSON, J. et al. 2009	"… cognitive or social skills that play an important role in promoting safety and successful problem management"	"The overall tool should contain as few items as possible to effectively yet reliably capture leadership style and key team behaviors".	Measure. Development of a tool	Simulation - facilitator - debriefing	*
HAYES, C.W. et al. 2007	"… the quality of cardiopulmonary resuscitation provided in teaching hospitals is suboptimal suggest that inadequate resident training may contribute to poor patient outcomes".	"The perceived lack of adequate training seemed to be responsible, at least in part, to feelings of being unprepared, overwhelmed, and of worrying about committing errors during cardiac arrests"	Measure. Survey. Likert-Scale.	Not teaching	-
ITANI, K.M. et al. 2004	NA	"… development of physician leadership has occurred at random in surgical training ... they have provided little formal training in the essential leadership skills"	Measure. Questionnaire, measuring 18 leadership skills	Not teaching	-
MARSCH, S.C. et al. 2004	"In the present study, the absence of structured leadership behaviour was associated with unfavourable outcome"	Absence of leadership behaviour was "associated with poor team performance … this finding could have important implications for the teaching of medical emergencies"	Measure. Strong LBDQ inspired	Simulation - video - debriefing	*
WISBORG, T. et al. 2003	"… training of multiprofessional teams will improve patient treatment ... a substantial proportion of deaths occurring after trauma are avoidable"	"Leadership training also seems to improve leadership performance during cardiac arrest"	Measure. Survey. Prevalence	Not teaching	-

COOPER, S. et al. 1999	… a study which demonstrated that "leaders who initiated a structure, distributed tasks, and remained “hands off” improved team performance"	"… without performance feedback, leaders will not have a model to positively influence their behaviour and performance will be dependent on personality"	Measure. Strong LBDQ inspired	Not teaching	-
Qualitative Studies					
SADIDEEN, H. et al. 2016	"Effective leadership is essential for successful functioning of work teams and accomplishment of task goals"	"Understanding leadership behaviors […] can identify important behaviors required to optimize non technical skills in a major resuscitation"	Measure	Simulation - video - debriefing.	*
LEENSTRA, N.F. et al. 2016	"poor leadership has been identified as a potential threat to patient safety"	"Good leadership is essential for optimal trauma team performance, and targeted training of leadership skills is necessary to achieve such leadership proficiency"	Measure. Need for a taxonomy. TTLS. 67 behavioural Markers	Not teaching	-
KOLEHMAINEN, C. et al. 2014	Effective leadership is critical. … Poor leadership was consistently cited as the major contributing factor to a chaotic code: “if you’re quiet and wishy-washy, it just goes horrifically"	"practical guidance needed for the deliberate practice of leadership skills … targeted training of leadership skills is necessary to achieve such leadership proficiency"	Measure. Survey. Gender.	Not teaching	-
JACOBSSON, M. et al. 2012	"it is a challenge for the formal leader to coordinate team members’ tasks in order to optimize teamwork to obtain a successful outcome"	NA	Measuring Leadership Styles	Not teaching	-
HJORTDAHL, M. et al.2009	"Better team function could improve patient outcome. […] Lack of leadership was often given as a reason for dysfunctional teamwork"	"The need for better training of trauma teams and especially team leaders requires further investigation and action"	Measure. Survey. Gender.	Not teaching	-
Yule S et al. 2006a (Development)	"Future research will establish the criterion validity of non-technical skills ratings on performance in the operating theatre and on patient safety outcomes"	"To date, the formal training of surgeons has focused on developing technical skills ... leadership have been developed in an informal and tacit manner"	Measure. Development of a taxonomy	Not teaching	-

Table 2. Symbols: + = actual teaching. * = debriefing, discussion. - = no teaching/training

Adapted LBDQ (Form XII): LBDQ (initiating structure)

1	Let the team know what was expected of them
2	Use of uniform guidelines
3	Positive attitude
4	What should be done
5	How things should be done
6	Allocate tasks
7	Make sure that his part in the team was understood
8	Plan the work to be done
9	Maintain definite standards
10	Remain 'hands off'

Fig. 2. Abridged by the author (TL) (Cooper, 2001)

NOTSS skills taxonomy (V 1.1) 2006

Category	**Element**
Situation awareness	Gathering information Understanding information Projecting and anticipating future state
Decision making	Considering options Selecting and communicating option Implementing and reviewing decisions
Task management	Planning and preparation Flexibility / responding to change
Leadership	Setting and maintaining standards Supporting others Coping with pressure
Communication and teamwork	Exchanging information Establishing a shared understanding Coordinating team activities

Fig. 3. As presented by S Yule [38]

Taxonomies discovered in this review: leadership, teamwork, and communication

	Type
1945: LDBQ	Leadership Behaviour Description Questionnaire - military
1978: CRM	Crew resource management - aviation. Later adapted to healthcare
1980: LSI	Leadership Style Indicator (48 adjectives)
1998: CRM	CRM curriculum validated by Gaba
1999: LDBQ (FormXII)	Adapted from 1790 original statements to ten dimensions of behaviour
2000: Jar tel (JARTEL)	Joint Aviation Requirements: Translation and Elaboration of Legislation
2002: NOTECHS (NTS)	Non-Technical Skills for Airline Pilots
2003: ANTS	Anaesthetists' Non-Technical Skills
2005: ACGME	Accreditation Council for Graduate Medical Education has established 6 competencies for resident and fellow development
2006: NOTSS	Non-Technical Skills for Surgeons
2007: Mayo High Performance Teamwork Scale	Rates team performance on the consistency of 16 different criteria
2007: GILFOYLE	Checklist (adapted from Gaba 1998)
2009: Jim Carlson	A reliable team behaviour measurement tool
2009: Oxford NOTECHS	Measuring teamwork behaviour in the operating theatre
2010: SMARTT	Algorithm: Situation Management Activity Rapidity Troubleshoot Talk to me
2011: Ottawa Global Rating Scale	Ottawa Crisis Resource Management Global Rating Scale. Evaluates the performance of the teamleader
2012: T-NOTECHS	The Modified Non-Technical Skills Scale for Traumasystem
2013: SLI	Surgeons' Leadership Inventory, Taxonomy
2015: Oxford NOTECHS	A modified Oxford NOTECHS Scale (Nicksa)
2016: TTLS	Taxonomy of Trauma Leadership Skills. 5 skill categories, and 37 skill elements. The skill elements are covered by 67 behavioural markers

Table 3

TRAINING RESIDENTS TO LEAD EMERGENCY TEAMS [PART TWO]

Barriers, Challenges and Learning Goals: a Qualitative Review

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Abstract:

Objective: An investigation to determine any consensus in opinions and views about challenges or barriers in training leadership in emergencies.

Summary of Background Data: Leadership in emergencies is reported as being very important for the patient outcome. A systematic review failed in 2016 to find any focused training of this function. The research has focused on developing taxonomies and tools to measuring leadership. An explicit need for workable leadership training of team leaders in emergencies was identified.

Method: Articles found in the systematic review, other reviews and opinions were included to incorporate experiences, perceptions and emotions connected with leadership training in emergency situations. On the basis of an article written in 1986, statements about challenges regarding leadership training were identified and all articles were searched for these. The method was directed summarized qualitative content analysis.

Findings: In total 40 articles covering the years 1986-2016 were analysed. Main findings: 23 articles described the situation as stressful, 18 described the importance of self-confidence and 16 described the situation as complex or complicated, 12 described the situation was perceived with concern, anxiety or panic.

Conclusions: The literature recommends finding a solution to teach residents to gain confidence in stressful surroundings. The literature recommends finding a way to work with body language, non-verbal communication, attitude and appearance in order to radiate credibility in a setting separated from medical knowledge.

Background

Team leadership in emergencies is reported as being important for the quality of the technical performance of teams, [13-24] for patient outcome, patient safety and patient care. [22,23,25-35] The quality of team leadership may even influence patient mortality and survival rates. [19,23,27,32]

However, many studies recognise that leadership training has been neglected, [1,16,17,23,27,29,36-39] and a recurrent call for *a workabl*e leadership training programme has been expressed explicitly. [1,14,16,17,21-23,26,27,29,34,36-43] This need has prevailed throughout the 31-year period addressed in our investigation.

A systematic review of the literature on leadership training for residents revealed no focused training of this function in 27 either qualitative or quantitative intervention studies (described in Part One of this article: Larsen, T et al: Training residents to lead emergency teams: A Systematic Review (under review)).

Many initiatives have sought to address the problems: in particular it can be emphasized that leadership is part of the Scottish initiative Anaesthetists' Nontechnical Skills (ANTS) [49] , adapted to 'Non-Technical Skills for Surgeons' (NOTSS) [38] and to 'Scrub Practitioners' List of Intra-operative Non-Technical Skills' (SPLINTS). [50] The latter replaced NOTECHS for nurses [51] – which was also modified to: Oxford NOTECHS [52] and among other things: T-NOTECHS [53] , as well as the Swiss leadership training programme based on the Leadership Behaviour Description Questionnaire (LBDQ) [1] . These programmes focus on developing 'formative assessment tools', [54] behavioural markers [55] and taxonomies in order to measure [15,22,33,38] leadership skills. The content, quality and complexity [22,36,43,59] of these tools have been discussed extensively; existing tools have been adapted/modified or new tools have been developed [22,26,33,36,38,39,43] and those involved have spent years discussing, in papers, the 'significant variability in terminology, training modalities and evaluation' [41] in this field. [15,43]

However, 'something' is apparently still missing, and the reason why 'residents feel unprepared and unsupervised as leaders' [27] should be explored. One explanation could be that there is a lack of clarity about the perception and definition of good leadership, as described by Stogdill (1974), who wrote: "[There are] almost as many definitions of leadership as there are persons who have attempted to define the concept". [99] Another explanation could be that the existing programmes have failed to locate the *actual* challenges in the effort to develop assessment tools.

The aim of this article is determine whether the literature reveals any opinions, attitudes, experiences or views to identify any *actual,* but perhaps overlooked challenges or barriers which leadership training for residents in emergencies needs to address. Similarly, the study will investigate whether it is possible to identify consensus on what characterizes a good clinical team leader, thus identifying specific learning goals. Finally, the article will examine the literature to determine whether there is consensus about those challenges, barriers, and goals. In addition, this result would reveal whether there have been any developments over the last 31 years in relation to these findings regarding leadership training. Do we find the same needs today that have identified over the past three decades or has a solution been found?

Method

During the systematic search including the earlier mentioned systematic review, 40 articles were found relevant, covering the period 1986-2016. A detailed review of search strategy and quality assessment is described in detail in the article: Larsen, T et al: Training residents to lead emergency teams: A Systematic Review (under review). The reviews and opinion pieces were included in our review, as they contained concepts that were relevant for systematizing the current discussion.

The Committees on Health Research Ethics for the Capital Region of Denmark was asked to give ethical approval but a formal review was waived for this study (H-4-2015-FSP).

By using a directed, summative approach on 'quantitative manifest content analysis' [63] in order to explore usage of the visible and surface content of the text it is possible to identify consensus on selected words from a quantitative approach. By using 'qualitative latent content analysis' [8] it is possible to interpret the underlying meaning of the words and thus, rather, interpret a qualitative approach. Directed (deductive) qualitative content analysis starts with preconceived codes or categories derived from prior relevant theory, research, or literature. [63] Introducing a different perspective on the articles found in the above-mentioned systematic review, the inclusion criteria were expanded to cover experience, perceptions and emotions relating to leadership training in emergency situations, and therefore primary as well as secondary articles became relevant.

The preconceived categories in the search was guided by the content of an article published in 1986, 31 years ago and written by Kenneth Iserson. [44] The article was identified as very relevant in that it focused on the actual experience of physicians when performing as team leader in an emergency. Modern safety concepts emphasize the need to take the actual working conditions into account and not (only) how work should be performed. Iserson states in this article: *"In critical clinical situations leadership is often lacking"*. This is because *"physicians are never taught clinical leadership"*. Iserson emphasizes the need when he states: *"Especially in emergency care, development of clinical leadership is vital and must be integrated into our education system at all levels."* Finally the author concludes: *"This is a serious deficiency in medical training."* The article provided key concepts that are still to be found in contemporary papers, [22,23,31,39,41,46] formulated the issues very clearly and thus served to guide our further search.

Key words were selected in Iserson's article. He strongly emphasizes that physicians are *1) unsupervised and unprepared* to rise to the occasion as team leaders in emergencies. He describes *2) the situation* itself, which may be *"stressful"*, *"chaotic"* and *"confusing"*, and therefore team

leaders often experience the situation with *3) negative feelings*, such as being *"uncomfortable"*, as an *"overwhelming burden"*, and perceive it with *"fear"* and *"anxiety"*. In order to *"restore order"* in a chaotic situation it is necessary that the leader creates *4) calmness* for the team and therefore *5) self-confidence* is prerequisite for good leadership. According to Ierson, a good leader is *6) perceived* through his *"force of personality"* and *"dominance"*, and the leader demonstrates *7) capacity as leader / appears as authoritative* if he is able to show *"responsibility"*, *"knowledge"*, *"power and authority"*. He emphasizes the necessity of *8) assuming leadership*, which involves the mental decision to assume *"the mantle of the group's possible failure"*. He finally states that it is possible to *9) "learn to lead"*. Those nine key issues constitute the themes to be examined in this article.

All 40 articles were collected in a single PDF document and searched for words to investigate in order to establish whether the above key issues identified by Iserson are still relevant today in the above themes. A comprehensive examination of the document was conducted searching for key words, their synonyms and, if available, meaningful positive and negative analogies, associations, metaphors, and sentences using the search function in Adobe Acrobat Reader DC, version 2017.012.20093. Words were searched in the document, and sentences based on these words were screened in relation to their relevance for the content of this study. Sentences were included if they contained anything about team leadership, teamwork, or personal challenges and feelings related to this. The words were selected by TL, and relevance to inclusion and exclusion was discussed until TL and RBH reached agreement on the decision.

The keywords were grouped in the above-mentioned nine themes, and the themes and quotes containing the words were sorted chronologically and presented in Appendix I.

The most important/significant quotes chosen on the basis of the articles examined are presented in this article. When considered to have a possible influence on interpretation, quotes were sorted according to where they appeared in the articles: before or after the methodology section, i.e., whether they formed a pre-condition in the background for the article or a finding or conclusion. We assumed that a conclusion can be stronger than a pre-condition; a pre-condition for an intervention or a review may be changed when the investigation is completed and a conclusion may contradict the pre-condition.

References mentioned in the background section plus all quotes mentioned in the result section are available in appendix I.

Results

The keywords were grouped into nine key themes (Table 1). The study revealed sentences that argued or expressed attitudes describing what subjects were relevant challenges in team leadership training. There was an emphasis on showing diversity in the statements presented. Original quotes are presented as well as other articles' references to them.

Residents feel unsupervised and unprepared: Ten articles [16,17,23,26,27,31,37,39,44,46] concluded that residents felt unprepared as leaders of cardiac arrest teams.

> "Nevertheless, our data support published findings that trainees would like further leadership training."
>
> *Robinson et al.*, 2016 [23]

A complex, stressful, unpredictable and chaotic experience: There was broad consensus that leadership in emergencies is perceived as a complex issue, both in terms of stressful situations demanding many decisions for the benefit of the patient, as well as of managing relations within the team itself.

Nine articles [16,24,25,29,30,33,44,56,58] mentioned complexity in their introduction/background sections.

> "Leadership is a complex concept, and the tools used to assess the quality of leadership are poorly described, inadequately validated, and infrequently used."
>
> Ford et al., 2016 [24]

In the discussion/conclusion sections, seven articles [19-22,35,39,41] stressed complexity.

> "Since many situations cannot be resolved by technical mastery alone, adaptive leadership involves analyzing complex situations, identifying available resources and required expertise, formulating a strategy in real-time, and coordinating multiple stakeholders."

Mantha et al.,2016. [41]

Six articles [16,25,28,34,38,56] used the phrase "Coping with pressure" as a pre-defined term in the original NOTSS-taxonomy (Non-Technical Skills for Surgeons) as developed by Yule et al. in 2006 [25,38] and presented by Flin et al. in 2007. [28] Three other articles [21,24,40] used a similar phrase: "Coping with stress".

Eight articles [16,23,27,29,30,33,47,59] emphasized the stressful working conditions in their introduction/background sections.

> "Cardiopulmonary resuscitation (CPR) is perceived as a stressful task by medical teams."

Krage et al., 2014 [59]

Ten articles [20,22,25,27,31,32,34,41,44,45] highlighted these conditions in the discussion / conclusion section.

> "Cardiopulmonary resuscitation can produce considerable stress, and the experience of stress and overload may impair Performance."

Hunziker et al., 2013 [31]

Performance in an emergency was described as "unpredictable" [23,30] or "unanticipated". [25] Jacobsson et al., 2012: "The tasks carried out by emergency interdisciplinary teams are complex, unpredictable, and urgent." [30]

> "Inhospital cardiac arrests are challenging, stressful and unpredictable. They can come without warning, often in unfamiliar clinical environments, with limited or difficult access to equipment. Furthermore, their success depends on the coordinated performance of an often ad-hoc cardiac arrest ('crash') team."

Robinson et al., 2016 [23]

Seven articles [1,32,34,41,44,46,60] used the word 'chaos' when describing the situation. Chaos when no leader rises to the occasion. [44] Chaos when leadership is not clear [46] in the environment for Indian Paramedics was described by Mantha et al., 2016:

> "… face complex and chaotic clinical environments that demand effective leadership, communication, and teamwork." [41]

An unpleasant, disturbing, frightening and panicked perception: The emergency situation was characterized by various forms of discomfort.

> "The leader needs to display a positive attitude, motivate and encourage the team, in a situation that is often unpleasant and disturbing."

Cooper et al., 1999 [1]

Not surprisingly this led to concerned trainees. [1,16,23,27,32,37,39]

> "The perceived lack of adequate training seemed to be responsible, at least in part, to feelings of being unprepared, overwhelmed, and of worrying about committing errors during cardiac arrests in a significant number of residents."

Hayes et.al, 2007. [27]

Eight articles [1,14,16,23,27,32,36,44] mentioned anxiety.

> "Several of the inexperienced team leaders mentioned that they felt anxious when they were the sole surgeon in the emergency room"

Hjortdahl et al., 2009. [16]

A single article mentioned panic.

> "They also described often being "panicked" but trying to appear as the "calmest person in the room". "One likened his behavior to a duck, saying: "If you've ever watched a duck on a pond, it looks as though it's floating effortlessly across the lake. But if you've ever looked underneath at a duck's feet, they're paddling feverishly."

Kolehmainen et al., 2014 [32]

Lowered stress: Four articles [16,30,32,44] claimed that a good leader was able to create "lowered stress" [44] and to "calm other people down" [32]

Two articles [32,58] mentioned noise and crowd control.

> "… the team leader has an important role in noise and crowd control."

Mercer et al., 2014 [58]

Confidence: Three articles [1,29,39] used the word confidence in their background section: the team should "demonstrate confidence in their leader", [1] the leader should "radiate confidence", [29] and the leader should have "confidence in performing emergency procedures." [39]

13 articles [1,16,23,27,32,36,37,39,41,42,44,46,47] concluded that the degree of self-confidence is crucial for the quality of the leadership. This will produce "more effective leaders", [36] "save the situation", [44] make "training for leadership much easier", [1] and "improve patient care and cardiac arrest outcomes" [23] .

> "… residents often take years to gain the confidence and expertise to master the non-technical and technical skills needed to address high-risk clinical emergencies."

Nicksa et al., 2015 [39]

How a leader is perceived: Eight articles [13,16,29-31,44,47] discussed the team's perception of the leader. To establish a comfortable and safe environment for the team, team members must be able to perceive their leader as trustworthy. [16,47] Stoller et al., 2013: "The team members had to be able to trust their leader." [47] Hjortdahl et al., 2009: "One nurse said that if the leader seems confident she feels confident too." [16] Jacobsson et al. emphasizes that it was importance that the leader "had a strong ethos and expressed competence." [30]

A shortcut to perception of authority: Three articles [32,35,46] state that the leader should take care of his/her appearance "especially for first meetings" and in this context that: "The clinician will work on ways to develop his/her own charisma." [46] It is important to adopt "a powerful posture" [32] and "Team members who are aware of how they use their bodies to communicate will be able to facilitate and improve their performance." [35]

> "… participants who assumed a powerful versus a non-powerful posture felt more confident and were more likely to take action."
>
> Kolehmainen et al., 2014. [32]

Another issue emphasized as important by eight articles [16,26,29,30,32,35,41,44] is how the leader uses his/her voice.

> "Anyone who tells you that being a white male with a deep voice and who's a little bit taller is not an advantage to being perceived positively, or perceived as in control, would be lying, in really any situation not just a code."
>
> Kolehmainen et al., 2014. [32]

Assuming Leadership: To become a good leader it is important to assume the leadership with all its implications including risks and failure. Five articles [1,18,24,26,32] state this view in the introduction/background sections.

Six articles [16,20,32,36,44,46] elaborate this view in their discussion/conclusion sections.

> "… recent Advanced Trauma Life Support (ATLS) guidelines have codified leadership's importance by emphasizing that for a team to "perform effectively one team member should assume the role of the team leader."
>
> Ford et al., 2016. [24]

When assuming leadership one can benefit from 'introspection' [46], 'psychological self-care', [60] or 'self-management.' [47]

> "… the ability to understand and manage oneself and to understand others and manage relationships – has been shown to differentiate between great and average leaders."
>
> Stoller et al., 2013. [47]

Born to lead – or learn to lead: Seven articles [1,16,23,26,32,42,44] mention that some are born to lead while others have to learn.

> "In the field of cardiac arrest leadership, an increasing weight of evidence supports the notion that individuals can be trained to lead."
>
> Robinson et al., 2016. [23]

Discussion

The literature states that the challenge and barrier the team leader must address is strong negative emotions caused by an extreme context. The literature on *taxonomies* states that if we find a way to refine and improve measurement tools, then we will eventually be able to train leadership.

It is interesting to note that the literature largely agrees on Iserson's views. It is similarly interesting to note that the literature thus agrees that there are actually very strong emotions to be addressed when training leadership for emergencies. It is disturbing to learn that all Iserson's statements written 31 years ago are still valid today. Despite many initiatives, research projects and man hours distributed over these years of intense work, the literature has failed to address what the literature itself has pointed out during this period. However, the literature seems repeatedly to provide an answer different from the target question, finding "something 'that works' in terms of leadership training in emergencies" to a seemingly similar – but essentially different – question: "Is there a method to *measure* leadership by physicians in emergency situations?" The change of focus could be explained by 'substitution'. The mechanism of replacing a difficult question with a simpler one is extensively described by psychologist Daniel Kahneman: "when faced with a difficult question, we often answer an easier one instead, usually without noticing the substitution […] The target question is the assessment you intend to produce. The heuristic question is the simpler question that you answer instead". [78] Even Yule, who in 2006 emphasized the importance of assessment tools and behavioural markers in order to *measure*, [38] had changed his mind in 2015:

> "The rate of developing assessment tools in this area has outpaced development of workable interventions to improve non-technical skills in surgical training and beyond."
>
> Yule et al., 2015 [34]

In Part One of this study it was discussed that it was possible to state that leadership training actually takes place in a clinical context which is complex itself – focusing simultaneously on 'task distribution', 'human factors' or 'initiating structure' (LBDQ) or 'task management', 'non-technical skills' or 'situation awareness' (NOTECHS) as well as on medical knowledge and creating structures while implementing algorithms and maintaining standards. But this setting would diminish the actual focus on targeted leadership training because the cognitive workload is too demanding. Kahneman describes two ways of thinking. System 1 is fast and intuitive and automatic: associative

memory continually constructs a coherent interpretation of what is going on. System 2 is slower, deliberate and logical: consisting of controlled operations representing an effortful mental activity. [78] According to this: when training situation awareness and leadership in combination with medical knowledge and algorithms we challenge the resident to work both in system 1 and 2 simultaneously. This is a very difficult training setting.

The most important subject to the authors of this paper is the foundation for the leadership role: the primary deliberate decision *to assume* leadership as described in ten of forty articles. To 'assume leadership' is a mental, deliberate decision, and important choice to be made beforehand. This should be part of the education. The basic foundation for being able to take the leadership.

In the literature we found a consensus on the *actual* challenge that needs to be taken into consideration. Over the past 31 years the literature has stated that these negative emotions, feelings and perceptions are highly involved when a team leader needs to rise to the occasion in front of an emergency team, but the literature has not as yet described a method to accommodate this. This has been the case whether the reason has been lack of knowledge, lack of leadership definition, lack of focus or lack of ability to handle the simple but difficult question: to find "something 'that works' in terms of leadership training in emergencies" in order to prepare residents for this.

As stated by six articles a good leader should create calmness in the extreme situation. 13 articles concluded that the team leader's degree of self-confidence is crucial for the quality of the leadership. Two specific learning goals to be addressed in the teaching of team leadership training were expressed.

Another finding is, that it is important that the leader has charisma, is trustworthy and express competence. Eleven articles recognise that non-verbal communication is important; three articles mention body posture and eight articles stress the importance of how to speak and use of the voice. Obviously, it should be investigated how to optimise the leaders charisma as well as radiating credibility and competence including non-verbal communication.

> "In accepting the leadership role, the individual assumes the mantle of the group's possible failure. Any individual's faltering can be laid at the leader's feet. This is the law of total responsibility."

Iserson, 1986 [44]

Limitations

When considered to have a possible relevance to the aim of this article, quotes were sorted according to where they appeared in the articles: before or after the methodology section, i.e. whether they expressed a pre-condition in the background for the article or a finding / conclusion as a result of an investigation. It is assumed that a conclusion may be stronger than a pre-condition; a pre-condition for an intervention or a review may change when the investigation has been completed and a conclusion may contradict the pre-condition. It turned out that whether the words were mentioned as a pre-condition or a conclusion had no effect on the outcome. A reason for this could be that the words had ben inherited and recycled throughout the literature. On the other hand, it may be argued that it is not crucial whether the words appear as a conclusion on the aim of an intervention in a research project. What is important to our study is the fact that the articles consider it necessary to emphasize the words in their articles at any stage whatsoever.

Conclusions

Assuming leadership is an individual and personal matter and an important and deliberate choice. The literature recommends that a method should be found which teaches residents how to achieve calmness and confidence in a stressful and threatening context. To this end it is recommended to find a way to work with body language, non-verbal communication, attitude and appearance in order to address emotions and radiate authority and credibility in a setting separated from medical knowledge.

Contributors

T. Larsen had full access to all the data in the study and had final responsibility for the decision to submit for publication. TL undertook the search for material, extracted and collected data, developed the analysis strategy, and wrote up the results. TL & R Beier-Holgersen conceived and designed the project, reviewed the scientific reports and performed quality assessments and interpretation of the results. P. Dieckmann and D. Østergaard provided advice and critically revised the manuscript.

Themes describing what problems the literature refer to as issues a team leader can experience in front of an emergency team	
When an article makes a statement both in the background and conclusion sections only one ref. is listed.	No. of statements
Physicians feel unsupervised and unprepared	
Residents feel unprepared / lack of competence / need further training [16,17,23,26,27,31,37,39,46]	10
The experience of the emergency situation	
A complex / complicated situation [16,19-22,24,25,29,30,33,35,39,41,44,56,58]	16
A stressful situation / pressure [16,20,22,23,25,27,29-34,41,45,47,59]	18
In addition stress / pressure is implicitly part of NOTECHS [21,24,28,40,56]	5
An unpredictable / unanticipated situation [23,25,30]	3
A chaotic situation [1,32,34,41,44,46,60]	7
An overwhelming experience	
An unpleasant / disturbing situation [1,32]	2
Perceived with anxiety / as a threat / 'a losing battle' / fail [1,14,16,23,27,32,36,44]	8
Perceived with panic [32]	1
Perceived with concern / doubt / is overwhelming / is worrying / is stressed [1,14,27]	3
The leader is able create calmness	
Good leadership creates calmness and lowered stress [16,30,32,44,58]	5
Self-confidence is important	
Self-confidence is an important element in leadership [1,16,23,27,29,32,36,37,39,41,42,44,46,47]	18
The team's perception of the leader	
Individual leadership behaviour will have an impact on the team's perception (radiate confidence, overall organization, clearly defined, trustworthy, most important human factor, communicates clearly, strong ethos etc.) [13,16,29-31,44,47]	8
The leader's appearance: short-cut to authority	
Body posture, appearance, non-verbal communication [32,35,46]	3
Voice (calm, clear, distinct, deep, fluent etc.) [16,26,29,30,32,35,41,44]	8
Assuming leadership – a deliberate decision	
Assuming leadership / risks / responsibility [1,16,18,20,24,26,32,36,44,46]	11
Managing oneself / introspection / psychological self-care [46,47,60]	3
Mentally prepare / rehearse / mental strain / mental models [25,32,56,58]	4
It is possible to learn to lead	
Leadership comes naturally to some / is a problem for others [1,16,23,26,32,42,44]	7

Table 1

CONDUCTING THE EMERGENCY TEAM: A NOVEL WAY TO TRAIN THE TEAM-LEADER FOR EMERGENCIES

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Abstract

Introduction: Worldwide, medical supervisors find it difficult to get students to rise to the occasion when called upon to act as leaders of emergency teams: many residents/rescuers feel unprepared to adopt the leadership role. The challenge is to address the residents very strong emotions caused by the extremely stressful context. No systematic leadership training takes this aspect into account.

Aim: The overall aim of the course is to investigate whether, in an emergency, a clinical team leader could apply a conductor's leadership skills.

Background: An orchestral conductor is a specialist in practicing leadership focusing on non-verbal communication. The conductor works with highly trained specialists and must lead them to cooperate and put his interpretation into effect. The conductor works purposefully in order to appear calm, genuine and gain authority.

Method: A conductor and a consultant prepared a course for residents, medical students and nurses, n = 61. Ten x two course days were completed. The exercises were musical and thus safe for the students as there were no clinical skills at stake. The programme aimed to create stress and anxiety in a safe learning environment.

Conclusion: The transfer of a conductor's skills improved and profoundly changed the participating students', nurses' and residents' behaviour and introduced a method to handle anxiety and show calmness and authority.

Perspectives: If this course in leadership is to be introduced as a compulsory part of the educating of doctors, the ideal time would be after clinical skills have been acquired, experience gained and routines understood in the clinic.

Funding: Tryg Foundation, Laerdal Foundation and Nordsjællands Hospital, Denmark.

Introduction

Worldwide, medical supervisors find it difficult to get students to rise to the occasion when called upon to act as leaders of emergency teams [100] : many residents feel unprepared for the leadership role in emergencies [16,17,23,26,27,32,37,39] . However, leadership in emergencies is considered very important for patient safety [1,13,14,16,17,19-23,26,27,29-33] and can affect mortality. [19,23,27,32]

It is necessary for residents to address and handle anxiety [16,23,27,32,44] and panic [32] in stressful [20,22,25,27,31,32,34,41,45] and complex [19-22,35,39,41] situations. [100] Therefore, in order to provide good and convincing leadership, residents must learn to be confident [1,16,23,27,32,36,37,39,41,42,44,46,47] and calm [16,30,32,44] when assuming the role of team leader. [100]

There is no systematic leadership training that takes this aspect into account. Handling negative feelings is not part of existing programmes. [101] Leadership during an emergency situation involves knowledge and skills, but also implies dealing with the pressure [16,25,28,34,38,56] of being the decision-maker and the pressure of bearing the ultimate responsibility for what happens (or does not). [101] This article describes a course that supplements existing programmes by addressing the emotional challenges for those leaders.

Background

Leadership and its relation to healthcare

It is important to fully understand that leadership and assuming leadership is an individual and personal matter and a deliberate choice. [101] It is *necessary* that the person who steps forward as teamleader fully understands the risks and responsibilities of the leadership role [1,20,32,44,47] – also referred to as the leaders' introspection, [46] psycological self-care, [60] mental readiness [20,25] or having the ability to understand and manage oneself. [47] "In accepting the leadership role, the individual assumes the mantle of the group's possible failure. Any individual's faltering can be laid at the leader's feet. This is the law of total responsibility", [44] stated by Iserson in 1986.

The conductor's role and its relation to leadership in healthcare

An orchestral conductor is a specialist in practicing leadership focusing on non-verbal communication. The conductor's goal is to interpret and realize the composer's intentions and to convey this interpretation to the orchestra to ensure the music comes alive in an artistically satisfactory way. The conductor works with highly trained specialists and must lead them to cooperate and put his interpretation into effect.

In order to achieve the respect and authority to lead an orchestra, it is important to appear calm, balanced, competent, authentic, and credible. The leader works purposefully with his posture and appearance in order to eliminate anything that could possibly prevent the message from being interpreted as intended.

It is necessary for the conductor to listen, sense, and observe what *actually* takes place in the room and demonstrate a *'presence to the moment'*, which will give him the ability to constantly adapt and adjust to changes and embrace the unexpected. This presence should also reflect his *'responsiveness',* defined by the ability to sense, notice, recognize, feel, and experience the emotions of another person or group of persons subjectively.

This ability to gain an overview of the situation in all its complexity and find solutions based on technical as well as human resources will be perceived by the team as signs of competence. When the leader adds the courage to *'improvise'* on the basis of a given situation, he will not only demonstrate competence, but make his presence felt. In so doing, he will be perceived as even more genuine by the teams.

"Improvisation requires a lot of experience and discipline and cannot be executed by beginners, neither is it something to be pulled out when everything else fails". [94] The importance of skilled professionals being able to improvise in their leadership roles is also discussed and emphasized by jazz-pianist and Professor of Management, Frank J. Barrett. [95]

By working with these objectives, the conductor or the teamleader's credibility will be enhanced. Conductors know that only when this credibility is established is the conductor able to lead the orchestra, and to provide the appropriate level of encouragement or criticism considered appropriate without upsetting anyone.

Table 2 shows the relation between the functions of a conductor and a team leader. Based on these similarities, we consider that training in the non-clinical context of conducting music might help residents to take into account, face, and deal with the emotional challenges of being a leader. The conductor's focus and objectives during the course are presented in table 3.

The overall aim of the course is to investigate whether, in an emergency, a clinical team leader could apply a conductor's leadership skills.

Method

This section covers several aspects. Firstly, pedagogic considerations and assumptions, then the development of the course and how it was conducted, and finally the evaluation.

Pedagogic considerations

Anxiety and safety

In order to simulate an emergency situation and to optimize leadership training the course creates a framework with stress, anxiety, and discomfort in a harmless, non-clinical, and safe setting. It is important to provide psychological safety [102] where the participants feel able to accept being uncomfortable and feel that they will be viewed positively even if they make mistakes. [103]

Transformative learning perspective

The course assumes that participants have to experience and obtain a 'bodily feel' of the pressure of being a conductor in order to really understand it, as described in *Embodied Cognition*. [68] This theory is used in the design of effective learning environments, especially those targeting conceptual change. [69] According to *Transformative Learning Theory* [70] one prerequisite for ensuring a real transformation is to be faced with a 'disorienting dilemma' [71] . A 'Disorienting Dilemma' is defined as an acute personal or social crisis or, at another level like on this course: the participants were given assignments which were almost impossible to solve.

Change of setting

The course builds on a change of teaching strategy to implement an element of surprise, which is also needed to create the dilemma that is used as trigger for transformative learning process. There is a radical change of setting with the shift from a traditional class-room set-up to a musical set-up in another room; this change of setting emphasizes the great importance that the instructors attach to this surprising exercise.

Apprenticeship

Traditionally, a conductor himself is trained via an apprenticeship and this method would be applied to the course. Individual 'straight on' feedback, offered with the utmost care and sensitivity, is a cornerstone when doing the exercises: the participants must not feel concerned at this point. The conductor has experienced that learning is promoted by getting close to this limit when giving this very personal feedback.

Development of the course

As described in the literature, the consultant had experienced the lack of leadership and anxiety in simulation training of residents and the missing focus on leadership. As an amateur trombone player she realized the parallel between the teamleader and the conductor when her concert band received a new skilled conductor. The development of the course was based on a conductor's skills

in order to give medical students, nurses, and residents the tools required to appear calm and credible in to the emergency team.

The conduct of the course

A consultant and an orchestral conductor were the faculty for the course.

The consultant was familiar with the students and residents as she is responsible for their education at the hospital. In addition, her presence guaranteed the clinical relevance of the course.

The presence of the conductor was a new element in the clinical context and therefore the participants were more attentive.

Classrooms: Teaching took place in three different rooms. Room one was an ordinary classroom setup. The faculty stood in front of the board. This situation was a known and safe framework for a course for medical students and doctors. In room two, a music stand was placed in front of a semi-circle with chairs for the participants. Behind the semi-circle was a piano. This musical setup was a 'change a setting' for the participants. Room three contained a fully equipped simulation room with a SimMan 2G patient simulator, again familiar to everybody.

Primarily, the consultant explained the background of the course, and based on her own experience described a case where the team leader failed with unfortunate consequences. The similarity between a teamleader in an emergency and a conductor at a concert was described: two highly tense situations demanding firm leadership in which decisions must be obeyed and there isn't much room for discussion. Then, the Conductor briefly described his thoughts on leadership as described in the background section and in table 3. The conductor promoted a *change of setting* by explaining that teaching would continue in the adjoining room, and the course participants themselves would have the opportunity to act as conductors and singers in a choir.

A chronological review of the content of the course days is presented in Table 4.

Participants

All participants were recruited from Nordsjællands Hospital, Denmark: Residents starting work in spring 2015 were contacted by mail and offered a course on team leadership and non-verbal communication. The residents were appointed and participated in the course one month prior to the beginning of their first clinical period as a doctor. In autumn 2014, 3rd semester graduate

students were offered courses starting in January 2015. The students enrolled. As an experiment, an additional training day was added for two different teams. To investigate whether the course was applicable to other ages, groups and health-care professionals or was relevant in teamwork with nurses, a course day was held for emergency room nurses.

The Committees on Health Research Ethics for the Capital Region of Denmark was asked to give ethical approval but a formal review was waived for this study (H-4-2015-FSP). All participants gave written consent for their videos to be displayed / published here.

Evaluation methods

Data acquisition and analysis

Integrated video and audio recordings representing 22:12 hours of observation of all the courses for the residents and students were made. One camera focused on the 'leader' and another on the 'team'. The first four course days were recorded on the GoPro Silver edition, and these cameras were replaced by the GoPro HERO 4 Black edition, which has high definition resolution (4K), allowing zooming in on the details of the footage in the editing process. The HD footage was edited on a MacBook Pro with two external two TB hard drives (one for backup). Recordings from a single course day took up between 40 and 60 GB of disk space: all 22:12 hours of recordings filled approximately one TB of hard drive space. The videos were edited in Adobe Premiere Pro CC, release 2017.1.2.

Dialogues from selected courses were transcribed verbatim (including short descriptions of important events, e.g. 'laughter'). Written field notes were compiled for all the courses. Complete dialogues were transcribed from six courses (the final course design) – a total of 160 pages. Transcription made partly by TL and partly by two medical students who were not attending or informed about the course ('blinded' as to the background, method and assumptions for the course). Throughout the project, TL kept a research diary, where observations and thoughts deemed to be relevant for the project were recorded (Online log available in Appendix to article three).

Comments and evaluations

All the participants made evaluations immediately after the courses, n = 61. They gave written quantitative evaluations and responded to a short survey of four quantitative questions plus an option for a free assessment comment (Appendix 1). The students and residents were encouraged

to reflect on the course in written evaluations after the course. After receiving edited video clips showing their personal performance during the two course days, the students and residents were sent a survey with 14 questions (Appendix II).

Analysis

Abduction as a method

An abductive approach to research makes it possible for the researcher to present a qualified presumption *(educated guess or inference)*[67] when commencing his investigation. Based on his findings, he acquires new knowledge, he might alter / adapt this new knowledge to the presumption and the process starts over. This principle is the foundation of more contemporary methods e.g. Grounded Theory or Qualitative Content Analysis.

Qualitative Content Analysis

All text-based data were gathered into one single pdf-document and searched for keywords and sentences describing the content of the course, and the words were interpreted in a meaningful context. The method was Qualitative Content Analysis, conventional, and inductive: Themes emerged in and abductive – inductive process, abductive because the conductor had his presumptions for the course – inductive because the findings adjusted the presumptions. When themes were established the process became directed by the themes, thus the process became deductive. The words were grouped into three themes (table 5, 6, and 7) according to the assumptions (as described in the background section and in table 3) and findings in the data set. The words were interpreted in a meaningful context.

Three keywords were important for the course though rarely verbalized: video footage was searched for *Trance, Apprenticeship* and *Transformation* based on the conductor's assumptions for the course. '*Trance'* is an experience, *'apprenticeship'* is an overall important teaching concept, '*transformation'* is an aim, but none of those keywords were explicitly verbalized during the course (table 5).

Video footage was reviewed several times, and edited with the aim of exemplifying the themes described above.

Results

20 three-hour course days were completed in the period January – May 2015, three course days were cancelled because of lack of participation. Seven participants were not able to attend course day two because of time pressure from other activities (table 1).

Written qualitative evaluations were received one day to five months after the course from 20 of 38 participants (53%). The video material was edited to 332 small video clips and each participant was sent their personal videos together with a new survey. These surveys were received 2·5 – 10 months after the course, 14 e-mail reminders were sent and ten of the 38 participants responded (26%). Unsolicited comments received 24 months after the course from four of the 38 participants (10%). In addition, two 'blinded' students wrote non-guided reflection on the course based on the content of their transcriptions of four course days. These considerations are included in the data set.

Three themes emerged: Table 5, Learning environment. Table 6, Pedagogics. Table 7, Learning goals – the conductor's focus.

All themes are highlighted with quotes according to whether they were made during *the courses* illustrating what took place during the courses (table 9) (comprehensive in appendix III) or were provided in evaluations *after the courses,* reflecting thoughts from the course up to two years later (table 10 and 11) (comprehensive in appendix IV).

Ten short videos were edited according to the themes and produced from the 22:12 hours of footage from the courses. The videos all give an impression of the learning environment and include laughter. The videos and the themes they are illustrating are presented in table 12.

Table12, Video 1 shows a 'change of setting' for the residents and the impact of being challenged to conduct a simple children's song. Given the difficult challenge of beating a 'basic four-beat pattern' (ill. 1 and table 12, video 1) the participants became more stressed in an already stressful situation, and this revealed personal physical challenges and interference – they could then be assessed by the conductor.

The video (video 1) show clear signs of participants feeling insecure: twisting their hands, scratching their neck, shaking their shoulders or head, laughing – mouth wide open, hiding their hands in their

laps and showing anxiety while laughing was interpreted as participants feeling stressed, finding the task very difficult and struggling to solve the challenge.

The participants' discomfort and uncertainty led them to pay more attention to the conductor – and strengthened the cohesion among the participants when laughing at each other.

Learning environment

Selected comments are shown below in the themes. All data are described in table 5 and 6, quotes are presented in table 9 and 10 as well as Appendix III and IV.

Learning environment

> 'Many points and a lot of learning are received best in a safe environment and when playing, which one must say that the course fulfils'.
>
> [S13], two months after

Safe, enjoyable laughter had a significant impact on the course indicating that the participants felt safe and enjoyed participating.

Reflections about the learning process were found. This further confirms that the participants felt safe to speak up and share reflections about the content of the course.

Trance

It was observed that a trance-like state frequently occurred between the leader and the team during the exercises, as shown in video 6, 7 and 9 and table 8 and 9, as well as Appendix III and IV.

Apprenticeship / 'Straight on' feedback

Participants recognized that the conductor was a specialist who, through his profession, had acquired the ability to focus on non-verbal language (Table 6). Part of the learning process through apprenticeship is the very direct personal feed-back (Table 12, Video 3). The conductor worked with the participants' body posture and addressed simple physical elements: hands, neck, chin, back, chest etc. This was done in order to emphasize different personal physical issues while explaining to the team their impact and importance. Furthermore, participants observed how personal instruction made a big impact on the person who received the instruction, and experienced how individual feedback immediately influences, transforms and strengthens the leader's credibility in front of the team. 15 participants stated that they felt that the faculty fully understood the

challenges they faced ('got under their skin') (Table 7: Stress and obstacles). 17 participants stated that they greatly appreciated this personal and 'straight on' feedback (Table 9 and 9: Apprenticeship).

Transformation

15 participants during the course and 21 participants after the course stated that there had been significant development in the individual participant's behaviour. (Table 5: Transformation and appendix III and IV).

Learning goals – the conductor's focus

Described in table 7.

Physics

> 'It was also very clear that the participants gained a much greater body awareness. They became aware of how they communicate, what they signal with their body language and what all this does with the message they are going to convey'
>
> 'Blinded' student 2

47 participants expressed that they had become aware of the importance of body language when communicating.

Authority

> 'The good thing about practicing non-verbal communication was to experience calmness, which could also be created in an emergency. There was not so much noise in the form of people speaking all at once, but I also experienced an inner calmness in communicating my message clearly and was well aware that the recipient had understood the order, and I was able to concentrate on the next part of the treatment algorithm.'
>
> [R8], four months after

17 participants specifically stated that they have achieved interaction between body language, appearance and authority – and understood why this leads to calmness and self-confidence – confidence for the leader as well for the members of the team.

> 'So when I feel that I'm calm – you can see it too.'
>
> [S5] dialogue from a course

Eye-contact

> ‘Especially as a doctor and a team leader in an emergency situation where there is a great tendency for things to get messy and communication is not efficient, you can pass orders and communicate through mimics, body language and your eyes.’’
>
> [S3], one month after

Eight participants during the course and ten participants after the course stated that they had learned that eye-contact is a powerful tool for ensuring that decisions are communicated, received and understood.

Presence at the specific moment

> ‘We are not good at being present … I am not. But it is important to be present when leading a large group of people… Presence can be used in a lot of contexts!’
>
> [S4], dialogue from the course

The importance of listening, being attentive and demonstrating awareness was a topic introduced repeatedly by the faculty during the courses. The participant understands the importance of presence in promoting the quality of cooperation with the team and eight participants stated this explicitly.

Responsiveness

> ’Yes, I felt that I got them more ... under control. Because when you look at people – you’ll know exactly where they are – and where I am myself’
>
> [R7], dialogue from a course

The participants learned that in this course context it was valid to talk about and express subjective perceptions *(I feel, I can see, it seems like, I can sense, I can tell)*. Sentient perceptions were stated by 11 participants.

Stress and obstacles

> ’I was pushed to the limit at the same time as I needed to use what was newly learned, which was a productive challenge’
>
> [S21], three months after

15 participants stated that they were pushed out of their comfort zone, however 19 participants acknowledged that the environment was nevertheless safe. A few sceptical comments from one participant and one ‘blinded’ student were identified (presented in table 11): independently of each other, they found it too complicated and, in terms of the clinic, irrelevant for doctors to learn conducting techniques.

Communication

> '…Impressive to see how much you can say without words, just body language and mimic.'
>
> [S10], five months after.

Participants were surprised and impressed to see how much they could communicate and how explicit and nuanced they could make their demands without speaking.

> 'Unbelievable how much you can say and ask for without using words'
>
> [S3] day one

Non-verbal, Smile / Grin

> Conductor: The very best: that's your smile when it succeeded! When you succeed, you look so proud and happy! And we are so happy to be part of your pride and your project. [S7] agrees: When you give that smile, we get such a 'Yes! I did it right!'
>
> Dialogue from a course

Non-verbal, Smile / Grin: The words 'smile' and 'grin' was found in three contexts: *Safe learning environment:* It was frequently observed and registered that the participants actually laughed and smiled during the course when they were enjoying themselves. *Anxiety and stress:* It was also observed and recorded that during the course the participants laughed and smiled as an involuntary and nervous reaction to stress. *Non-verbal communication:* A smile especially can express very nuanced and different emotions: kindness, pride, appreciation, embarrassment, compassion, silliness and confusion etc. As such, how and when to use a smile when communicating as a leader was discussed in depth – i.e. when it promotes and when it interferes with the leadership.

Engagement

> ... I felt like I was a part of your [project]. You were engaged! Because if you were not, you'd just have proceeded, and then I'd just go: 'Well, who cares anyway'
>
> [S5] dialogue from a course

Participants experienced that, in order to demonstrate authority and leadership in a convincing manner, it was necessary for the leader to show he was fully absorbed in the project.

Additional findings

(Presented in table 9, as well as Appendix IV)

The additional findings were mainly guided by one surprising factor; for most of the participants transferring the newly acquired leadership competencies from a musical setting to a full scale CPR simulation turned out to be a problem (Table11, video 10, and table 9, as well as Appendix IV). A reasonable explanation was that, when challenged on their clinical knowledge, the participants forgot about non-verbal communication and leadership (therefore a new theme was introduced: *Training algorithms and leadership*). However, the participants were excited about the content of the course and considered the competencies to be important for their future work as doctors (new theme: *Relevance*). This problem led to discussions about when in education would be the ideal time to learn these skills (*When to learn*). These discussions and the written evaluations confirmed that the course addressed important topics which were not covered in formal education (*Missing angle at the university*). An interesting finding was that the course participants considered that the course could be used in many other contexts besides the musical and clinical (*Generally applicable*). These themes concerned the perspective of the lessons learned from the courses, and they are presented in table 8.

Training algorithms and leadership

14 of the participants stated that they had benefited from the CPR exercise, but the majority showed they forgot the newly learned lessons when challenged on clinical knowledge (one example in table 12, Video 10). Four participants stated that it was advantageous to train leadership separately from medical competence.

When to learn

The nurses responded most positively to the course (figure 1). The average age in this group was over 50, approximately 20 years older than the two other groups, which indicates that after years of experience this group was aware of how fatal it could be when the team leader failed. This view was confirmed by three participants who pointed out that the ideal time to attend this course in relation to the medical education programme would be after clinical knowledge and clinical routine / experience had been acquired.

Relevance

> '… without the ability to communicate, six years of study are to some extent almost useless'
>
> [S7], day one

35 of the participants agreed that the course was highly relevant for their clinical practice.

’Anyone could need it in the daily work’

Nurse 1, day one

Two years after the course, four participants stated that it had changed their professional behaviour.

“I personally think the course has been a good foundation, now that I’ve started as a resident.”

[S14], unsolicited comment, 24 months after (by e-mail)

Missing angle at the University

11 participants stated that the content of the course had an important objective which was lacking in teaching at the university.

Generally applicable

‘I felt a big improvement when attending an oral examination last Monday... I got rid of the worst of my bad habits! So cool!’

[S5] day two

13 participants stated that the subject was relevant to educational contexts, clinics, when collaborating in general, day to day work, doctors’ work, instructing cross-fit, swimming lessons, public speaking and attending oral exams.

’Think I will benefit from this both professionally and privately…’

[S11], day one

New knowledge

As shown in figures 1 and 2, all course participants responded positively to the course. 80·4% stated that they acquired new ideas. Nurses yielded the highest result, 95·7% reported that they acquired a great deal of new knowledge.

Discussion

Summary of main findings

The transfer of a conductor’s skills improved and profoundly changed the participating students’, nurses’ and residents’ behaviour and introduced a method to handle anxiety and demonstrate calmness and authority.

We believe that this course represents the missing link between what the researchers have done and what the researchers have known and sought for more than three decades.

The course works in an area that goes beyond language, demonstrating a shared perception in collaboration when creating music together. The philosopher Susan K Langer made this a prerequisite and explained it when she stated: '*the limits of language are not the last limits of experience, and things inaccessible to language may have their own forms of conception'.* [82] This leads to the concept described as 'trance' in this article where time and place dissolve.

When collaboration is optimal when working with an orchestra, a state can occur where time and place are dissolved as described in flow-psychology. "Flow" is defined by the psychologist Csikszentmihályi as: "the creative moment when a person is completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one… " (Interview, Wired magazine, *September 2006 issue*, p. 21.) … "The flow state must be a general pedagogical ideal because it is often extremely good learning, as you are optimally challenged, fully focused and emotionally involved so you tend to remember very much of what you are dealing with" (TL's translation). [75]

An important part of the reflection takes place during dialogues during the course. At the beginning of the first day, the conductor uses words he considers important in relation to teaching. He introduces concepts such as *'assuming leadership', 'radiate authority', 'presence at the specific moment'* and showing *'engagement'*. Gradually, reflection and feedback are left to the students who, equipped with these objectives and vocabulary, assess each other's performances. It should be mentioned that there is a delicate balance between course participants actually acquiring this new knowledge and simply repeating the words of the conductor.

Expressing safety or sheer avoidance manoeuvre? (Table 12, video 5) When the participants are dancing, making caricatures, and flirting with the members of team as demonstrated in this video, it is debatable whether they are doing so as an expression of well-being and security or in order to draw attention away from their personal sense of insecurity in the specific situation. This is a recurring topic for the course: stress and obstacles go hand in hand with safety and happiness.

It is interesting to ascertain that the skills and competences addressed in the course are situated on a meta-level and are a prerequisite for the teaching: the faculty has to be able to assume the leadership role as educators who are able to improvise when teaching. Every participant brings in

his own experiences, perceptions and emotions (table 12, video 11). It is very important for the faculty to be able to demonstrate 'presence at the specific moment' and 'responsiveness' in order to appear credible as teachers and role models.

It is possible to use existing learning theories to define and explain why the course has a huge impact on the participants, but the project has created new learning goals and a methodology of its own.

> 'I think the course is a great opportunity to work with yourself in a safe but challenging way, and there is a great deal of praise for the instructors to ensuring a good framework'
>
> [S10], video survey, five months after

Limitations

It is possible to argue that the course was a clinical challenge and setting while a consultant and fellow students were present, and that the participants' professional knowledge was therefore challenged and they were in competition with each other. But as the results in the videos and the text-analysis show, the majority stated that they perceived the learning environment as safe.

Beyond limits of language: words cannot express substantial parts of human perception and experience. However, in order to underline which objectives were addressed during the course, this is demonstrated primarily by words in the form of quotes. The challenge inherent in this article is to document the conductor's highly qualitative approach in introducing non-verbal communication in a clinical research tradition. It should be mentioned that all the videos presented in table 12 are in fact more *explanatory* when documenting the nuances in the content of the course.

Perspectives

If this course in leadership is to be introduced as a compulsory part of the educating of doctors, consideration should be given to when it is to be implemented. Our results indicate the ideal time would be after clinical skills have been acquired, experience gained and routines understood in the clinic.

Conclusion

The aim of this project was to transfer the competencies from an orchestral conductor to residents in healthcare in emergencies. The focus was on appearance, authority and non-verbal communication. The transfer of a conductor's skills improved and profoundly changed the

participating students', nurses' and residents' behaviour and introduced a method to handle anxiety and show calmness and authority. This course seems to accommodate the need for an operational and targeted training of the team leader in emergencies, addressing a way to achieve confidence in a stressful, but safe learning environment. In addition the outcome turned out to be a profound transformation of participants' self-understanding.

Contributors

T Larsen had full access to all the data in the study and had final responsibility for the decision to submit for publication. TL undertook the collection of data, developed the analysis strategy, and wrote up the results. TL & R Beier-Holgersen, conceived and designed the project and interpretation of the results. P Dieckmann and D Østergaard provided advise and critically revised the manuscript.

Declaration of interests

We declare no competing interests.

Role of the funding source

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Population	Participation in course. January – May 2015		
	Day 1 (3 hours) (11 course days)	Day 2 (3 hours) (7 course days)	Day (3 hours) (2 course days)
Residents	15	11	0
Medical students	23	20	4
Nurses	23	0	0
Total	61	31	4

Table 1. Population and participation in course

	The Conductor	The Team Leader
1	Has the professional competence to control the process	Has the professional competence to control the process
2	The musicians have clearly defined tasks in the team	The specialists have clearly defined tasks in the team
3	Works in a process that takes place over time. A process that cannot be interrupted	Works in a process that takes place over time. A process that should not be interrupted
4	The individual musicians must be led to step forward and perform their tasks and step back to let others perform their role in the process	The individual team members must be led to step forward and perform their tasks and step back to let others perform their role in the process
5	Has his score but is open to soloist's input (musical interpretation)	Has his algorithm but is open to input from the team members
6	Must continuously adjust and adapt the work in terms of how the concert is evolving and responding to the musicians' efforts	Must continuously adjust and adapt the work in terms of how the process is evolving and responding to the members' efforts
7	Must be able to read the orchestra as a group as well as the individual musicians, and to respond to people and show empathy	Must be able to read the team as a group as well as the individual members and to respond to people and show empathy
8	Must be prepared to handle crises and conflicts in the orchestra and to solve problems instantly	Must be prepared to handle crises and conflicts at the team and to solve problems instantly
9	Top-down management / authoritative leadership	Top-down management / authoritative leadership
10	Manages a team of professional, highly trained musicians whose skills define their roles	Manages a team of professional highly skilled specialists and is aware of what skills exist in the team and how these are best used
11	Provides nothing in itself, no hands-on. The task is defined as overview, communication and leadership	Can contribute actively in the team but should be aware of the risk of head-down. The task is defined as overview, communication and leadership
12	Working in a culture where all musicians look attentively at the head, focus on their own task, respond to the other's efforts, and trust in his responsibility and overview	Working in a culture where eye contact and nonverbal communication are not recognized tools
13	Working in a culture where gestures, eye contact, facial expressions and body language is defined as the only tool in communication. Used, sent and received instantly	
14	Keep the leadership from start to the very end. But the musicians is in some extent able to overrule the conductor if they don't find him capable at conducting the concert	Another team member may claim the leadership in the process
15	Cannot use verbal communication at the concert	Verbal prescriptions are standard in communication

Table 2: A parallelization between the conductor and team leader's function

The conductors focus
Appearance immediate, intuitive decoding
Appears confident
Appears easily readable
Appears comfortable
Professionally focused (Authority, engaged)
Leadership – Shows Power
Leadership – Is demanding (opposite caring)
Presence to the moment (Intense)
Presence to the moment (listening)
Presence to the moment (paying attention)
Absorbed in his project
Physique, exact observations: control of body
Appears calm
Appears relaxed
Seeking eye contact
Relaxed use of facial expressions
Relaxed use of Eyes
Relaxed use of Eyebrows
Relaxed use of smiles
Shoulders back
Raised chin
In control of hands
In control of legs
Disturbing elements, exact observations
Very individual characteristics. Examples: Fixed grin. Unintended smile. Licking their lips. Very raised eyebrows. Awkward location of hand. Nodding his head. Leaning violently forward. Touching his face. Scratches on the neck, showing stress and discomfort, etc.

Table 3

Musical exercises, course-day one			
Exercise	Content	Objectives	Comment
Initiate a sound (class and simulation room)	Trainees must in turn get the others to sing 'ah' initiated by a simple Conducting gesture	Calmness, authority and require an action.	This exercise was replaced by conducting 'Frere Jacques' after two courses
Beating a basic 4/4 pattern (music room)	A simple conducting exercise that focuses on the correct movements of hands	Necessary preparation for the following exercise. An apparently simple but in fact difficult obstacle	A big obstacle, requires a great attention
'Frere Jaques' (music room)	Conducting a choir	Authority, presence to the moment, 'first meeting' and non-verbal communication	Obstacles, disorienting dilemma, discomfort, stress and anxiety
Ghetto Blaster orchestra, (class room)	Conduct a Ghetto Blaster orchestra, improvising w. three sounds	Leading a multidisciplinary team. Authority, presence to the moment, appearance and communicating without words.	Experience the intensity in the communication when conducting an orchestra 'achieving a state of trance'
Musical exercises, course-day two			
Ghetto Blaster orchestra, (class room)	Conduct a Ghetto Blaster orchestra, improvising with ten sounds	Leading a multidisciplinary team. Authority, presence to the moment, appearance and communicating without words.	Experience the intensity in the communication when conducting an orchestra 'achieving a state of trance'
Mastery, (class room))	The conductor tells and shows	Experience the strong authority, presence to the moment, appearance and nonverbal communication from a professional conductor.	The power of eye-contact and use of empathy
Ghetto Blaster orchestra (class room)	Conduct a Ghetto Blaster orchestra: follow a score	Leading a complex situation following a composed score. A parallel to a clinical algorithm. A difficult obstacle	Obstacle, disorienting dilemma, discomfort. Leadership in an extremely complicated exercise.
CPR algorithm with sounds on Ghetto Blasters (class room)	Sounds were composed to illustrate the different tasks to be performed at a CPR emergency. They were to be performed according to the CPR algorithm	Transfer to the clinic	This exercise was removed from the course after two course-days.
CPR simulation (Simulation room)	Perform a full CPR simulation as team leader with a medical team	Transfer of the learned leadership competencies to the clinic	It was a problem training leadership and medical algorithms simultaneously
Emergency, course-day three			
Personal videos	Watching videos from the first course-day	Reflecting on the course and the topics and own performance	Major impact on the participants
Emergency simulation (Simulation room)	Perform a full emergency simulation as team leader	Incl. to diagnose. A possibility for calling 'time-out' if problems occur	Most participants experienced this simulation as regular acute training

Table 4

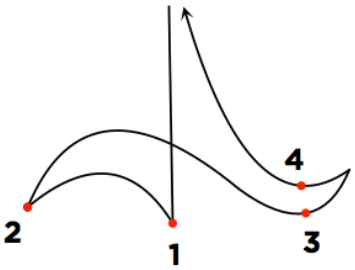

Illustration 1. Beating time like a conductor: a basic four-beat pattern

Learning environment		Video: Table 12	Quote
Laughter	The participant is enjoying the course: laughing, dancing, playing, acting silly etc.	Video 1, 3 & 5	Table 10: 'Learning environment' and 'Non-verbal, grin / smile
Reflection	In order to address anxiety it is essential to create a safe learning environment.		Table 9 and 9: All comments express a reflection. Both during the courses and after the courses

Table 5

Pedagogics		Video: Table 12	Quote
Trance	It was important to give the participants a feeling of the intense communication when leading an orchestra non-verbally.	Video 6, 7, and 9	Table 9: Trance Table 10: Trance
Apprenticeship / 'Straight on' feedback	A conductor is usually trained through apprenticeship and it is therefore natural that this learning method is applied to this course.	Video 1, 2, 3, and 8	Table 9: Apprenticeship Table 10: Apprenticeship
Transformation	The purpose of the course is to provide participants with tools to act convincingly and calm in stressful and unpredictable situations, that is: a possibility to be able to change of behaviour.	Video 8, plus progress and development from video 4 to 9	Table 9: Transformation Table 10: Transformation

Table 6

Learning goals – the conductor's focus		Video: Table 12	Quote
Physics	Appear / look / stand, arm, back, body–posture / body–language / body–position, chest, chin, ear, face / mimic, hands, head, mouth, shoulder, straight, upright	Video 3	Table 9: Physics Table 10: Apprenticeship / Non-verbal communication and Physics Table 11: Physics
Authority	Authority, calm, command, confident, control, credible, decisive, demand, determines, issuing orders, leadership, manage, overview, power,	Video 9	Table 9: Authority Table 10: Authority

	relaxed, safe, super, sure		
Eye-contact	Eye contact, eyebrows, eye, gaze, look	Video 2, 6, 7, 8, and 9	Table 9: Eye contact Table 10: Eye contact
Presence to the moment	Attentive, concentrated, conscious, empathy, focus, hear, informed, listening, present	Video 6, 7 and 9	Table 9: Presence to the moment Table 10: Presence to the moment
Responsiveness	Feel, look / see, perceive, seem, sense / tell	Video 6, 7 and 9	Table 9: Responsiveness
Stress & obstacles	Chaos, difficult, disturb, doubt, personal limits, nervous, panic, pressure, pulse, stress, tense / strain, uncertain	Video 1, 4 and 8	Table 9: Stress & obstacles Table 10: Stress & obstacles Table 11: Stress & obstacles
Communication	Clear, communication, contact, message, react, respond, signal, vague	Video 6, 7 and 9	Table 9: Communication Table 10: Communication
Non-Verbal: Grin / Smile	Smile / Grin expressing: nervous reaction, kindness, proudness, appreciation, embarrassment, compassion, silliness or confusion	Video 1, 3, 4, 5 and 6	Table 9: Non-Verbal: Grin / Smile Table 10: Non-Verbal: Grin / Smile
Engagement	Absorbed, busy, engaged / enthusiastic, excited, happy / looking forward to. Intense, shine, thrilled	Video 1, 6, 7, and 9	Table 9: Engagement

Table 7

Additional findings revealed by analysing the data. Lessons learned from the course		Video / figure	Quote
Training algorithms and leadership	Training algorithms is about acquiring knowledge in a strained, 'slower, more deliberate and effortful form of thinking' which requires all attention and focus.	Table 12: video 10	Table 10: Training algorithms and leadership
When to learn	Three participants stated that only when medical knowledge and knowledge of algorithms have been acquired it is possible to deal with leadership.		Table 10: When to learn
Relevance	More than 80% of the participants stated that they would implement the new ideas in their daily work to a high extent. The rest of the participants stated that they would implement the new ideas in their daily work to some extent.	Figure 1 and 2	Table 10: Relevance
Missing angle at the university	Several participants mentioned that the content of the course had an important objective which was lacking in teaching at the university.		Table 10: Missing angle at the university
Generally applicable	It was mentioned that the subject is relevant to educational contexts, clinics, collaboration in general, day to day work, doctors work, instruct cross-fit, swimming lessons, public speaking and attending oral exam.		Table 10: Generally applicable

Table 8

Table 9

The table contains selected citations from participants *during the course*. In the left column key themes is given, in the right column citations from the participants is given. S = Student, R = Resident, BS = 'Blinded' Student, CS = Consultant, C = Conductor

Learning environment [Video 1, 2, 3 and 5]	Laughter is not a spoken word, but a registered and described event that occurs frequently on the course days. (Laugh, grin, fun, smile) This indicates that the course participants feel comfortable and safe at the courses. Reflection is frequently taking place at the course – which indicates that participants feel comfortable to speak up and share thoughts on the learning.
Trance [Video 6, 7, and 9]	[S1]: ... I also felt completely in my own world. It was a really amazing feeling. [S1]: It's just really cool when you get that feeling. That kind of 'flow' where you can manage everything.
Apprentice-ship / Role Model	[S7] to Conductor: You are completely off the scale … if this is a kind of scatter plot then we are here – and you are all the way up here. It's amazing! [S13] to Conductor: Well, there are lots of things I can't see. Without finding it out from you … I reckon … [S10]: Yes, it's crazy!
Transfor-mation [Video 8, plus develop-ment from video 4 to 9]	[CS]: It's really amazing what has happened since when you first walked through that door, when we started [S10]: Yeah ... (scrunching her eyebrows and shaking his head) ... two [CS] and [S10] together: ... hours ago! [CS]: Yeah! [R3]: I just think, you know, it was just so great to see you guys, or – I suppose I have tried myself as well – but anyway, just to be able to see! How much you have all progressed with this course. I'm just sat here thinking shit, wow!
Physics [Video 3]	[R3]: You can really tell the difference when you straighten yourself up Conductor: I'm trying to find…how about this word? Trying to give you a kind of bodily "point zero"…I mean where you are in balance. And after you have this "point zero" – that's when you can start to add a smile or…anger or empathy or whatever, but with a body you are able to control.
Authority [Video 9]	[S5] to [S10]: It really looked like you were in control and you were totally confident… [C]: You were in the moment now. [CS]: And it was you that led me all the way. [S1]: I also think it was…it was really cool! You find this kind of calmness. That you can just be present, you know? That's what it has to be like when you become a doctor.
Eye contact [Video 2, 6, 7, 8, and 9]	[S5]: (makes a tunnel shape with her hands between Conductor's face and her's) You almost felt that you got kind of a … tunnel (mimes the "tunnel" eagerly) and that you look and have this "connection". [C]: We're BOTH gonna figure this out … 'You and I' [S1]. There is no doubt about it. You make eye contact [S1]: I agree. I was in no doubt that you were in control of us. You looked really intensely at us! [R3]: Yeah, it was as if before, people were just looking for the sake of looking. But now! (Points at her eyes) You're looking at us!
Presence to the moment [Video 6, 7, and 9]	[S1]: That was also why I just wanted to listen to how it sounded. You know, just standing there listening to all the different parts coming together. [R1] to [R2]: You were really "like this", "like this"…every time you made a change you just did this…with a little nod with your head like this…and then, "wow, NOW it sounds good!"
Responsive-ness [Video 6, 7, and 9]	[R5]: I think I got a lot out of it, in the sense that it was clear that it was you making the decisions, but you were also very empathetic. [R4] to [R3]: your eyes were very intense…so…there was no doubting what you wanted… [S1]: But I can really sense your energy, especially you (Conductor). It was awesome!
Stress & challenges [Video 1, 4, and 8]	[R7]: It's chaotic, I can't find my way and then I get stressed. Then it becomes even more chaotic! [S10]: It's a crazy challenge!
Communi-cation [Video 6, 7, and 9]	[S3]: Yeah well I felt that when I took you in groups of two, there wasn't any doubt what you two wanted and… [CS]: In reality you communicated a great deal without saying a word.
Non-Verbal Grin / Smile [video 1, 3, 4, 5, and 6	[C]: So if you show a silly laugh, they'll think: "Well, why that silly laugh?" [S3]: Phew! I *don't* have rhythm! (grinning, waving her hands)
Engagement [Video 1, 6, 7, and 9]	[C]: You give out this amazing presence and: now let's do this!! [R6] overjoyed: I can't wait! [C]: Yes, and what happens is your eyes just close down. You are not present at all [S1]: Yes, I can feel it happening [C]: You are not in this room at all

Table 10

The table contains selected citations from participants *after the course*. In the left column key themes is given, in the right column citations from the participants is given. S = Student, D = Resident, BS = 'Blinded' Student, CS = Consultant, C = Conductor

Learning environment [Video 2] [Video 5]	[S6], 14 days after: Frere Jacques was a great way to start the course, and it was carried out in a way that made it o.k. to laugh at ourselves and at each other. At the same time you managed to keep it serious enough that it didn't become nonsensical. We could use laughter to make it easier to get outside our comfort zones, but without a clear purpose the whole thing would have collapsed. I don't know how you did it, but you deserve credit for it. [S9], one month after: … creating a safe and secure learning environment in the space of a few minutes, which makes for a steep learning curve. Especially when the first task is something as out of the ordinary as conducting a choir. [S11], three months after: You were allowed to "fail in Your appearance". [BS1]: It was really great that you asked the students what they were experiencing and let others give critique. Ture is sometimes a bit quick off the mark to say what he thinks and experiences. This sometimes affects what the others say and sometimes it feels like the students just agree with him instead of saying what they think.
Trance [Video 6, 7, and 9]	[BS2]: [S5] looks with her mouth wide open, impressed. The others are deep in focus … The lights go out, nobody reacts The music intensifies, [S5] smiles, [S10] looks quickly to one side … Everyone is fully focused – trance-like. Conductor ends the session: Isn't this fun?
Apprentice-ship / 'Straight on' feedback [Video 1, 2, 3 and 8]	[S11], three months after: Unbelievably good teaching! Really great that Ture said what he thought you could do better, straight to the point without beating about the bush. Solid, clear and good teaching! [S12], six months after: [was feedback from the instructor any help?] Yes to a great extent. Especially when you felt that the feedback from the instructor was spot-on and I think this was the case to a very large degree. [S9], two months after: Solid learning! We were really allowed to work with our expressiveness.
Apprentice-ship / Non-verbal Communi-cation [Video 1, 2, 3, and 8]	[S13], two months after: During the conducting exercises it was really useful to get feedback on our posture, mimic and gesture. To be made aware of what signals you send non-stop, whether you want to or not. [S9], two months after: There was lots of learning here. Especially as you were good to catch the small details that the untrained eye doesn't see, but reacts to anyway."
Trans-formation [Video 8, plus progress from video 4 to 9]	[S10], five months after: All three of us progressed a great deal in a short space of time, and it was incredibly fascinating. [S6], day one: I learned some general things and things about myself. [S20], one month after: … it's interesting that the skills we learn from you are already in the back of our mind ready to use only after a short time
Physics [Video 3]	[S11] three months after: I think I have good control over how I stand and move my arms, but my face goes amok without me noticing it; it clearly makes me appear very uncertain..
Authority [Video 9]	[S19], six months after: Your expression becomes more authoritative after you get feedback and you give off more "leader-charisma". [Nurse 2], day one: It is a good thing to be able to appear authoritative. Be aware of this
Eye contact [Video 2, 6, 7, 8, and 9]	[S8], day one: Eye contact is important, thereby giving possibility for non-verbal orders [S18], dag one: I became very aware of eye contact and relaxed body language
Presence to the moment [Video 6, 7 and 9]	[S7], three months after: I was quite excited about training what it is to relax and rest within yourself and your body when you are standing in front of a group of highly qualified strangers. Keeping calm, leadership and the upper hand mentally, and letting it show in your body language. It really crossed my personal boundaries but it was very useful!
Stress & challenges [Video 1, 4, and 8]	[BS2]: My experience was that it was a really good environment to learn in. They were forced completely out of their comfort zone and were "broken down", in the sense that they were in a situation they had never been in before, and had therefore no established strategies they could use to deal with the challenge. [S6], five months after: In any case, it felt a bit like turning part of yourself inside out, standing in front of all of you.
Communi-cation [Video 6, 7, and 9]	[S10], five months after: It was very impressive to experience how much you can say without words, just with body language and mimics. [NURSE2], day one: Incredible what you can manage without language
Non-Verbal Grin / Smile [video 1, 3, 4, 5, and 6	[S6], 14 days after: We could use laughter to make it easier to get outside our comfort zones
Training	[S14], six months after: Maybe to jump from the

algorithms and leadership [Video 10]	exercises to the cardiac arrest scenario was a little sudden…? In any case you forget everything you have learned when you are standing in front of that bed. [S12], six months after: But a bit difficult to transfer some of the small details when you are not 100 percent certain of the cardiac arrest algorithm.
When to learn	[S9], two months after: I still think that it should be combined with in-depth knowledge of the cardiac arrest algorithm, as part of a doctor's confidence and body language is connected with having their knowledge in place. However, when this knowledge is acquired, there is a lot to be gained from this type of music training, as you are stripping the doctor of his or her knowledge and putting him in an environment where only their body language counts. [S3], one month after: My only criticism would be that as a younger doctor/medicine student, you have too much focus on your professional knowledge and of course you prioritise this when you are in an emergency situation, and unfortunately you don't have enough resources to think about and make use of the non-verbal communication training. On the other hand, it could be an appropriate course for more experienced doctors that have their knowledge and experience in place - they would have the resources needed to make use of the non-verbal communication training.
Relevance	[BS2]: Another important thing is that you can be very bright in terms of your medical knowledge, but if you don't manage to communicate in a way that gets through to people, your knowledge is effectively reduced to nothing. In other words, being a doctor is about a lot more than being able to remember what is in the textbooks. [S6], day one: It was much better than what I expected. A very positive experience. Beats other communication courses many times over [S13], two months after: Training in taking decisions while everybody's eyes are on you is highly relevant for doctors and medical students. [S5], four months after: …the nervousness and my reaction were completely the same. And the way I have to learn to tackle it is also the same, regardless of whether I am with a patient in a ward, or in a classroom with medical students.
Missing angle at the university	[S7], day one: Crazily important aspect of a doctor's work, which I never realized was missing from our existing education before today. [S3] day one: Very important learning around what it is to be a team leader, which you never think about on a daily basis or receive instruction in it whilst training. [S15] day one: Super exciting and very relevant in relation to the future job. A subject that is missing in our training. [R1], two months after: At the same time it is a role in which you rarely receive formal teaching during training. [S16], one month after: In general a really great course which I hope becomes an obligatory part of the training. I think everyone could benefit from it!
Generally applicable	[NURSE1]: 'Everybody could need it in their day-to-day work' [S17] day one: Can be used in a teaching context, in a clinic, and many more situations [S7], three months after: Unfortunately, I haven't had the opportunity to try out these newly learned skills in the clinic yet. But I instruct a little cross-fit team, and I can really use it there! [S4] one week after: Also, have you planned any more courses for medicine students? I have a mate or two who think that sounds interesting.'

Table 11
Scepticism. D = Resident, BS = 'Blinded' Student

Stress and obstacles	[BS1]: The first game with Frere Jaques focuses on something that is too technically complicated in relation to a medical benefit [R2], two months after: I sometimes felt You focused on some details that were indifferent to us as doctors. I.e. I think too much time was spent on the correct factor to conduct Frere Jaques
Physics	[R2], two months after: I still think that too much emphasis was placed on not having to smile / should look very serious.

11 videos (hyperlinks). All videos gives an impression of a safe learning environment and shows enjoying laughter	
1.Training beating a four beat pattern youtu.be/WW898db57Zw	Duration: 0:38. A change of setting: four male and four female participants are training beating a basic four-beat scheme. Focused attention, handling a difficult obstacle. Cohesion on the team. Theme: Stress and obstacles
2. Apprenticeship youtu.be/EnHlustj3F0	Duration: 1:50. The conductor explains and shows care for nine participants in order to make the individual participants obtain a feel of calmness when performing as a leader. The conductor stands as a role model. Themes: Apprenticeship, Eye-contact, Presence to the moment, Responsiveness, Communication, Non-verbal, Engagement.
3. 'Straight on' Feedback youtu.be/fwbgfTNf_e8	Duration: 2:04. 13 participants receive very 'Straight on' personal feedback from the conductor who goes to the limit. Themes: Apprenticeship / 'Straight on' feedback, Physics, Authority, Stress and obstacles, Communication, Non-verbal.
4. Discomfort & Obstacles youtu.be/UmIFk9VXuCQ	Duration: 2:12. 21 participants show discomfort: shake their heads, laugh nervously, scratch their neck, show rolling eyes, hide the face in their hands, smile apologetic etc. Themes: Stress and obstacles, non-verbal
5. A safe environment youtu.be/_ZmUYjI-T4E	Duration: 2:24. 19 participants show they feel safe, fool around and laugh. Female participant often does the 'shimmy', small dance movements, plays with a hat etc. Themes: Safe learning environment
6. The intensity in communication when conducting youtu.be/3sPmMQCne_E	Duration: 0:29. Four participants conduct team. They are showing excellent leadership and are in a 'state of Trance' with their team. Themes: Trance, Authority, Eye-contact, Presence to the moment, Responsiveness, Communication, Non-verbal, Engagement.
7. Achieving a state of flow youtu.be/KcyZf3_QfMk	Duration: 1:12. One participant conducts completely absorbed for more than ten minutes. The team (orchestra) isn't moving, fully focused on the conductor. Light goes out at 0:20 (2:37) but nobody pays attention to this. Themes: Trance, Authority, Eye-contact, Presence to the moment, Responsiveness, Communication, Non-verbal, Engagement
8. A Transformation youtu.be/GW7XPdnf-EU	Duration: 6:54. A real transformation (English subtitles). Shows how the trainers 'gets under the skin' of the participants. Shows the reflection on the learning and the support from the other participants. The participant in focus goes from saying "My palms are totally sweaty" and "I think it's horrible" to say: "I wish everyone could try this" and "It is very impressive". Themes: Trance, Transformation, Authority, Eye-contact, Presence to the moment, Responsiveness, Stress and obstacles, Communication, Non-verbal, Engagement
9. End Point youtu.be/IQtMa0VJgjw	Duration: 1:55. 16 participants showing excellent leadership when conducting. In control of their body, attentive to the project, confident, absorbed and in full control of the situation. Themes: Trance, Authority, Eye-contact, Presence to the moment, Responsiveness, Communication, Non-verbal, Engagement
10. A Breakdown youtu.be/f5BiNFL_zDU	Duration: 1:21. A participant breakdown. After attending the two course-days concerning leadership she tries to transfer the learned skills to the clinic in a medical acute simulation. When confronted with her lack of medical knowledge she forgets all trained leadership skills and loses control of the situation. Themes: Physics, Stress and obstacles, Non-verbal, Training algorithms and leadership.
11. Unique individuals youtu.be/Bdok4ArYXcM	Every participant brings in their own experiences, perceptions and emotions

Table 12

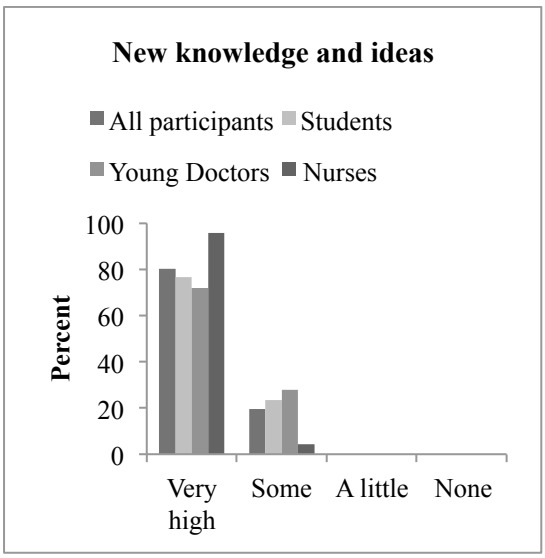

Figure 2. Did I get new ideas? n = 61 participants. Answers from course days 1 and 2, a total of n = 96 answers

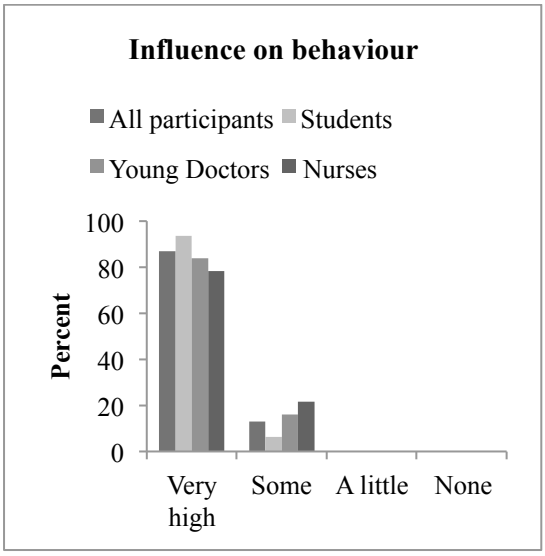

Figure 3. Will I apply information and ideas? n = 61 participants. Answers from course days 1 and 2, a total of n = 96 answers

Appendix I:

Nordsjællands Hospital

Simulationunit SimNord

Evaluation and feedback of course

Team-leadership

Date_____	Very high	Some	A little	None	Comments/suggestions for improvement
Expectations: Was my expectations fulfilled?	☐	☐	☐	☐	
New knowledge and ideas: Did I learn what I needed, did I get new ideas?	☐	☐	☐	☐	
Use of learning: Will I apply information and ideas?	☐	☐	☐	☐	
Impact on results: Will the new knowledge I have acquired influence on / improve my practice and my results?	☐	☐	☐	☐	

Other comments, name and team

Developed from D Kirkpatrick training evaluation model 1959

Appendix II:

Video survey sent to the students along with four - eight video clips showing the individual participant's performance as team leader at the two course days
About the videos usability as a learning instrument
Which of the videos made an impression on you and why?
Do you have comments on the individual videos?
Do you want to return and go back to the videos?
About the learning method, when did you experience learning
In the more classical teaching situations?
When you were instructed yourself?
When you observed others being instructed?
In the immediate reactions of the others when you received instruction?
Was the personal feedback from the instructor applicable?
Was the conversations between the course participants rewarding?
Was it useful that the instructors came close to you?
Was there a safe environment on the team?
Was it easy to be heard?
Were the exercises relevant to your performance as team leader in the cardiac arrest scenario?
Do you have further comments about your first review after watching the videos?

APPENDIX

Abstract to "Team Management - Can music contribute to better understanding?"

AIM: to train medical students to use non-verbal communication like the conductor of an orchestra. The overall goal was to improve communication in medical teams.

METHOD: in order to explain to the students how to take control as a team leader, communicate more effectively and work well in a team, the conductor described the skills required to conduct an orchestra. He explained how to use eye contact, body language and gestures and set the students two musical exercises to perform and then gave individual feedback on their performance. These skills were then transferred to a simulated medical emergency situation in which every student was given the opportunity to play the team leader.

RESULTS: the students found the experience unexpectedly useful as it enabled them to focus on the skills required of a leader and this resulted in greater self-awareness, enhanced self-confidence and better communication.

CONCLUSION: medical students can benefit greatly from applying a conductor's skills to a medical situation: their leadership ability, degree of cooperation and professional competence are considerably enhanced [48]

ONLINE APPENDIX

Article one

Appendix II: Found opinions about leadership in emergencies and views on the identified leadership measurement tools in the systematic review. Comprehensive result of qualitative content analysis (conventional): turelarsen.dk/Appendix/TER-AppendixII.pdf

Article two

Appendix I: Opinions, attitudes, experiences or views to identify any challenges or barriers which leadership training for residents in emergencies needs to address. Identified consensus on what characterizes a good clinical team leader: learning goals. Comprehensive result of qualitative content analysis (directed): turelarsen.dk/Appendix/B-AppendixI.pdf

Article three

Appendix III: Comments made by the participants *during* the courses illustrating the themes found.
Comprehensive result of qualitative content analysis: turelarsen.dk/Appendix/CET-AppendixIII.pdf

Appendix IV: Comments made by the participants *after* the courses illustrating the themes found.
Comprehensive result of qualitative content analysis: turelarsen.dk/Appendix/CET-AppendixIV.pdf

11 edited videos showing results from qualitative content analysis:
turelarsen.dk/Appendix/11 videos.pdf

Log from the course: turelarsen.dk/Appendix/Log 2015.pdf

Supplementary material

Before and after videos: *turelarsen.dk/Appendix/BA-videos.pdf*

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